DIY boat owner

1998 - #1 (SPRING)
the MARINE MAINTENANCE MAGAZINE

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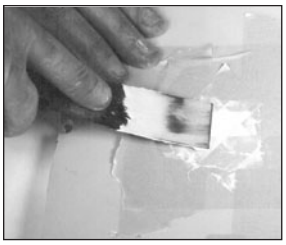

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# CURRENTS

DIY boat owner ONLINE

## READER EXCHANGE

***Use this column to tell us what you like or don't like about DIY, what stories you would like us to cover or share your opinions with other readers. Send your letters to the editor via mail, fax or e-mail. Our addresses are listed on page 2. We reserve the right to edit letters for clarity and length.***

### Help for Online Errors

Some of our visitors to DIY ONLINE (www.diy-boat.com) have complained that they're getting a DNS error when they click on the "Subscribe" button. The order forms in DIY ONLINE are all secure, meaning they are encrypted to ensure the information provided is protected from data thieves (a.k.a. hackers). If you get a DNS error, it's likely you're using an old browser (i.e. Netscape 1.0) which simply cannot retrieve secure pages. DIY ONLINE is best viewed with Netscape 3.0. You can update your software for free on the net by downloading the newest version of Netscape.

### Balsa Goes Auto-Tech

Lightweight and durable, Baltek's end-grain balsa, used in most fiberglass boat construction, is now utilized in the construction of cockpit floorboards — that is the floorboards of the '98 Corvette. When General Motors redesigned the first all-new Corvette in 13 years, it replaced the traditional stamped-steel floorboards with a sandwich of end-grain balsa and fiberglass. Balsa was chosen over honeycomb and polyurethane foam-core because it virtually eliminated vibration and gave a ride that was substantially quieter and more comfortable. This marks the first use of balsa sandwich construction in a production automobile.

### Fans of Twin Keelers

Together with a friend, *DIY* reader Craig Anderson edits and publishes a small newsletter called *Twin-Keeler* for owners and admirers of twin-keeled sailing craft. If you're interested in receiving a complimentary copy, send your name and address to Twin-Keeler Subscriptions, 2943 W. Balmoral Ave., #2, Chicago, IL 60625.

## SPARE PARTS

### Source For European-Built Parts

If you own a boat or equipment made in Europe and are in need of replacement or spare parts that you can't locate locally, Express Yacht Parts offers a find-and-export service. Engines, generators, windchargers, heat exchangers and fasteners are just a few of the items they can help source. There's no finder's fee and quotations are free. Owner Julian Wilson claims the company will look into exporting anything that's not readily available in North America. Contact: Express Yacht Parts, 51 St. Mary's Rd., Cowes, Isle of Wight, P031 7ST, England; Tel: +44 1983 282449, Fax: +44 1983 282450 or e-mail: julian.wilson@connect-2.co.uk.

### Answers to Electrical Problems

When you have trouble solving onboard power problems or need help with installation, Ferris Power Products offers an affordable professional design service. For a fee of US$50, refundable on equipment purchases over US$1,000, you will receive the Ferris Power Survey to complete and return. Once processed, you'll receive detailed information outlining your electrical problems, the recommended equipment and an estimate of the cost to upgrade. For more information contact: Hamilton Ferris Co., Box 126, Ashland MA 01721; Tel: (508) 881-4602, Fax: (508) 881-3846, e-mail: hfcopower@aol.com .

# TALKBACK Q&A

## Unpegging a Tach

**Q:** My boat's tachometer is always pegged, even though the VOM shows it's getting 12 volts all the time. How does the tach operate and do you have any idea what is causing this problem?
*Ray Hernandez, Wichita, Kan.*

**A:** According to Steve Auger, MerCruiser Service Training Instructor for Mercury Marine, how a tachometer operates depends on the boat's ignition system and the engine type. On a MerCruiser stern drive, the tach is wired to the negative side of the coil and reads the engine running pulses being generated at the coil. Every time the points open or close, the tach picks up a pulse. A tach that's pegged all the time typically indicates that there is a bad ground, a bad voltage supply or the grey wire that leads from the tach to the engine is picking up some sort of inductive current.

Outboards use an alternator-driven ignition system, where a tach reads the number of positive and negative pulses. When a tach stops functioning, it's an indication of a failed rectifier or voltage regulator. To troubleshoot, remove the tach line that goes from the engine to the tach and attach it to a shop tack. If you get signals (pulses), this indicates a defective tach. If there are no pulses on the line, it's likely you have a wiring harness problem.

## Floor Replacement

**Q:** I'd like to replace the cheap, sheet-vinyl floor in the galley of my '96 Silverton 312 SC. The surface under the vinyl is gelcoat. I was thinking of using a wood-strip floor, like those made by Bruce that is readily available in home centers. I've been getting different opinions about how to go about it. Any comments on the types of wood flooring and installation procedures would be appreciated.
*John Rafes, After Midnight II, Atlantic City, N.J.*

**A:** The problem with household wood flooring products is the materials. Thick domestic hardwoods don't do so well in a high-humidity environment. The expansion of these products is normally hidden in a house by the expansion joint that must be left around the edge, and the baseboard and quarter-round molding. In your boat, there may not be a way to install this type of product and allow for the expansion that will inevitably follow. To achieve a pleasing wood floor look, a better choice is to use a plywood product, which is dimensionally superior (in stability) to any solid wood product. There are teak and holly faced plywoods (often marketed as Deckply) specifically made for this purpose. A 6mm (1/4") 4'x8' sheet is about $150, which isn't cheap, but it looks good, is durable and won't warp. Joints are best accomplished at natural transitions like bulkheads. Make a pattern of cardboard first. If a mistake is made, it is possible to scarf this material invisibly, thanks to the alternating wood motif. Finish with a polyurethane topcoat.
*—WR*

## Soundproofing

**Q:** Can you suggest a good product and source of sound insulation for my engine box. The only product I can find is the old-style grey foam insulation with the lead-lined, silver-Mylar backing. I would like to find a better product than this as it seems to quickly deteriorate and crumble into the engine and bilge.
*Tod Michaelis, Palm Beach, Fla.*

**A:** It seems you've described a polyester-based lead foam composite, which inherently exhibits poor hydrolytic stability as well as low resistance to moisture, humidity and extensive heat and cool cycles. The polyether foams used by Soundown and others are formulated to exhibit excellent hydrolytic stability and have a service life in the range of 10 years and much longer in cooler and dryer climates. Our WINTER '96 issue has complete information on engine soundproofing materials and installation. If you need more information contact Soundown at (800) 359-1036 or visit their website at soundown.com.

## To Idle or Not

**Q:** In a back issue, you recommended warming up diesel engines for an extended period of time. All the major engine providers recommend this not be done at the dock. Their advice is that diesel engines need a load to warm up and that after a very short one- to two-minute startup one should get underway. Upon return to the dock, it's also recommended that you idle the engine to help cool it down and allow the turbo-oil feed to align. As always, never rev your engine before shutting down.
*C. McGuire, Long Island, N.Y.*

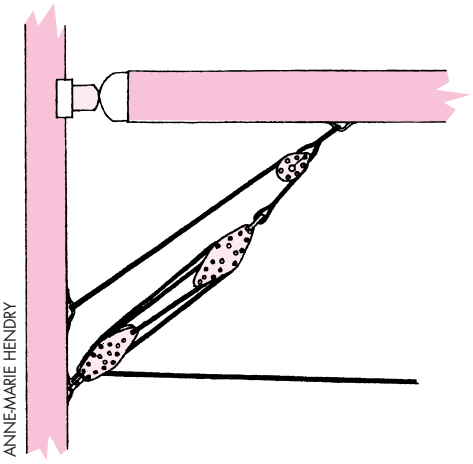
**A:** Charles Gallimore of E & C Marine in Toronto, specialists in diesel engines and presenters of *DIY's MRT Workshop* on diesel engine servicing, offers this advice: There are several reasons for recommending that a diesel engine be run up to operating temperature. First of all, the engine should be left in idle only long enough for the operator to check all belts, hoses and gauges

and to ensure the exhaust is pumping water. The engine should then be put into gear and revved to approximately 1,000 rpm in order to bring it up to operating temperature as quickly as possible. There are a series of different metals that expand at different temperatures and the idea is to get them all expanded as soon as possible. It also requires approximately 825 to 850 rpm to excite most alternators and it's best to know that this is operating before leaving the dock. Whether to allow the engine to idle to cool upon returning to the dock depends upon how it has been operated. If the engine has been run at slow speeds for at least 10 minutes, there is no need to allow it to idle, since it will have cooled already. If it has been run at high rpms for an extended period and not had the 10-minute, slow speed, cool-down time, then allow it a few minutes to cool. The reason for this is the opposite of the warm-up recommendation in relation to the different metals. They also contract at different temperatures and need to be at the coolest possible temperature before shutdown.

## Cascading Tackles

**Q:** I am looking for a diagram of a system of blocks and line called cascade tackle.
*Capt. Mitch Mitchell,* Sinisterre, *Tampa, Fla.*

**A:** To build high-powered mainsheet and backstay systems with normal-sized blocks, you can use a technique called cascading, which is a series of interconnected tackles. Cascading tackles save both weight and money — each tackle uses less load, so the size of the hardware can be reduced. For example: a 16:1 tackle normally requires a pair of blocks with eight sheaves each, but it can also be accomplished with a 4:1 tackle pulling against another 4:1 tackle. Here's another example as shown in the illustration above: A boom vang with a 2:1 purchase led to a 4:1 tackle. Only one block in the initial cascade of 2:1 must have the


ANNE-MARIE HENDRY

required breaking strength, say 1,600 pounds; the second cascade of 4:1 can be assembled of blocks of half the breaking strength (800 pounds). By building an additional purchase into a tackle system, you reduce the load on the winch by half, allowing the use of a much smaller and lighter winch. Reducing the load on the winch also allows the sheet to be eased with more control.
— *JM*

## Marquis Info Wanted

Wayne Jochem of Denver, Colo., is looking for information for the 5.7m (19') Marquis Caribbean cuddy cabin he purchased last summer. Send e-mail replies to Wjochem@aol.com.

## Needs Tara Info

Peter Narth recently purchased a 1982 Doral Tara with a Cobra 5.7L 250-hp stern drive and is looking for an operator's manual and other relevant information. Send e-mail replies to pnarth@minet.gov.mb.ca.

## Replacement Parts for Santana

Jim Peterson of Gardnerville, Nev., is in need of a used rudder, post tiller and boom for his Santana 3030. Send e-mail replies to mango@aci.net.

# TECH TIPS

**RECYCLING OLD SOCKS:** An easy way to wax tubular railings is to put an old sweatsock over your hand, dip it into the wax and go. By curving your hand around the railing you'll be able to cover more area in less time.
*Bill Lindsay, Hollywood, Fla.*

**DRY AND HAPPY:** When the onboard humidity gets to be too much, purchase a household humidifier if you have the space to stow one. Attach a hose to the fitting on the catch basin and run it to a sink. You'll have to maintain an inside temperature above 18°C/65°F or the humidifier won't function correctly.
*Ryc Rienks in soggy San Fransciso, Calif.*

**BORING TOOL:** When countersinking holes, purchase a depth collar to put around the countersink. Set the collar to the depth to which you want your countersunk hole. Now, all your countersunk holes will be exactly the same depth and size.
*Sandra Turney, Sandy's Beach, Ottawa, Ont.*

**TIMEPIECE:** Keep an inexpensive hourglass in the cockpit to time watch changes, anchor watches, etc.

**A GASKET IN A PINCH:** If you tear the original gasket when replacing your engine's fuel pump and there's neither a replacement gasket nor gasket paper for making one available, you can make one with sealant. Carefully clean and degrease the mating surfaces involved. Spread a thin, even coat of silicone sealant on those surfaces. Allow to set, then reinstall the part, being careful not to overtighten bolts. This will not last forever, but it will probably get you home.
*Phil Friedman, Port Royal Marine, Pompano Beach, Fla.*

**DC REFIT WITH YELLOW**: Black is the standard for the AC hot wire and for many older boats, the standard for DC negative wire. Confusing these two when cutting wires can produce deadly results. When rewiring your DC system, use a yellow negative wire instead of black, as recommended by ABYC.

**FOAM PICKINGS:** Use the sturdier close-celled foam brushes to apply varnish and Cetol, rather than bristle brushes or the el cheapo foam brushes. You'll get a smoother finish and you won't have to pick off any foamy bits or bristles left on the wood. Quality foam brushes will last two or three applications, depending on how rough your wood is and how much you have to coat.

**STRIPE REPAIR:** To neatly repair a nick in vinyl hull striping, cut diagonal lines across the stripe on either side of the nick with a razor. Heat with a blow dryer to warm the glue, then remove the nicked section. Use acetone to remove any remaining glue. Cut a new tape section slightly larger than the old to allow for shrinkage and apply, overlapping the tapes.
*Bill Lindsay, Hollywood, Fla.*

**FREEING STUCK PARTS:** The best product for removing stuck bolts is PB Blaster, available at most auto supply stores in the U.S. (sorry it's not sold in Canada). Spray the bolts, leave for 24 hours (instead of the few minutes the instructions recommend), then drive the bolts out with a small sledgehammer.
*Stephen Best, Shelburne, Ont.*

**CURE FOR WAX BURN:** Hot sun can bake wax on to the surface and cause streaking before you can buff it off. When this happens, wet a cheesecloth with mineral spirits, wipe down the waxed area, then buff again.

**DENTAL ASSIST:** Carry a supply of dental picks on board. They're great tools for pulling off O-rings on fuel filters, lifting out water pump impellers, 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

# IT PAYS TO KNOW YOUR WOODS

The current stock of boatbuilding woods have limitations in application and availability. It's important to understand these limitations.

***By Wayne Redditt***

There are few topics as debated by boatbuilders and repairers as wood selection. There are two reasons for the continuing discussions. First, the world's supply of suitable lumber is rapidly shrinking. Second, the majority of books that builders and repairers turn to for advice on wood selection are outdated.

The woods that boatbuilders covet are the same now as always — woods that are strong, lightweight, decay resistant, workable and have dimensional stability. These requirements rule out most of the native North American hardwoods as candidates for successful boat lumber. The softwoods offer more variety and more suitable species but, unfortunately, are highly sought after by competing industries, which affects price and quality. The tropical woods have always been a source of high-quality boat lumber but that era is quickly ending.

Let's look at some of the traditional woods used in boatbuilding and compare these to current alternative offerings.

There are few people that think of boat lumber without considering teak. Teak has characteristics that endeared it to boatbuilders for generations. Then fiberglass boatbuilders drove a stake into the heart of the traditional users by using teak for frivolous purposes, such as drink holders and trim. In the late '80s, one large manufacturer alone was responsible for buying over 11-million-board-feet of Burmese teak lumber. All of this was made into little pieces of trim and other accent bits. Currently, the price of teak averages $19 to $27 per board-foot (1" x 12" x 12").

Plantation teak resembles teak from the natural forest, but the growing conditions don't impart the stress on the growing tree that helps form its characteristics of strength and durability. Consequently, the wood is inferior to natural teak for boatbuilding purposes.

The bottom line: Avoid teak if at all possible. If a dark, rich interior wood is required, use walnut instead. It's considerably cheaper ($6 to $7 per board-foot) than teak and in abundant supply.

Mahogany is the most versatile of all boat lumber in my opinion. The true Honduran (Central American) mahogany has been replaced by what is termed SA (South American) mahogany by many lumber dealers. The SA mahogany may not be Swietenia Spp. but merely a look-a-like lumber. This creates a problem for the novice wood buyer, since the characteristics of the "good wood" are unknown and they are buying on faith alone. The real stuff is available, but may require some searching and long-distance shipping costs. Mahogany makes great planking due primarily to its dimensional stability and rot resistance. Beware of sapwood though, as this has virtually no resistance to rot and should never be used if the wood has any chance of becoming moist. Mahogany currently sells in the range of $7 to $9 per board-foot range — still a relative bargain compared to teak!

Sitka spruce is used primarily in spars because of the wood's strength and light weight. Spruce lumber of any variety has little resistance to rot and Sitka spruce is no exception. Its good characteristics are unbeatable for the right purposes though and it's worth searching out. Sitka spruce sells for $7 to $10 per board-foot on the West Coast and slightly higher everywhere else.

Western red cedar is wonderful stuff. The house builders really like this wood for exterior structures, like decks and siding. Rot resistance is the key to the popularity of red cedar. Cedar is most commonly used for cold-molding construction these days. The light weight and good gluing properties of this wood, combined with decay resistance and moderate strength make it an obvious selection for this purpose. Strip-building uses cedar's best characteristics to advantage. It can also be used successfully for laminated overhead beams for cabin tops, biminis, decks and other lightweight structures. Current prices range from $3 to $4 per board-foot for clear lumber — an absolute bargain!

Regionally, there are woods that qualify as tried-and-true boat lumber. Douglas fir, yellow cedar, cypress, longleaf pine and others have been used with great success, but are unavailable in many areas.

There may be no adequate local substitute for proper boat lumber in your area. Certainly in central Ontario (my area) there are no local woods that can be used for boatbuilding. Interiors excepted, all of the useful woods are imported. Many would disagree with that last statement, but for me, the cost of boatbuilding is not measured in the price of the lumber, but in the time it takes to do the job. The wood materials are usually minor considerations (about 10%) in the overall scheme.

One last note: Lumber prices are increasing, and probably should. Most woods have been undervalued for a long time.

# ELECTRONICS

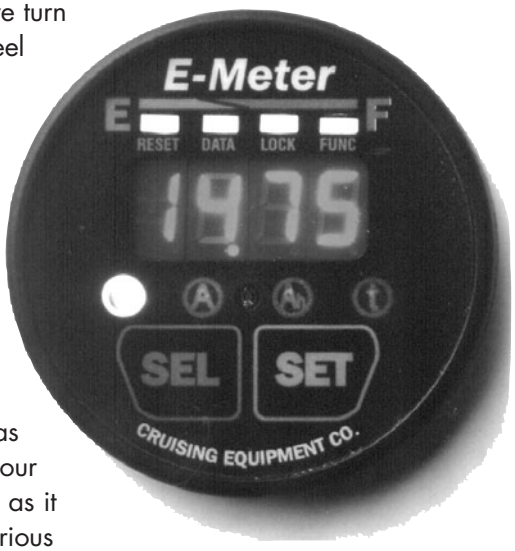
## SYSTEM MONITORS

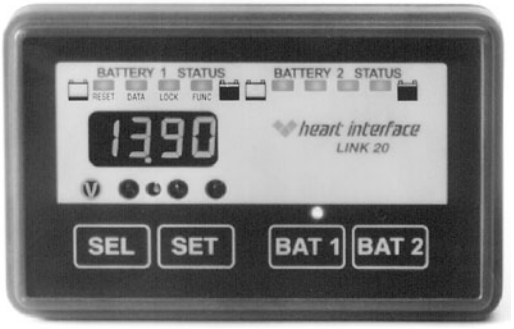
System monitors have given boaters an increased understanding and awareness of their electrical power system on board, taking the mystery out of electricity by making it visible.

*By Kevin Jeffrey*

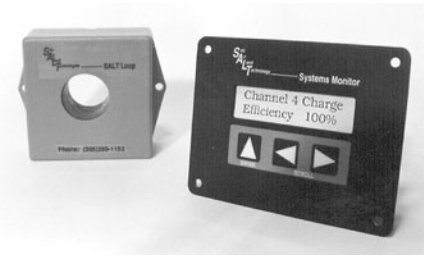
The average boater spends a great deal of time contemplating the mysteries of the universe, and on board a boat nothing is quite so mysterious as electricity. It's hard to understand how electricity works because we can't see it. We can see its effect when we turn on a light, we can hear its effect when we turn on a radio, and we can feel its effect when we operate a fan. In other words, we can easily understand the work being done, but not electricity itself. For most of us, a great deal of the mystery would be removed if we could see electricity as it was being produced by our charging sources, as it was being directed into our batteries for later use, and as it was being used by our various appliances. It may surprise you, but affordable, easy-to-use system monitors let us do just that.

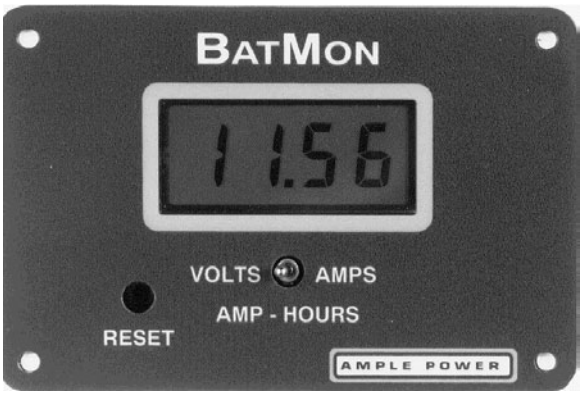
Electricity becomes visible through the use of specialized metering. Ammeters for measuring current flow and voltmeters for measuring battery state of charge have been around for some time, but in a typical boat installation the type, quality and quantity of these devices yield only isolated bits of information, leaving owners guessing about the general health of their batteries and how much power they produce or consume. System monitors combine a variety of sophisticated monitoring functions into one convenient piece of gear, nicely integrating and displaying in digital form all the necessary information about the status of your electrical power system.




***System monitors for marine use: (clockwise from top): Heart Link 20, SALT Systems Monitor, Ample Power BatMon and Cruising Equipment E-meter.***




### Charging Current

Knowing how much electrical current each of our charging sources is producing at any given time allows us to determine how well they are performing in various conditions (levels of sunshine for solar panels, wind speeds for wind generators, boat speeds for water generators and engine rpm for high-output alternators). From this we can estimate how much energy the charging sources are producing over time (i.e., if a device is producing 10 amps for 5 hours it has produced 50 amp-hours). In the past, a boater had to install a separate ammeter for each charging source to accurately track current flow,

whereas the ammeter function on a system monitor displays current being produced from any charging source on board.

## Load Current

Knowing how much electricity is being consumed by appliances at any given time, and over periods of time, helps boaters track energy use and maintain a balance between energy production and energy consumption. Having an accurate ammeter on the load side of a power system also instantly reveals how efficient appliances are. The beauty of a system monitor is that its digital ammeter function tracks current flowing in or out of the battery bank, so appliance loads of any size are as easily monitored as charging current.

## Battery State of Charge

Monitoring battery state of charge is also essential to good system operation. In a lead-acid battery (wet or gel), state of charge is proportional to voltage readings, making an accurate voltmeter function desirable. Since only a single volt distinguishes between a full and a discharged battery, it's best to have the voltage displayed digitally to at least a tenth of a volt accuracy. Unfortunately, voltage readings serve only as an indication of battery health, since voltage can be temporarily affected by charging or discharging sources. The only time voltage indicates true battery condition is when a battery has been at rest, with no current coming in or going out, for a number of hours.

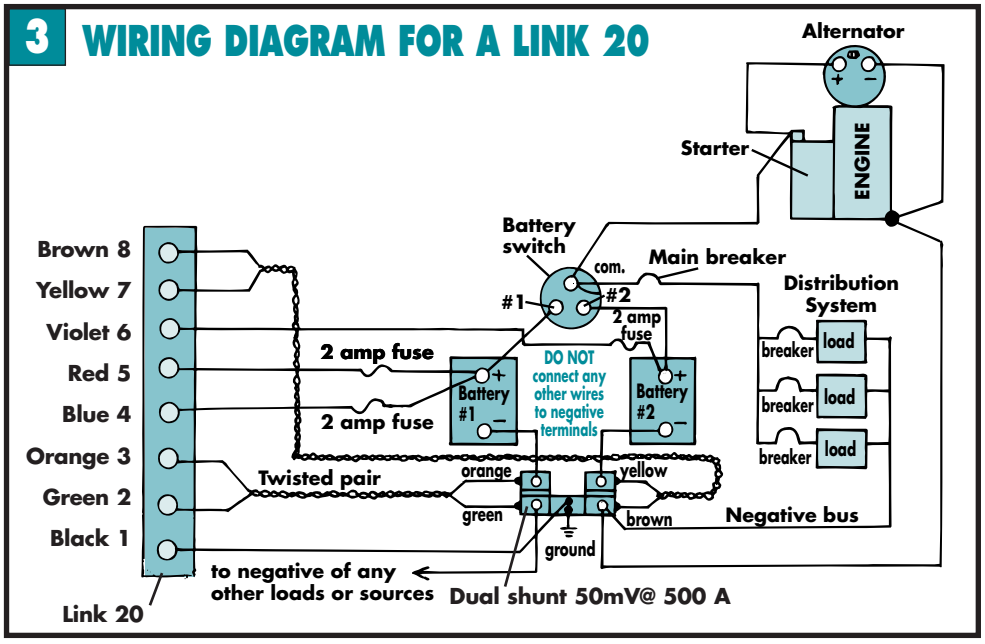
System monitors provide a digital voltmeter function, but they also have an amp-hour gauge for a more accurate display of battery state of charge. Using a sophisticated calculation, this gauge actually counts amp-hours going into or out of a battery, all the while accounting for the rather irrational electrical behavior batteries exhibit. A single glance tells you how much energy remains and

how long before it's time to recharge. As an added feature, most system monitors have a function called 'time remaining,' which indicates how long before the battery bank is at full charge or discharged to the 50% level.

amp-hour flow and time remaining.

Current is displayed as the sum total of all charging or discharging gear at any given moment. To read an individual charging source output — read as a positive number — you must turn off all other chargers and all appliances. To read an individual appliance load, turn off all other appliances and all charging sources. The amp-hour display usually starts with the total number of amp-hours in the battery bank and counts down as power is consumed. When half the amp-hours are gone you know it's time to recharge. If you check the ammeter function and it's positive, the time remaining function will tell you how long, at that level of current, until your battery is fully charged. If the ammeter reading is negative, the time remaining function will tell you how long, at that level of current, until your battery bank is discharged to the 50% level.

**3 WIRING DIAGRAM FOR A LINK 20**




ANNE-MARIE HENDRY

***Monitoring two battery banks requires two E-Meters (or Link 10s) or one Link 20 as each battery bank must have its own shunt wired into the negative of both batteries. A typical installation takes four to eight hours.***

## Inner Workings

How do system monitors manage to provide all this information in a single piece of gear? They use a current shunt or loop installed in the negative line of a specific battery bank (shown in **Figure 1**), usually the house bank since it's not necessary to count amp-hours in a starting battery. The main current is allowed to flow through the shunt or loop without interruption, while small secondary connections allow for current measurement. By measuring the current flow through this shunt or loop, a system monitor tracks charging current or load current, and calculates

## Products and Installation

Marine system monitors designed for a single house bank include the Heart Interface Link 10, Cruising Equipment's E-Meter and Ample Power's BatMon. The Link 20 from Heart Interface provides complete monitoring functions for two battery banks (**Figure 1**), while Ample Power's EMON Energy Monitor II monitors one house bank, displays voltage only for an engine starting bank and, as an option, can display amps and amp-hours produced by renewable charging sources. A more sophisticated approach is taken by the systems monitor from Sea, Air & Land Technologies (SALT), which can monitor up to four battery banks or charging sources, uses either standard shunts or unique current loops (no cable splicing necessary), has up to twenty programmable alarm functions, and can connect to a PC.

Installation of a system monitor consists of connecting a current shunt or loop in the main negative cable of each battery bank to be monitored, then running a handful of light-gauge wires from various points on or near the battery bank back to the system monitor display. The display can be mounted in any convenient onboard location, typically near the nav station. You must keep monitored battery banks electrically isolated from other batteries on board. If you connect banks using the 'both' function on your battery switch, the ammeter and voltmeter functions will continue to operate normally, but the amp-hour and time remaining functions will be confused by what they read as a temporary change in bank size.

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

# FIBERGLASS COSMETIC REPAIRS

It's easy to repair cracks, gouges, nicks, small holes and non-skid yourself. Just follow these easy steps for professional results every time.

## TOOLS

- Dust masks and respirator
- Safety glasses
- Latex gloves
- Disposable mixing containers (paper or plastic)
- Mixing sheets
- Stir sticks
- Masking tape
- Glue brushes
- Squeegee
- Preval sprayer
- Rags
- Putty knives (flexible)
- Utility knife
- Sanding blocks
- Wet/dry sandpaper, 320 to 600 grit
- Rotary bit (carbide, non-ferrous, non-plastic cutting bit with big flutes)
- Hacksaw
- Metal file
- Chisel
- Power buffer with foam buff pad

## Materials

- Gelcoat resin
- Polyester pigments
- Polyester or vinylester resin and hardener
- Chop-strand mat
- Fillers
- Solvent (acetone or lacquer thinner)
- Buffing compound
- Mold release (PVA or wax)

*By Wayne Redditt and Jan Mundy*

Cosmetic fiberglass repairs can be easily accomplished with a little know-how, inexpensive tools and supplies purchased from chandleries or specialty fiberglass suppliers.

It's important to note the distinction between cosmetic and structural repairs. Cosmetic repairs, such as minor scratches, shallow nicks, star crazing, gouges, small drilled holes and non-skid, are done for the sake of appearance. These generally do not affect the strength of the fiberglass laminate. Structural repairs are spider cracks, punctures, breaks and large holes that penetrate the laminate, affecting the boat's structural integrity. Such repairs are beyond the scope of this article.

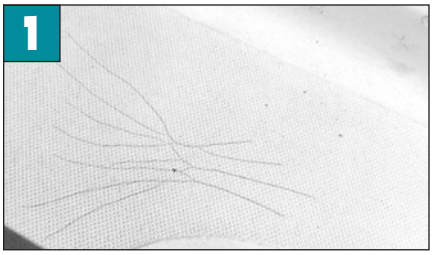
The cosmetic repair procedures recommended here are based on our *MRT Workshop* held last winter and presented by *DIY* columnist Wayne Redditt. Before attempting any of these repairs, you should be aware of the potential safety and health risks involved. Read all manufacturers' safety precautions outlined on the labels. Many of the chemicals are highly toxic, so the work area should be well-ventilated. Always wear gloves when handling gelcoat or resin, safety glasses or goggles when grinding, and a dust mask when grinding, sanding and buffing. When spraying gelcoat or mold release, always don a respirator with the proper filter.

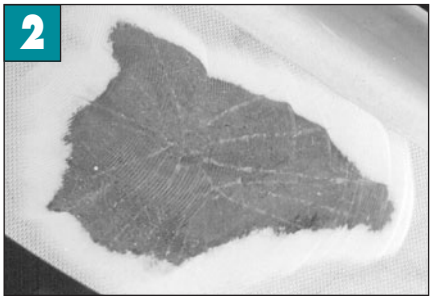
When doing any of these repairs, carefully follow the manufacturers' instructions and the directions for mixing and application of gelcoat, resins and other repair materials.

## Surveying the Damage

Clean the surface with detergent and fresh water, then clean the repair area with solvent. Inspect the repair to determine the extent of the damage. Where it's accessible, check the underside of the laminate. Ensure that structural damage has not occurred.

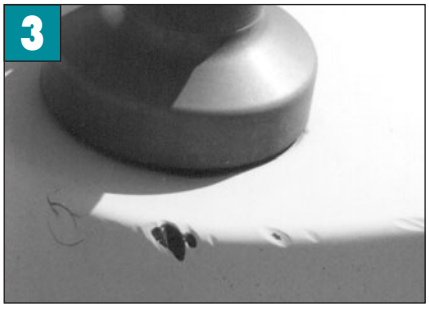
Spider cracking and corner cracks are almost always related to a structural problem caused by flexing. The telltale "webs" on the surface (**Figure 1**) often extend into the laminate. The extent of the damage only becomes clearly visible after grinding through the gelcoat. Whitish cracks or discoloration radi-



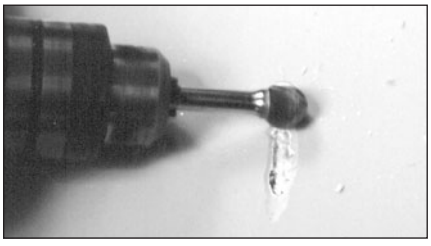
ating outwards, as shown in **Figure 2**, indicate a damaged laminate. Repair involves grinding the laminate to remove all delaminated glass, filling with putty and stiffening the structure to resist flexing. If the damaged laminate is not repaired, cracking will recur in the gelcoat.

## Repairing Gouges & Holes




When a scratch or gouge is very shallow and doesn't break through the gelcoat into the laminate beneath, it's best to simply wet sand with 400- to 600-grit abrasive and buff with a rubbing compound or polish. There may be a slight depression created (do not sand through into the laminate), but it will be less noticeable than a filled repair that's not perfectly color-matched. A deeper scratch or gouge (**Figure 3**) that goes into the laminate, but doesn't delaminate it, requires a different approach.

### STEP 1



Bevel the edge of the repair using a drill with a rotary or chamfering bit, or use a utility knife to contour the edges. Remove all loose and damaged gelcoat without enlarging the size of the repair area. Grind the gouge until you have a uniform dark color in the underlying laminate.

Remove the dust out of the gouge, then mask the area with a quality masking tape (3M is best). Tape close to the edge of the repair but not inside the repair zone or you'll have to refill. The thickness of the tape (about .005") provides an accurate measuring gauge for the finished height of the filler, allowing for shrinkage, which is about 5%. Tip: Layer the masking tape sequentially in a grid pattern around the repair. To remove it, you pull the bottom layer and it all comes off together.

Use a clean rag and clean the gouge with solvent. Do not use solvents around the repair until it's masked off completely. Gelcoat has been waxed and if you smear the wax into the repair area it will cause bonding problems.

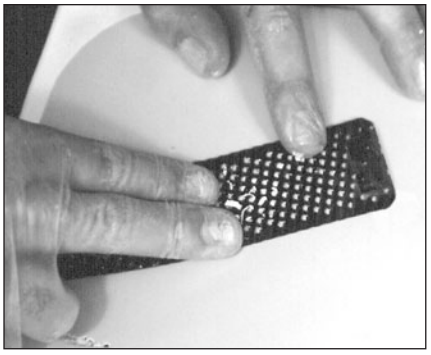
### STEP 2


Place a quantity of the correct putty filler (different types for above or below waterline repairs) on a plastic sheet or impregnated paper (available on pads from auto body suppliers). Don't mix on cardboard as it absorbs the material, especially the hardener. Add the creme hardener. To ensure the correct resin-to-hardener ratio, a good rule is to mix one golf-ball size amount of putty to 2.54cm (1") of creme hardener, regardless of the size of the repair. Use a pre-mixed quality filler, such as 3M Marine Premium Filler or Marine Filler which are very fine, gritless, modified vinylester compounds. Hardener is a different color (in this case blue), so mix until the colors are well-blended. You can't overmix.

### STEP 3

Tightly pack the filler into the repair area, spreading with a putty knife to remove the air bubbles. Remove the excess, leveling the surface with a putty knife large enough to span the tape so the filler is flush with the taped edge. If you fill the gouge only to the level of the gelcoat, when it cures, it shrinks, creating a hollow that must be refilled. Immediately remove the masking tape. The filler hardens in 20 minutes or so, depending on the amount and type of hardener used and the working temperature.

### STEP 4



Grate the repair with a Surform (remove the handle) while the filler is still "green" (not fully cured) so it's flush with the gelcoat. Gelcoat is extremely hard so you won't scratch it. Let the filler cure overnight. If the repair has any hollows, you'll have to refill them.

## COLOR-MATCHING

Color-matching gelcoat is one of the most difficult repair procedures. Color is added to gelcoat in the form of polyester pigments. If you're fortunate, your boat's gelcoat will exactly match a standard color in one of the off-the-shelf packaged gelcoat repair kits. If the color comes close but not quite perfect, then get ready for some work.

Begin by finding a smooth, flat, near-vertical surface somewhere close to the repair. Clean and buff the surrounding area. (Don't attempt to match color to a badly oxidized surface.)

To test the color of pigment required, dab a small quantity of uncatalyzed gelcoat resin onto the buffed surface. (Uncatalyzed resin will not harden and will not harm the surface of your boat.) Start with a gelcoat that is similar in color to the final color that you are attempting to match. For example, it's better to start with a white gelcoat and tint to off-white, than to pigment neutral gelcoat, which allows you to change the resin to any color. Add enough pigment but no more than 10% or you'll have over-pigmented resin, causing a loss of gloss that no buffing will restore. If you under-pigment your neutral gelcoat, the result is a translucent finish.

Now, add a minute quantity of the pigment you believe will shade the color to the desired hue and mix thoroughly. Pigments are very viscous and must be thoroughly mixed with the resin. Undermixing causes either a marble effect or colored streaks in the gelcoat. If the color does not match, try to determine the method required to make it right. Does it need black? White? Some yellow perhaps? There is no shortcut to doing this. Experimentation and practice are the only way to master this skill. Keep a record of the amount of pigment added. Once you've mastered the color match in your test area, you'll need to duplicate it in a much larger quantity.

— *Wayne Redditt*

## STEP 5


Prepare enough gelcoat to coat the repair. Mix a small quantity of neutral gel with your color pigment on the mixing paper or use a plastic container (yogurt containers are impervious to chemicals) for larger quantities. Use a premixed pigment that's color-matched to the gelcoat, otherwise you'll have to mix a custom batch (see Color Matching above). For a few small repairs, gelcoat repair kits (from Seacare and others) are easy to work with and less expensive than purchasing jars of polyester pigment.

## STEP 6

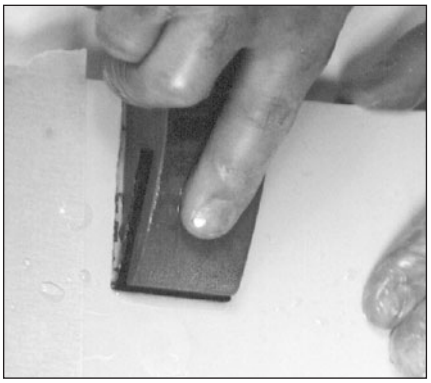
For small repairs, put a quantity of gelcoat in the upturned bottom of a plastic container and add catalyst at a ratio of 2%. Don't overcatalyze or you'll have a "cooked" edge that forms a luminous circle around the edge. When mixing larger quantities, use a small syringe to measure the exact amount of catalyst (see Non-Skid, Step 2). Mix well.

## STEP 7

Mask the edge of the repair. Be sure not to overlap the tape inside the repair or the gelcoat won't fully cover and you'll have to reapply. Clean the repair area with solvent.

Apply the gelcoat liberally with a putty knife, overlapping the tape. Remove the masking tape.

## STEP 8



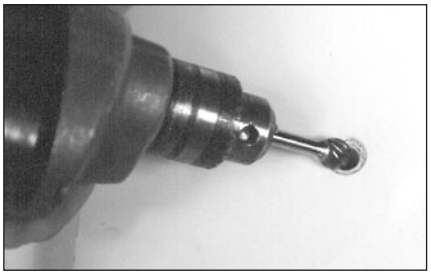
Using 320-grit paper on a rubber sanding block, wet sand the repair area. Place a squeegee over the repair and check for level. It should be perfectly flat. Any low spots require more gelcoat. Finish sanding with 400- then 600-grit wet paper. Use lots of water. Resist the temptation to sand with your fingers or you'll have ripples in the finished surface.

## STEP 9

Finish the repair by buffing with a fine rubbing compound. Use a foam pad mounted on a power buffer and begin by putting compound on the surface, then manually swirl the buffer around to work the compound into the pad. You can also buff with an angle sander but use low speed or you'll burn the gelcoat.

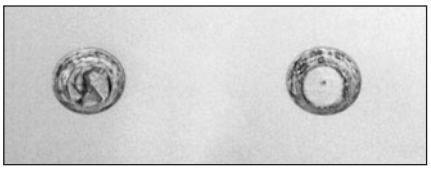
## STEP 10

Repairing drilled holes is similar, the only difference is you need to fill the hole. Begin by beveling the edge, using a drill with a cutting bit.



Remove the dust and clean with solvent.

## STEP 11



If accessible, cover the back of the repair with masking tape. When it's not, stuff a wad of masking tape into the hole (left) or insert a short piece of doweling (right) — anything to prevent filler from running out the hole and into the interior. Continue, following Steps 2 and 3 on page 12.

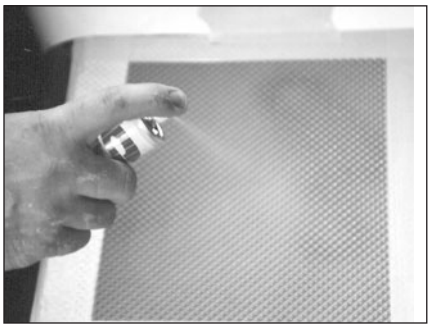
## STEP 12

Using a power drill with a rotary bit, grind off the filler to about .020" below surface level, or the thickness of the applied gelcoat. Fill with color-matched gelcoat following instructions in Steps 5 and 6 on page 13, then proceed through to Step 9.

## Repairing Non-Skid

Damage to non-skid decks is usually caused by dropping heavy objects, such as the anchor or a hammer, or stowing small outboards, bicycles, a dinghy or other bulky gear topsides. Repairing premixed painted non-skid is easy, just reapply. It becomes more difficult with a molded non-skid. The procedures outlined below use a three-step repair method: First a pattern or mold is made of the non-skid, a replacement patch is laminated from the mold, which is then glued onto the deck after removing the damaged deck surface. This is not an easy repair and usually takes some careful analysis of deck camber, total area of repair and pattern alignment.

## STEP 1

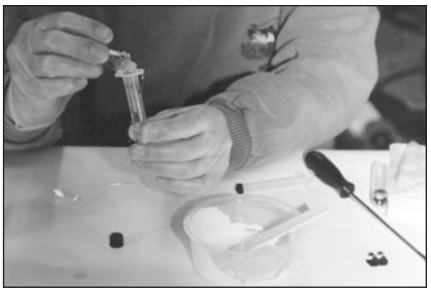


To make the mold, first select a flat portion of the non-skid deck that is in good condition. Wash the surface and let it dry. Mask off an area twice as large as the repair area. Use paper or plastic sheeting to prevent overspray getting on the deck. Clean the work area with acetone. Using a disposable Preval sprayer (available at autobody supply shops), spray the masked area with a thin, even coating of polyvinyl alcohol (PVA). Wear a respirator — this is toxic stuff! You can use mold-release wax instead but it fills up the pores, giving an uneven coating. If the work area is not completely covered with PVA, the mold will stick to the deck and you'll be doing another repair. Allow the PVA film to dry for about 20 minutes.

## STEP 2

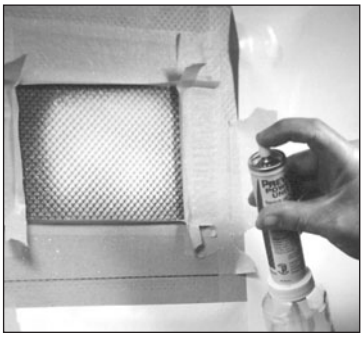
Use a syringe to measure the exact amounts of color-matched gelcoat and catalyst. (A metric one is preferred as it's easier to calibrate in millilitres than ounces.) Measure the gelcoat then load it into the Preval

spray bottle. Add catalyst at a ratio of 2%. An easy method to measure it is to calculate the number of drops per millilitre. In our demonstration, five drops equaled 1ml. Don't overcatalyze. Stir well. Working time is about 20 minutes.



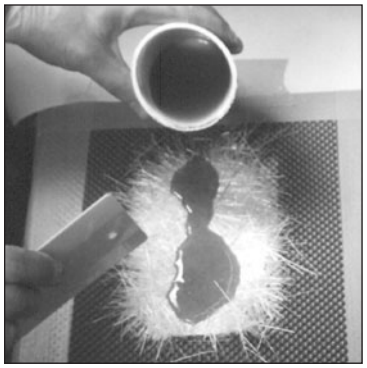
## STEP 3

Spray a thick coating of gelcoat over the PVA film. Do not brush on the gelcoat. If you disturb the PVA with the brush the mold will stick to the deck. Note the dam formed by masking tape along the edges of the work area in the photo. This is so the sprayed gelcoat doesn't create a hard edge. Let the gelcoat cure completely (one to two hours).



## STEP 4

Build your mold by laying up three or four layers of chop-strand mat soaked in general purpose polyester or vinylester resin mixed with hardener according to directions. Pour a small quantity of resin in the center of the cloth, then spread with a squeegee.

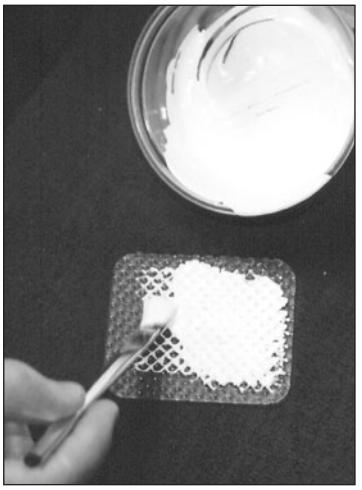


## STEP 5

When all the layers are wetted out, use a ribbed metal roller, working toward the edges, to remove air bubbles. If you're in a hurry, you can overcatalyze resin by up to 5% when making your mold and replacement patch. Your finished mold should be about 4.7mm (3/16") thick. Let cure overnight, then pop it off the deck. Wash both the mold and deck surface with water to remove the PVA.

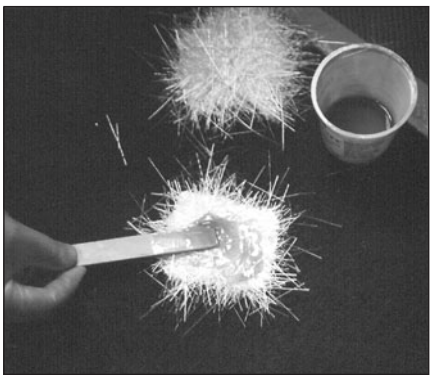
## STEP 6

To make a replacement patch, take your mold and repeat the entire laminating process. First wax the mold (use PVA or mold-release wax), then spray or brush on a thin coating of color-matched gelcoat. Don't make this too thick; the grid pattern in the mold should be just almost filled.



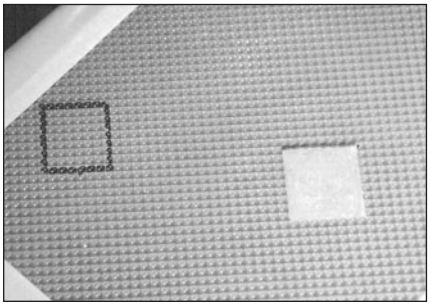
## STEP 7

Once the gelcoat has cured, laminate two layers of chop-strand mat onto the gelcoat. Let cure overnight. Remove the part from the mold. This should perfectly match the



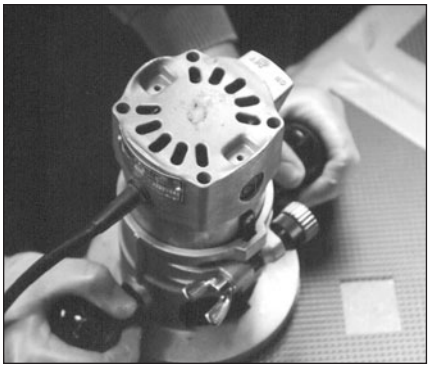
pattern and color of your deck's non-skid. If the bottom of your replacement piece isn't uniform, sand it until flat.

## STEP 8



Outline the repair area on deck with a felt pen so it forms a square or rectangle. This is the easiest to cut, although you can radius the corners. If your non-skid has a geometric pattern, count the number of diamonds, for example, so that all sides are equal and you'll be cutting in the groove.

## STEP 9



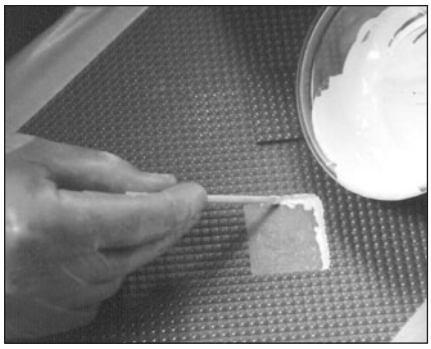
Using a router with a 1/2" straight, single-flute carbide cutting bit, carefully remove the deck surface. (Don't use spiral or double flute bits which tend to break away.) Step the depth of the cuts so you just cut into the laminate below the gelcoat. Make the first cut no more than 1.5mm (1/16"). Keep lowering the router bit until the cutting depth matches the thickness of your replacement piece. Cut carefully. Too deep and you'll go through the deck. Don't do this with an expensive router as fiberglass dust will destroy it.

## STEP 10

Square the corners with a chisel, cutting into the repair zone. If you attempt to chisel into the good non-skid, it will crack the gelcoat and you'll have an ever-growing repair zone. Transfer the shape of your deck cutout to your replacement patch, aligning the pattern so it matches perfectly. Place it in a vice, then cut to size with a hacksaw. A hacksaw gives a perfectly clean cut without the edges breaking away. Dry-fit your patch and file, if necessary, with a metal file to fit the deck cutout.

## STEP 11

To make an invisible repair, mix some color-matched gelcoat with catalyst and apply to the edge of the

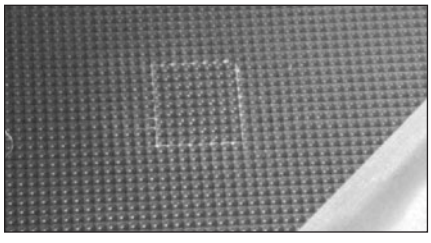


deck cutout. (We used a lighter gelcoat for demonstration purposes.) When the patch is positioned, it will squeeze out the gelcoat, eliminating the join line.

## STEP 12

Mix a small quantity of laminating resin with catalyst and drop some in the center of the cutout. This acts as a glue. Be careful not to touch the gelcoat. Place a few strands of mat, cut to short lengths with scissors, in the bottom to help bond the repair.

## STEP 13



Place the replacement part in the cutout. Immediately remove any excess gelcoat with an acetone-soaked rag. The color-matched gelcoat gives a virtually invisible repair. (Contrasting gelcoat was used and is visible in the photo.) Weigh down the patch with a heavy object. ⚓

# HAVING AC POWER On Board

Underway or at the dock, enjoy all the comforts of home with an AC power system.

*By Kevin Jeffery*

The desire to have a few household conveniences on a boat is natural and often enhances rather than diminishes the pleasure of getting away from it all. Household appliances run off of AC (alternating current) electricity, so if you want to bring them on board you must have some provision for maintaining a reliable AC power supply.

You can use an inverter to supply usable AC power indirectly through the stored DC (direct current) power in your battery bank. Or you can provide your own direct source of AC power from a shorepower connection for use at a dock, an engine-driven AC generator (commonly referred to as gen-sets), or a modified AC alternator driven off the main auxiliary engine. Inverters are convenient and easy to install and use, but you must have a reliable means of replacing the power they draw from the batteries. Direct AC sources don't rob the battery bank of stored energy, but you must be dockside using a shorepower connection or you must use engine-driven equipment to generate the power. A good review of the options available will help you decide which AC power sources are best for your needs.

## Option 1: DC-to-AC Inverters

There are several other ways to provide remote AC power, but none match the freedom and convenience offered by DC-to-AC inverters (hereafter referred to simply as inverters). If your AC loads are moderate and your battery capacity and charging system sufficient, inverters can eliminate the need for any other AC source.

Inverters allow you to have AC power almost anywhere. They don't actually create electricity, they only change it from one type to another. Modern solid-state inverters draw upon the energy stored in a bank of batteries. They simultaneously raise the voltage and create a simulated AC waveform — the final product is 110V/60Hz AC power (or 220V/50Hz for overseas use). If your charging sources have sufficient output, they can keep an inverter from depleting your batteries.

Over the past few years there have been significant advances in inverters that make their use efficient and affordable. Inverter operation is whisper-quiet, perfect for what I call "quiet time" loads — engine noise doesn't have to be present when you are actually using AC appliances. Of course, the batteries must eventually be recharged and that operation can be a noisy affair if you're using an engine-driven charger, but it's usually possible to schedule engine-driven charging for more convenient times.

The electricity inverters draw from the batteries can be supplied by renewable chargers such as solar panels and wind- or water-powered generators. Many factors determine whether or not renewable charging sources can supply your total AC load, but at least you have the opportunity to do so with an inverter.

Modern inverters use very little idle current — standby power when the unit is on but no load is being drawn — compared to engine-driven AC power sources. For many boaters this can be a large portion of the time. Previously, it was necessary to turn an inverter on for a specific task, then off again to prevent high standby losses. Now an efficient inverter may consume only half a watt on standby. Compare this to an engine-driven AC power source that is cranking away, consuming fuel whether you are using the AC power or not.

### TIPS — HOT, NEUTRAL OR GROUND?

*You must use a polarity tester to make sure correct polarity is maintained in the black and white wires. Marinco offers an inexpensive polarity tester that plugs into any AC outlet and warns of such common AC wiring problems as reversed hot and ground, reversed hot and neutral, open safety ground, and open hot conductor.*

Other inverter advantages include their relatively small size and weight, lower initial cost and reliability. Installation is uncomplicated and there's no additional engine to maintain.

Inverters come in a variety of

sizes and output ratings, from small 50- to 250-watt pocket inverters — ideal for powering computers, radios, tape decks, TVs and VCRs — to large units of 2,500 watts or more. Most of the larger inverters also have a powerful performance charging function that automatically kicks in when AC power from dockside or a gen-set is available. This feature eliminates the need for a separate battery charger.

Inverters for marine use are most practical for supplying AC loads up to about 2,500 watts, particularly if the larger loads in your system are only on for short periods of time. Even though the current draw of large intermittent loads may be high when the appliance is on, the total energy consumed by microwave ovens, toasters and coffee makers is usually moderate. Loads that are usually not supplied by inverters include AC-to-DC battery chargers (in essence, you would be trying to use battery power to charge your batteries!), air conditioners (unless supplemented by an engine-driven, high-output charging source), and appliances with large heating elements, such as hot-water heaters, space heaters and electric ranges.

AC electricity from the utility company is in the form of a pure sine wave. Inverters, which attempt to duplicate utility power electronically, are often classified by their type of output.

**Modified Sine-Wave Inverters.** Most of the inverters presently on the market have a modified sine wave output that closely approximates utility power. Heavy-duty models are suitable for running electric motors with high start-up loads, since their surge capability is typically three to four times their rated power. Some electronic equipment, including certain computers, laser printers and some fax and answering machines, won't run properly on modified sine wave output. Most other appliances, including TVs, VCRs, ink-jet printers and laptop computers, have no trouble at all.

**Pure Sine-Wave Inverters.** Some new inverters are equipped to produce pure sine-wave power that is as good or better than utility-grade. Pure sine-wave inverters will run any AC appliance without harm or annoying sounds. Increasingly, discriminating boaters are using a small pure sine-wave inverter to power their sensitive audio and office equipment, and a larger modified sine-wave inverter if needed for the other AC loads. Units include Dimensions (250-watt model), Trace SW series and Statpower PROsine.

**Cost.** Inverter cost is proportional to the rated output. Pocket inverters of 250 watts cost around CDN$180/ US$150; 1500-watt inverters cost around CDN$798/ US$625 without a charger and CDN$1,129/US$900 with; and 2500-watt models with a charging option or pure sine-wave output cost around CDN$1,580/ US$1,250 to CDN$1,905/ US$1,500 and higher. Additional battery charging sources needed to replenish inverter loads should also be taken into account.

## Option 2: Shorepower Connection

If you spend a lot of time dockside, have very large AC loads or limited

## TROUBLESHOOTING AC SYSTEMS

| Problem | Solution |
|---|---|
| **Tripped Breaker** | Loose wires at the breakers are a common problem. Occasionally bundled wires are bundled so tightly that the hot and neutral have chafed to the point of shorting. |
| **Breaker Tripping Repeatedly** | Check for loose connections, corrosion or, if the breaker capacity is smaller than the load it is serving, faulty breakers. |
| **Battery Failure When AC Charger is Present** | The most common cause of battery failure when an AC battery charger is present on board is due to the charger not being fully automatic with 100% shutoff capability. Ferro-resonant chargers made for long-term dockside use may continue to trickle charge even when the batteries are full, causing excessive voltage and inevitable battery damage. Check to make sure your charger's current stops completely when the batteries are full. |
| **Excessive Galvanic Corrosion On Board** | If a shorepower connection is used, check to make sure that stray current from the dockside AC power supply can't find its way to the DC circuit on board. If the incoming green AC ground wire is bonded with the boat's DC ground, as recommended by ABYC, install a galvanic isolator or isolation transformer to prevent stray current from following that path. |
| **Voltage Reading Between The White And Green** | Indicates that these wires are bonded somewhere in the circuit, something that must be avoided. If your AC circuit is properly wired, you should get a voltage reading between the black and white wires, the black and green wires, but NOT the white and green. |

battery capacity, you might find it necessary to have your boat's AC appliances run off a direct AC power source. If you can get by with having direct AC power only when you're at a dock, then a shorepower connection is all you need. It's relatively inexpensive to install and operates quietly. A complete shorepower system consists of electrical components that bring power to the boat and distribute it to the individual AC circuits on board.

***Shorepower components include a cord-set, one-piece adapters, pigtail adapters and non-metallic or stainless-steel inlets.***

**Shorepower Cord.** Similar to heavy-duty outdoor extension cords, these have a male plug on one end and a female receptacle on the other. Unlike straight blade ends found on standard cords, they incorporate twist-lock devices at each end so the cords can't be accidentally unplugged in areas of foot traffic. Shorepower cords also have an outer coating highly resistant to ultraviolet rays, salt and moisture. Cord sets complete with end plug and receptacle are available in 12-, 25- and 50-foot lengths, with either a 15-, 30- or 50-ampere rating. Amperage ratings are applicable for both 125-volt and 250-volt services. The end plugs on 250-volt cords have a slightly different configuration to keep the two services separate. End connectors and insulated wire can be purchased separately for custom owner-assembled cords.

**Shorepower inlet.** This is where the shorepower enters your boat. It consists of a male plug that is flush-mounted in a waterproof box with a tightly sealing cover, similar to outdoor electrical outlets for homes. The box is placed at some convenient location close to the boat's AC electrical panel.

***Shorepower inlet mounted in the bow of a Nonsuch 30 requires a watertight unit. Inlets are usually mounted in areas that are not normally subject to submersion, such as the cabin side or cockpit coaming.***

**Galvanic Isolators.** American Boat & Yacht Council (ABYC) recommends that the incoming AC green ground wire be bonded to the DC ground on board. This common ground provides protection from electrocution in the event that AC

# HAVING AC POWER On Board

current escapes from the AC wiring on board (i.e. through a short in an AC battery charger). This common ground, however, can set the stage for major galvanic corrosion problems, since stray current in a marina can enter a boat through the AC ground wire and pass into the boat's DC system. An galvanic isolator (**see Figure A**), which typically installs in the green ground wire from the shorepower supply, can protect against corrosion and still allow your AC circuit to adhere to ABYC recommendations. Galvanic isolators are relatively inexpensive (around $225 for a good-quality model), lightweight and easy to install, since they are wired directly into the green AC grounding wire. A good quality UL-listed model is available from Quicksilver, a subsidiary of Mercury Marine, for around CDN$225/US$160. Other models are available from Newmar and Professional Mariner.

It would be nice to have some type of indication or alarm on the unit that alerts a boatowner to the fact that stray current is being handled by the galvanic isolator. Future models may incorporate this feature.

**Figure A**

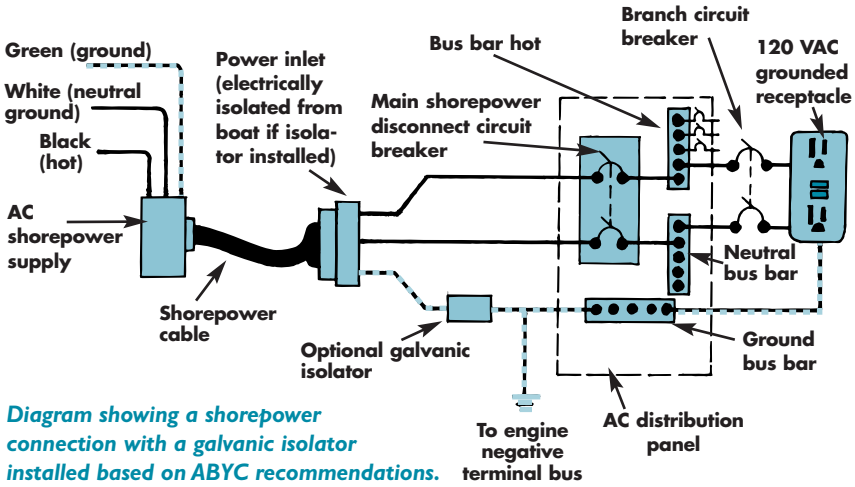



*Diagram showing a shorepower connection with a galvanic isolator installed based on ABYC recommendations.*

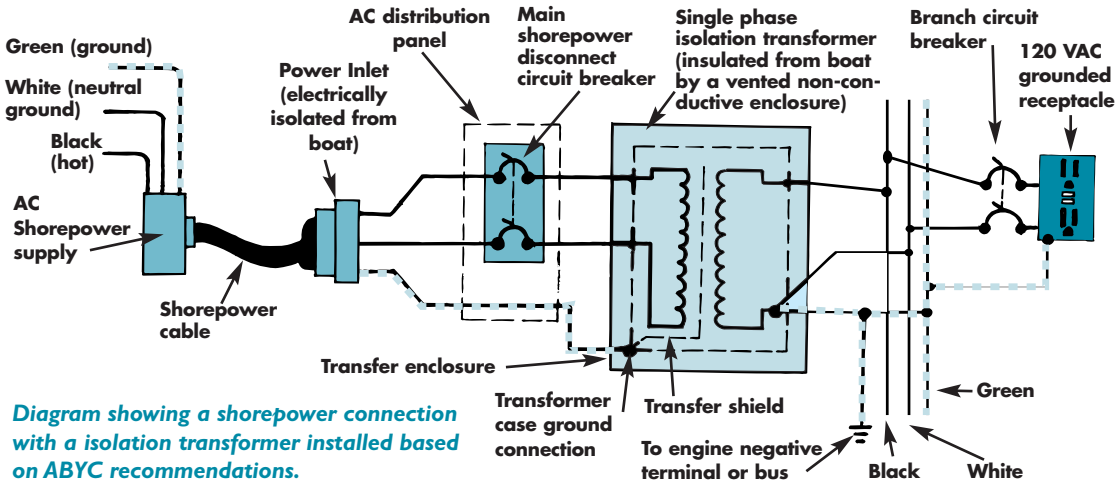
ANNE-MARIE HENDRY

***Quicksilver's galvanic isolator protects the hull, zinc anodes and aluminum drives (powerboats) from galvanic corrosion when your boat is plugged into shorepower.***

### Isolation Transformers:

Additional protection is found in an isolation transformer, a device that transmits dockside power magnetically to onboard circuits without direct wire connections. With this device, the incoming AC power is kept completely separate from the DC power on board, so there is no chance for stray galvanic current from dockside to reach the boat, and no chance for dockside AC problems to pose a safety hazard for the boat's crew. As shown in **Figure B**, when using an isolation transformer, the boat's AC ground wire is still connected to the DC ground to provide protection against faulty AC circuits on the boat. The down side to isolation transformers are their weight (31+ kg/70+ lb) and their installed cost (over $500). They are typically found only on larger boats.

**Figure B**




ANNE-MARIE HENDRY

*Diagram showing a shorepower connection with a isolation transformer installed based on ABYC recommendations.*

## Option 3: Gen-sets

If you need to have direct AC electricity when no utility power is available, then some type of engine-driven AC power source is your only alternative. Gen-sets are rated according to their continuous AC output capability, ranging from 2.5kW to 6.0kW for the smaller units to over 15kW. Self-contained gen-sets closely match a gasoline- or diesel-fueled engine with an AC electrical generator. Gen-sets can power heavy AC equipment that is on for long periods of time, such as air conditioning units, as well as large yet intermittent AC loads, such as electric cooking appliances, high-capacity water-makers, holding-plate refrigeration systems, washing machines and battery chargers.

Any generator that is coupled with an internal combustion engine could reasonably be called a gen-set, but industry practice is to reserve the term for permanently mounted units. Gen-sets are similar to small boat main engines in construction and appearance. The engine shaft is combined with a specially designed AC generator. Fuel is supplied through a separate tank or through the fuel tank for the main engine.

## SAFETY WITH AC POWER ON BOARD

▼ Before working on AC circuits on board, disconnect the AC power from its source. Take your time and observe correct polarity. Have a reverse polarity indicator on board, either integrated into your AC panel or in a hand-held model. Check for correct polarity every time you plug into shorepower. Dockside AC with reverse polarity (the hot and neutral wires are crossed) can damage onboard AC equipment and be a definite safety hazard if the neutral and ground wires on board ever become shorted, carrying hot AC current through the ground wiring.

▼ Use GFCI receptacles on each circuit. A GFCI at the head of a branch circuit can protect outlets downline in the same circuit.

▼ Install an indicator light that clearly shows that live AC power is present on board.

▼ Make sure your boat is wired by a competent marine electrician and adheres to ABYC recommendations.

Most gen-sets create a considerable amount of noise when operating, from both engine and exhaust, although water-cooled units tend to be less noisy than air-cooled units. Gen-sets are usually installed in mechanical compartments that are acoustically and thermally isolated from the living spaces, but additional steps can be taken to decrease noise. Most manufacturers offer some type of sound shield or sound-deadening panels that completely surround the unit, greatly reducing noise transmitted through the air. Additional noise reduction comes from rubber mounting feet and the use of flexible water, fuel, exhaust and electrical connections.

The engine and electrical generator shafts are directly coupled so that the engine rpm is also that of the generator. Engine rpm is governed so that the frequency of the AC output is held fairly constant. Large gen-sets have AC generators that are designed to operate at lower engine speeds — 1,800 rpms for 60Hz output and around 1,500 rpms for 50Hz output. On these larger gen-sets, lower engine speed reduces vibration and increases fuel consumption by about 25% over large portable generators.

Recently, a concept known as VST (variable speed technology) was developed. VST control logic allows a

generator to adjust engine speed to the AC load being drawn, while keeping the AC output current voltage and frequency more or less constant (similar to the technology used on modified AC alternator systems). This results in additional savings in fuel and wear on the gen-set since, if the AC load is small or nonexistent, the engine speed will be reduced accordingly.

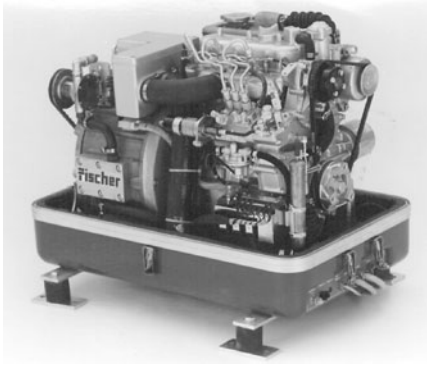
Marine gen-sets are typically water-cooled in one of three ways: directly by seawater pumped through the cooling system and into the exhaust system; indirectly through the use of a heat exchanger, where heat is exchanged between captive oil or water in the gen-set and seawater; or indirectly by way of keel- or skin-cooling where pipes in the keel or a section of the hull act as the heat exchanger.

**Efficiency.** When a gen-set is running, AC power is available but not necessarily being used. This is quite different from DC charging systems, where every time they operate useful energy is being stored or consumed. Gen-set fuel consumption, to a certain extent, is proportional to load, so there is some fuel savings at loads less than rated output. If the unit has VST, the fuel savings can be significant when smaller loads are present.

With this in mind, if a 4.5kW gen-set is running and close to 4,500 watts of AC electricity is being consumed, then the overall efficiency is around 20%. If the load drops to 1,000 watts, the overall efficiency can drop to around 10%, unless the unit is equipped with VST, in which case efficiency will be closer to 15%.

System efficiency can be increased by closely matching a gen-set's output to your electrical needs; operating your AC loads together when possible to make full use of a gen-set's capacity; turning the unit off when it is not needed; using an inverter when possible; and by running an AC-to-DC battery charger to recharge your battery bank any time the gen-set is on.

**Cost.** Compact gas- or diesel-fueled gen-sets in the 3.0kW to 4.5kW range are readily available, with costs ranging from US$3,500 to US$10,000. These units can fit into spare lockers and other small spaces on board. If you need more power, consider a unit in the 6kW range;




***Fischer Panda water-cooled generators with three-piece insulated fiberglass sound shields are extremely quiet: the 7.8kW Panda 8 (shown) has a noise level rating of just 53 dBa.***

they are still of modest size and weight, run in the US$5,000 to US$12,500 range, and typically have enough power to run the charging side of a large inverter-charger rated at around 120 amperes.

### Option 4: Modified AC Alternators

Modified AC alternators and control systems are powered by a boat's main engine, eliminating the need for a secondary engine. Power Technology's SeaPower 5kW and 10kW models employ a custom, high-voltage alternator intended to replace or supplement the existing alternator on board. They produce precise 115-volt/60Hz utility-type power (230-volt/50Hz power on the export versions). Most boaters leave their existing alternator in place for battery charging. If a modified AC alternator system must replace your existing alternator due to space limitations, you can use the AC power to run a battery charger or the charging side of an inverter-charger. As with a standard alternator, you'll be charging whenever the main engine is running.

If you are considering upgrading your present alternator and also want high-capacity AC power without a gen-set, this is a good system to investigate. Powerboaters won't need to run a gen-set while underway and sailors get a convenient, lightweight direct AC power source without buying and maintaining another engine. Keep in mind that a modified AC alternator only operates with the main engine running; you may want to consider using an inverter for the small, continuous AC loads on board, or during times when you'd prefer not to listen to the engine.

## AC WIRING TIPS

*Many production boats built between the 1960s and mid-80s are incorrectly wired. We've compiled a few wiring AC tips (to ABYC standard), but you should be aware that this is by no means a complete treatment of the topic and you should consult a marine electrician before undertaking any AC wiring.*

▼ All conductors and flexible cords should meet the requirements of the applicable standards of Underwriters Laboratories, Inc. The minimum surface marking on individual conductors and their jacket should include: A. type/style, B. voltage, C. wire size, D. temperature rating dry.

▼ All conductors should be at least 16 AWG (18 AWG is permissible as internal wiring in panelboards).

▼ Conductors should be identified to indicate circuit polarity as follows:

| | |
|---|---|
| BLACK | Ungrounded conductor |
| WHITE | Grounded neutral conductor |
| GREEN, GREEN WITH YELLOW STRIPE | Grounding conductor |
| RED, ORANGE, BLUE | Additional ungrounded conductors |
| BLACK W/RED STRIPE, BLACK W/BLUE STRIPE, BLACK W/ORANGE STRIPE | Additional colors for ungrounded conductors (black) |

▼ Conductors and flexible cords must be stranded copper.

▼ All connections normally carrying current should be made in approved enclosures. Junction boxes, cabinets and other enclosures should be made weatherproof or installed in a protected location to minimize moisture accumulation. Unused openings in electrical enclosures should be closed.

▼ All conductors should be supported and/or clamped to relieve strain on connections.

▼ When AC and DC conductors are run together, the AC conductors should be sheathed, bundled or otherwise kept separate from the DC conductors.

▼ Current-carrying conductors should be routed as high as practical above the bilge water level and other areas where water may accumulate and as far away as practical from exhaust pipes and other heat sources.

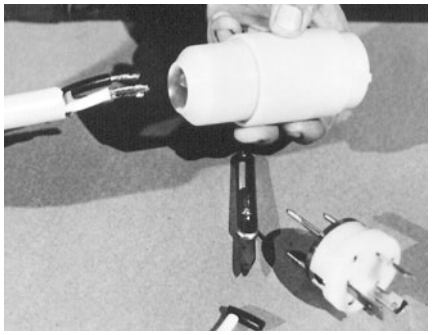
▼ Terminal connectors should be the ring or captive spade types and they should be the same nominal size as the stud. Connections may be made using a set-screw pressure-type conductor connector providing a means is used to prevent the set-screw from bearing directly on the conductor strands. Twist-on connectors (wire nuts) should not be used.

▼ Solder must not be the sole means of mechanical connection in any circuit.

▼ No more than four conductors should be secured to any one terminal stud. If additional connections are necessary, two or more terminal studs shall be connected together by means of jumpers or copper straps.

▼ The shanks of terminals must be protected against accidental shorting by using insulation barriers or sleeves, except those used in grounding systems.

▼ Install a weatherproof shorepower inlet in an area free of spray or splash; otherwise, you must install a watertight inlet.



*When a bad shorepower connection develops, splice a new plug or connector onto the cordset.*

small, continuous AC loads on board, or during times when you'd prefer not to listen to the engine.

**Output.** The alternators supplied with the SeaPower systems are custom, high-voltage units. A separate AC power unit takes the alternator output and converts it to pure sine wave 115-volt/60Hz or 230-volt/50Hz output capable of running sophisticated electronic equipment, digital controls and inverters with integral chargers. Output voltage is regulated to within plus or minus 5 volts and frequency is held to within .01%. A remote control/display panel completes the system.

**Alternator speed.** Alternator speed can vary from 1,600 rpm to 8,000 rpm continuous or 10,000 rpm intermittent, while the AC power unit ensures that the AC output remains clean and constant at any alternator speed.

**Input load.** The engine power required to produce AC power is about 1.7 hp for every kilowatt of power produced. That's about 8.5 hp for the 5kW SeaPower and 17 hp for the 10kW model. It's clear that an engine with a minimum of around 25hp is needed to operate these units.

**Protection.** These units have built-in circuits that protect the system in the event of high voltage, high temperature of the alternator or AC power unit, short circuit, low battery voltage and excessive load.

**Efficiency.** Running the main engine to produce electricity is typically not as efficient as operating a gen-set or portable generator. The overall system efficiency is around 10% to 15% for the AC output under maximum load. This occurs when all of the energy being produced is put

*SeaPower's AC alternator bolts directly to the engine, eliminating the need for a secondary engine.*

# HAVING AC POWER ON BOARD

to use. If the unit is producing 4,000 watts of power, but only 1,000 watts are being used, then the overall efficiency drops to around 5% to 8%. Charging batteries anytime AC power is produced can increase efficiency.

**Cost.** The SeaPower 5kW unit sells for CDN$5,193/US$3,995; the 10kW for CDN$10,400/US$8,000.

## Other AC System Components

Other components to complete an AC system installation include:

**AC Master Control Panel:** The master control panel distributes the power to your individual circuits, including 110-volt refrigeration, lights, water heater and groups of AC outlets. The master control panel is equipped with a master breaker that disconnects the entire AC system on board, and individual breakers for each circuit. Panels from Blue Sea (#8043), Marinetics (#EP9635), Paneltronics (#9972305B) and others have reverse polarity indication, an added safety feature that indicates faulty utility-power wiring.

***AC panels come in a variety of configurations, depending on your requirements: (left) panel with five-branch circuit capacity for basic installations; (right) Paneltronics' full-function distribution center with controls for shorepower, generator and inverter, current and voltage meters and 10-breaker capacity. Both panels are equipped with reverse polarity lights.***


**AC Outlet:** Outlets for marine use are almost identical to those used on land. Outlets with ground fault circuit interrupt (GFCI) protection should be used near the head and galley, and can be used throughout the boat for added protection. One GFCI outlet can protect downline outlets on the same circuit. Marine outlets are available with teak or stainless-steel cover plates.

**Ship-To-Shore Selector Switch:** This double-pole, double-throw switch allows you to select either shorepower or output from your onboard AC power source. You may elect to install one of these switches for future use if you don't presently have an onboard AC power source in the system. The switch cuts off power from one source before engaging the other, preventing the two systems from mixing. The power switch is a device that automatically transfers the load from your inverter to "grid power" when you start your generator or plug into shorepower. The power switch is available in 30-amp (US$112) and 50-amp (US$182) models for 120-volt AC circuits.

***AC outlet receptacle with GFCI, reset and test buttons to protect the user from line-to-ground electrical shock hazards.***

*Kevin Jeffrey is a longtime cruiser and independent electrical power consultant. He is the author of the* Independent Energy Guide *and publisher of* Sailor's Multihull Guide, *now in its second edition.*

## DIY INSTALL BILL

*Cost of a typical shorepower connection for power or sailboat.*

### Parts

| | |
|---|---|
| 15m/50' shorepower cord | $63 |
| 1 30A shorepower inlet with stainless-steel case | $91 |
| 1 galvanic isolator (best quality) | $225 |
| 1 basic AC panel (with double-pole main breaker, 4 branch circuits, and reverse polarity indicator) | $230 |
| 3 AC outlets, GFCI type (Ground Fault Circuit Interrupter) | $84 |
| 30m/100' spool of primary AC boat cable, 10/3 AWG | $154 |
| Miscellaneous parts | $75 |
| **TOTAL** | $922 |

***Labor Rate for Professional Installer***

| | |
|---|---|
| 8 hrs @ $50 per hour | $400 |

*Note: Prices are in Canadian funds. U.S. parts prices will be about 30%*

SAILBOAT RIGGING

# INSTALLING HARDWARE ON ALUMINUM SPARS

A pro reveals the secrets to successful drilling, screwing and tapping.

**TOOLS**

*Drill and bits*
*Tap set*
*Club hammer*
*Assorted screwdrivers*
*Pop rivet gun and rivets*
*Cutting oil*
*Tapping fluid*

There will come a time when you'll need to install an electronics bracket, an exit box for an added halyard or an eye strap for lazy jacks. Installing hardware on aluminum spars is easy with the proper tools and some basic skills. *DIY* spent a morning with Dan Klacko, owner of Klacko Spars (905/825-0015), custom spar builders and metal fabricators in Oakville, Ont., who shared some (but not all) of his techniques for installing hardware on aluminum spars.

Before every hardware installation, you must first determine the type of fasteners to use. Since we're not all skilled welders, we'll focus only on mechanical fasteners.

## Fasteners

Stainless-steel bolts and machine screws or monel rivets are the preferred fasteners for installing mast hardware. Normally, bolts with locking nuts are used to fasten hardware that is mounted on opposite sides, such as shroud tangs or a bail. (Note: Thru-bolting requires a compression tube or the mast may compress and collapse.)

Machine screws are used exclusively by custom mast builders to fasten most hardware. More time-consuming to install than rivets, they require drilling an undersize hole, then using a tap drill to make a threaded hole for the screw. Screws are identified by the size and number of threads. A No. 10-24 screw, for example, denotes a screw with a maximum diameter of 10 (.190) and 24 threads per inch. Look for National Fine (NF) screws; the finer the thread, the better the holding power.

It's recommended to use pop rivets only when the spar is too thin to tap for threaded fasteners or to install a conduit (see Wiring Refit). Rivets come in aluminum, monel and stainless steel. Aluminum rivets are cheap, not very strong and often have steel shanks that quickly corrode, weakening the rivet and the surrounding metal. Stainless-steel rivets are the best choice if you can't find monel (available at your local rigger), which offer superior corrosion-resistance and strength. Using pop rivets makes quick work of any installation — simply drill and pop in a rivet.

A properly installed rivet can equal the holding power of a machine screw but you can't tighten it. A loose rivet must be drilled out and replaced. Ditto if you want to service or replace a piece of hardware. Unlike rivets, machine screws are easily removed and reinstalled if you need to remove the hardware. And repairing a threaded hole is simple. If the threads are stripped or overloading results in a screw that can't be tightened, you can easily drill and tap to the next size screw.

## How Many Holes are Too Many?

Contrary to popular belief, drilling lots of holes in your mast has little effect on its structural integrity provided the mast is PROPERLY designed and loaded for your boat.

In the 30 years that Klacko has been building, repairing and replacing spars, he has never known of a mast to fail from an overabundance of drilled holes. Mast failure usually happens because a mast is flexing too much, the section is too small for the boat, it's not properly rigged or a chainplate, clevis pin or other critical fitting fails. Removing material for items like an exit box also tends to weaken a mast, but usually won't cause collapse — provided it's properly designed for your boat. Rather

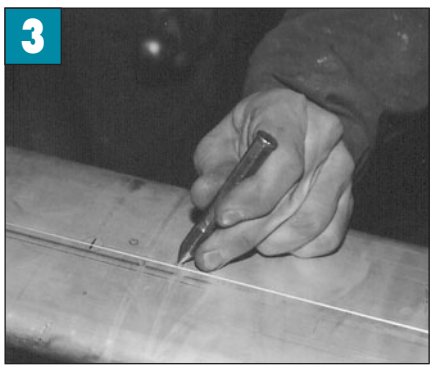

1

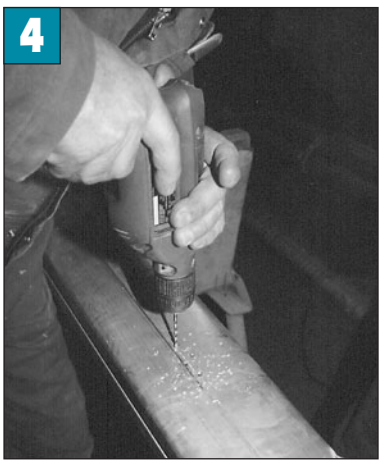
improper installation — such as cutting holes with square corners — can cause stress cracks that migrate from the opening, possibly resulting in failure.

How many drilled holes are too many? There are still many older-style masts in use today with sections that are spliced vertically and

horizontally, then fastened together with hundreds of rivets. Such a mast for a 25-footer may have more than 800 rivets. Drilling a series of holes in a line for mast steps or around the base for turning blocks creates little or no risk of cracking or breaking — provided the mast is correctly loaded. The only exceptions are free-standing, unstayed masts (i.e. Nonsuch and Freedom). Constant mast flexing forms cracks around drilled fittings, particularly around the base. After a few failures, builders now use clamp-on fittings on this style of mast.

## Installing Hardware


As mechanical fastening is best, we're only providing the instructions for machine screw attachment. Riveting is straightforward, provided you invest in a quality rivet tool and drill the hole just large enough for a tight fit. Before starting on your mast, we suggest you practice your tapping techniques on some scrap metal.

Lay the fitting on the mast and mark the holes to be drilled (**Figure 1**). When installing fittings on opposite sides use a paper or metal "sleeve" as a guide, wrap it around the mast so it overlaps (**Figure 2**), align the top edges and draw a line. Use a

center punch, whacked hard with a hammer, to make a small dimple to seat your drill bit (**Figure 3**). Drill a pilot hole with a variable-speed drill and sharp bit (**Figure 4**). Apply lots of cutting oil (best), soapy water or candle wax to lubricate and cool the bit. Now drill a hole of the correct size for the tap (**refer to Figure 5 for drill size**). Larger holes may require drilling two undersize holes before selecting the proper size bit.

Tapping the threads is easily done with a tap

**Figure 5**

*The following table lists the most common screw sizes, the preferred tap drill and alternative bit in inches.*

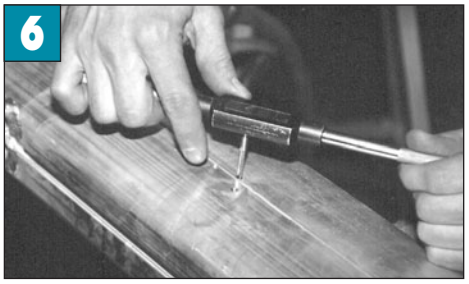
| Screw Size | Threads per inch | Tap Drill | Substitute bit* |
|---|---|---|---|
| No. 6 | 32 NC | 36 | 7/64" |
| No. 8 | 32 NC | 29 | 9/64" |
| No. 8 | 36 NF | 29 | 9/64" |
| No. 10 | 24 NC | 25 | 5/32" |
| No. 10 | 32 NF | 21 | 5/32" |
| No. 12 | 24 NC | 16 | 11/64" |
| No. 12 | 28 NF | 14 | NA |
| 1/4" | 20 NC | 7 | 13/64" |
| 1/4" | 28 NF | 3 | 7/32" |

***If you don't have the correct numbered drill bit, you can substitute the bit listed without compromise.***

wrench and tap (**Figure 6**). (To save money, purchase the wrench separately and the taps as needed.) Place a drop of tapping fluid on the tap bit, then center it in the hole. Hold the tap straight or your screw will go in on an angle. Turn the wrench a quarter turn, then turn it back just a little, turn beyond the first cut and turn back. This breaks off the metal chips that you've cut, which cause the tap to bind in the hole and break. Continue turning and backing off until you've cut to the depth required. Use lots of cutting oil and go slow or you'll break the tap. Always wear safety glasses when working on metal.

Aluminum and stainless steel are dissimilar metals and masts that aren't protected from moisture begin to corrode quickly, particularly in saltwater. (Freshwater boaters are not exempt, corrosion just takes longer.) To prevent moisture collecting and corroding aluminum, you need to insulate the hardware and fasteners from the spar with a gasket of some sort.

Popular practice in the '70s and early '80s was to



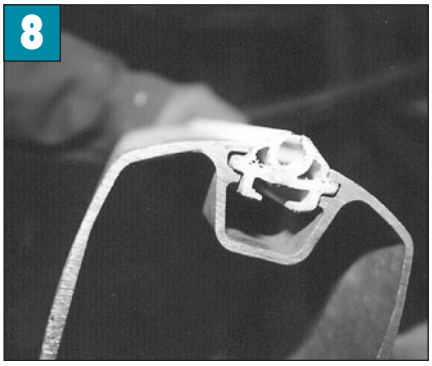

use a rubber gasket or electrical tape. These products actually trapped moisture and helped accelerate corroding of the aluminum. Instead, bed the fitting and fasteners in sealant, which fills in the gaps and stays pliable so it moves with the flexing of the mast without breaking the seal and allowing water to enter. Klacko recommends using polyurethane sealant (i.e. 3M 5200) or silicone, which allows easier removal of the fitting. Be sure to put a dab of sealant on fastener threads and under rivet flanges before installing. Mounting hardware with sealant gaskets is rarely done on a stock mast. Check your mast and remove and bed any hardware that's without. If you're not doing the work yourself, you'll need to specify when contracting a rigger.

When cutting an opening for a halyard, be sure to round the corners (**Figure 7**). Square edges can form a crack in that area. Although most masts use an exit or sheave box, it's actually not necessary to install any hardware here. Sheave boxes are rarely used now as they put too much restriction on halyards. Let halyards exit directly though the cutout; for wire-rope halyards, add a stainless-steel cover plate.


## Wiring Refit

Most newer masts are designed with an internal conduit for wires that is built into the extrusion, either a channel (**Figure 8**) or a protruding knob into which split PVC pipe (**Figure 9**) slides.

The primary reason to confine wiring in a conduit is to eliminate noise — wire chafe isn't usually a concern unless you have wire-rope halyards or lots of internal halyards. On masts without a conduit, you can stop the wire slapping by adding some sort of cushioning. A simple remedy is to purchase pre-slit, foam water pipe insulation, available at hardware stores, slip it over the wires, push it up to the masthead (or as high as possible), and tape the bottom so it doesn't slide down. Alternatively, take a sheet of flexible Styrofoam rolled into a tube and stuff it inside the mast.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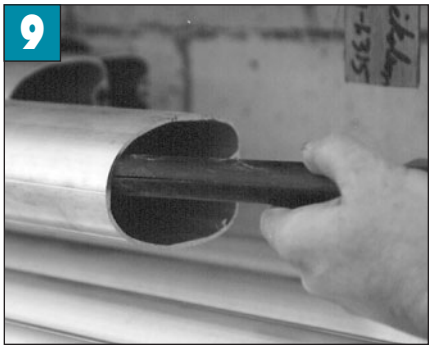
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Masts not equipped with a wiring conduit can be retrofitted, but not easily and only with the mast unrigged. A professional rigger charges about $200 or more but you can do the job yourself. Use plastic conduit or PVC Schedule 40 pipe of about 12mm (1/2") ID, or larger if your mast has lots of wires. Use 1.5m (5') lengths and join with a coupling (whipping will eventually break the longer 3m (10') lengths). Lay the conduit alongside the mast on the track side where there are no openings or drilled fittings. Mark the placement of each coupling, then drill two holes through each one and the mast for 3/16" rivets. Use aluminum rivets with aluminum mandrels — this is critical or you'll get corrosion.

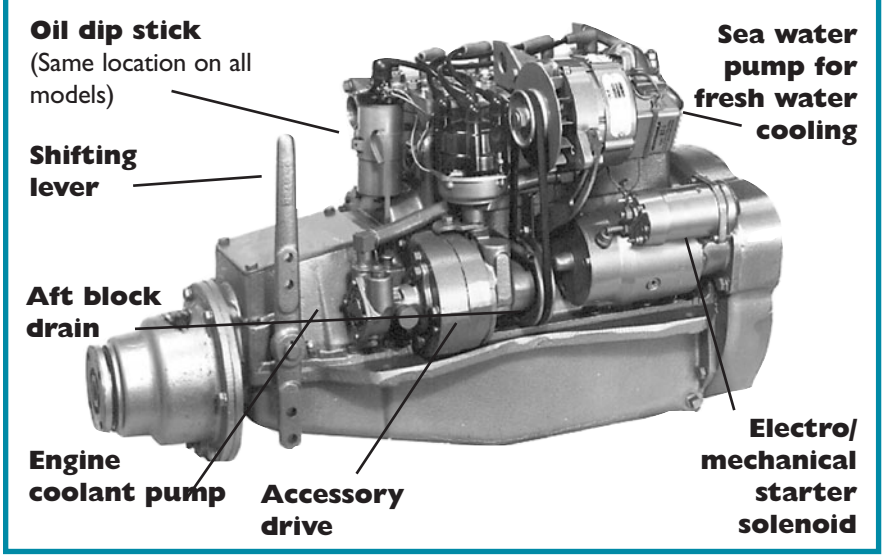
Slide the conduit inside the mast, being careful not to snag the halyards. Make some wire hooks, bent to a 90° angle to hold the conduit in place. Dab some sealant on the holes, then, starting at the bottom, rivet the conduit to the mast. It may be necessary to drill additional holes beside the conduit to hold it in place with your hooks as you drill the conduit. Drill exit holes through the mast and conduit for spreader and steaming lights, and the external leads. Starting at the top, snake the wires through the conduit. It's a good idea to also drop some messenger lines in the event you need to add wires later. Seal the exit holes with sealant.

ENGINE TROUBLESHOOTING

# ATOMIC 4 — DESIGN CHANGES & TECHNICAL BULLETINS

Upgrade your existing engine to the latest specifications and technical bulletins to increase reliability and performance.

## TYPICAL LATE MODEL CONFIGURATION (STARTER SIDE)




*By Robert Hess*

The Universal Atomic 4 gasoline inboard engine was built from 1948 to 1986 by the Universal Motor Company in Oshkosh, Wisc. (Universal also manufactured the Atomic 1 and Atomic 2; however, the Atomic 4 was by far the most successful.) Around 30,000 Atomic 4s were sold in North America, and although thousands of boats were later converted to diesel, there are probably still around 20,000 engines in use.

After production ceased, Universal continued to supply parts until it was purchased by Westerbeke. Westerbeke has continued supplying parts, and in some cases issued technical bulletins detailing the modification of existing components and changes in the specification of some parts. Most electrical parts were supplied by Prestolite, Delco and Motorola, and are available from automotive parts stores such as UAP Napa and Lordco, along with gaskets, bearings, belts and hose.

## Specifications

The following describes the various engines produced by serial numbers and the recommended upgrades:

▼ Serial numbers to 79475 indicate a pre-1968 early-style engine with manifold-mounted thermostat and Prestolite ignition.

▼ Serial numbers 79476 to 170508 indicate the 1968-style engine (model UJ) with integral cylinder head thermostat housing, Delco ignition and a Zenith Series 61 carburetor. The Series 61 carburetor was fitted with an adjustable main jet, and has a float height setting of 1-9/64".

▼ Serial numbers 170509 and up indicate a Zenith Series 68 carburetor and Motorola 35-amp alternator. The Series 68 carburetor has a fixed main jet and a float height of 1-5/32". Later versions of this carburetor do not have the restricted 1/8" copper line between the bottom of the carburetor throat and the intake manifold, which was designed to remove excess gasoline when flooding occurred.

▼ Serial numbers 171514 and up indicate the elimination of the external valve chamber oil line.

▼ Serial numbers 174340 and up indicate a change to an Oberdorfer model M202-3 water pump. The pump is fitted with a type M3 half cam, which pumps less water than the type M7 full cam fitted in the model M202M7 pumps used on diesels.

▼ Serial numbers 174802 and up indicate new-style valves are fitted.

▼ Serial numbers 176500 and up indicate the valve guide internal diameter is changed from .3150" to .3145" in order to decrease valve stem-to-guide clearance by .005".

▼ Serial numbers 192787 and up indicate a new-style flywheel, which requires a new-style starter motor, part number 261126, and a new flywheel cover.

▼ Serial numbers 178800 and up indicate a new-style transmission planet gear/clutch case, and a reduced number of clutch plates.

▼ Serial numbers 202987 and up indicate an electric fuel pump and low oil pressure switch to replace the Delco mechanical fuel pump. To

upgrade to this specification, order a Westerbeke #299250 conversion kit, which includes an oil switch #299303, other needed parts and an instruction sheet. Remove the mechanical pump, blank off the hole in the side of the block, and install the new electric pump. Install the low oil pressure switch in a "T" junction at the oil pressure sender port (or in another lubrication system pressure port), retaining the oil pressure sensor and its connection to the engine control panel oil-pressure gauge. Wire the pump by connecting it in series with the oil pressure switch to the ignition coil positive terminal, and with a direct connection to the starter motor "R" (resistor) terminal which bypasses the low oil pressure switch to allow the pump to operate while starting.

## Replacement Parts

Every engine part except new cylinder blocks and oil pan is available, either from Westerbeke or from small Atomic 4 specialists and auto parts stores. Here's a partial listing.

**Electrical:** Later engines had a 20-amp fuse installed between the ammeter negative terminal and the ignition switch "B" terminal, and a 10-amp fuse between the ammeter negative terminal and the bilge blower switch. There was also a 35-amp main fuse installed between the starter motor solenoid heavy positive terminal and the ammeter positive terminal. Marine automatic reset circuit breakers or manual reset circuit breakers should be used instead of fuses; however, if in-line fuses are fitted they should be a waterproof type, such as the Ancor #607013, #607014 or #607015.

**Separators:** Some sailboat manufacturers installed good-quality marine fuel-water separators in the engine compartment of their boats during the initial engine installation to increase reliability. Canadian manufacturers usually specified the Fram FCS1136-M, which is still available from auto parts stores. Several newer models of marine fuel-water separators made by Fram, Racor and other manufacturers can also be used. Never install a fuel-water separator with a glass bowl or a petcock drain on a boat, especially when using gasoline as fuel. Specify metal bowls and screw-in-plug drains. A fuel-water separator is recommended for all installations.

**Carburetors:** Late-model Atomic 4s had different carburetor jets than those manufactured earlier. This jet specification will usually reduce plug fouling and lower fuel consumption. When changing jets, change them all at the same time. The new specification is: Main jet, #21, Zenith C52-7-21; Idle jet, #12, Zenith C55-22-12; Well Vent jet, #21, Zenith C77-18-21; Main Discharge Nozzle jet, #55, Zenith C66-114-4-55; and Idle Bleed hole, #20 (carburetor casting, drill size .039").

ENGINE TROUBLESHOOTING

**Relief Valve:** The Universal Oil Pressure Plunger Kit, part number 256575, was a modification to the adjustable oil-pressure relief valve that converts it from the post-'67 design using a steel ball back to the pre-'67 design using a plunger. Apparently Universal decided that the plunger design controlled oil pressure more accurately. My experience is that the ball valve works fine, so I don't recommend this modification.

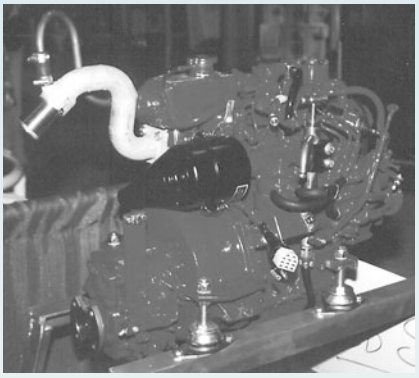
**Flame Arrester:** Westerbeke's Revised Flame Arrester Kit, part number 303073, was introduced in January '90. It consists of a new-style round carburetor flame arrester element that fits to the original-style rectangular body. This modification is really a parts replacement for the original rectangular flame arrester element. Don't do it unless you've lost the original and can't find another one.

**Thermostat:** Westerbeke Service Bulletin P31993, January '93, advises of a new-style thermostat, part

## REPOWERING WITH DIESEL

Upgrading your Atomic 4 to a diesel is a viable option for some owners. You'll have better fuel efficiency, reduced maintenance costs, insurance rates may fall slightly while the resale value may increase.

Diesel replacement engines are available from Westerbeke, who offers two Universal models, and Beta Marine, a U.K.-based manufacturer with distributors across North America. Beta Marine offers two drop-in diesel replacements: a 20-hp (BD722) three-cylinder diesel and 10-hp (Beta Ten) two-cylinder. The more popular 20-hp weighs about 32% less than the Atomic 4 and has a 40-amp alternator (55-amp optional). Engines are marinized Kubota diesels complete with an instrument panel, flexible shaft coupling, multi-pin wiring harness and self-bleeding fuel system customized by Beta Marine. They are offered with identical "footprints" as a no-cost option, so you won't have to build new engine beds. Just be sure to ask for the Atomic 4 package when ordering.



***Drop-in replacement diesel from Beta Marine.***

A repower involves electrical and plumbing work and perhaps some fiberglassing to reinforce the engine mounts. You'll need to change the prop shaft from 3/4" to 1" and battery cables (original cables are one size too small), upgrade the exhaust system to a water-lift muffler and add a cutlass bearing, stuffing box, water strainer and seacock for the intake (raw-water cooled) or a plastic "catch" tank for fresh-water cooled systems.

Other additions include a new prop — if your boat's propeller aperture is small, you'll have to get creative with the diameter and pitch — plus miscellaneous hose, wiring, 4 lag screws for engine mounting and other sundry parts. Beta's self-bleeding fuel system (a real time-saver) requires a good battery (now's the time to upgrade to a Surrette). You may need to replace the fuel tank (necessary with a galvanized tank) or just give it a thorough cleaning provided it has a return fuel line. It's quite common to have to replace the engine controls — although the originals can be modified, this adds to the labor.

Expect to pay US$6,000 for the Beta Marine 20-hp Atomic 4 package plus another US$1,500 for parts. If you don't feel confident doing the work yourself, an experienced repower specialist will be able to give you a firm price quote up front so that you know what you're getting into. A professional installation, not including removal of the Atomic 4, takes 20 to 30 hours. You'll save about six hours labor if you lift out the engine yourself.

number 262278 (60°C/140°F) for saltwater use, and #200468 (82°C/180°F) for freshwater and heat exchanger use, and suggests a modification to the thermostat. The modification involves tapping the inside of the thermostat housing the 90° inlet pipe barb fitting (the one that connects the hose from the water pump and block tee fitting) to a 1/8" NPT thread and installing a 1/8" NPT brass plug with a 1/8" hole drilled in it. This increases the amount of water forced through the block and head water jackets instead of through the thermostat bypass; however, when the engine is cold (and the thermostat is closed to restrict coolant from exiting the block), the water pump must force all the cooling water through the 1/8" hole in the brass plug, which causes so much pressure in the block that it can cause frost plugs to leak. For that reason, always remove the thermostat when carrying out this modification.

Removing the thermostat without any other modification will cause the engine to run hotter, not colder, because the thermostat is a two-stage type and forces the coolant to flow through the bypass when the engine is cold, then gradually diverts it through block and cylinder head water jackets as the engine warms up to ensure there is always a flow of water to the exhaust system. Removing the thermostat is a common cause of cylinder head cracking and head gasket failure in raw-water cooled engines. Not only does the rear of the cylinder head overheat due to a lack of water flow, the front of the cylinder head near the thermostat housing is excessively cooled due to the flow of cold water through the thermostat housing bypass port, which warps and cracks the head. The water temperature sensor port is right beside the thermostat housing, so it reads cold even though parts of the engine are running hot. The real solution to most overheating problems is to rebuild the engine (see DIY 1997-#4 issue) and flush the salt and dirt out of the block and cylinder head water jackets.

**Head Gasket:** Westerbeke Service Bulletin 223, May '96, advises of the availability of a new single graphite head gasket, part number #200452 to replace the two metal/asbestos gaskets #263776 used previously. No retorquing is required with the new gasket (the old double gasket required retorquing after engine warm-up). You have to ask for the new-style gasket or the dealer may try to sell you the old double gasket to get rid of his stock. Check the cylinder head for flatness, and if it's warped more than .006" grind it to roughness spec #125. Lubricate the cylinder head nuts with oil before torquing, then torque the head in correct order (from the center out) and in three stages to the final torque of 35 ft. per lb. Check the compression after head installation and ensure it does not exceed 125 psi. If compression exceeds 125 psi, the head has been ground excessively and must be replaced. The compression can be decreased by installing

ENGINE TROUBLESHOOTING

a thin stainless-steel spacer cut to match the coolant passages and cylinder bores between two head gaskets rather than by buying a new cylinder head. This modification may not be reliable.

**Ignition:** New 35-amp Motorola alternators exactly like the originals are available from auto parts stores for $300. The correct alternator belt is a Dayco 15250/11A0635. Never use a FHP (electric motor fractional horsepower) belt even if it's the right length, because FHP belts have a different sheave angle than automotive belts and will slip or break.

**Spark Plugs:** Use NGK BR6S spark plugs with the gap set to .035".

**Additives:** The use of a lead substitute and octane booster is recommended. These help improve the performance of the engine and lessen plug fouling and sooting. Gas line antifreeze will remove some of the water in the fuel tank and help stop tank corrosion (and carburetor problems if you don't have a good fuel-water separator).

**Accessories:** Several small American manufacturers make accessories for the Atomic 4. A solid state (breakerless) ignition system, freshwater cooling system/heat exchanger, PCV (positive crankcase ventilation) valve adapter and bypass oil filter are available. I highly recommend a freshwater cooling system/heat exchanger, but I don't think any of the other items are necessary if you change the oil regularly using a good quality 15-40 oil (API Code SJ), and replace the distributor points once a year.

## QUICK FACTS

**Atomic 4** — 30 hp @ 3,500 rpm

| DIRECT DRIVE | REDUCTION DRIVE | V DRIVE |
|---|---|---|
| VJ | VJR | VJVD |
| 5101 | 5102 | 5103 |

**Atomic 4 *Stevedore (Canadian models)**

18 hp @ 2,500 rpm

| DIRECT DRIVE | REDUCTION DRIVE | V DRIVE |
|---|---|---|
| VJS | VJSR | VJSVD |
| 5111 | 5112 | 5113 |

**Canadian Stevedore models differed only in that they had a reducer bushing in the intake manifold throats. The reducer lowered engine horsepower and was discontinued after several years. This reducer can be removed by boring the manifold throat out to the size of the carburetor throat, or replacing the manifold with one from an Atomic 4 and rejetting the carburetor.*

## Troubleshooting

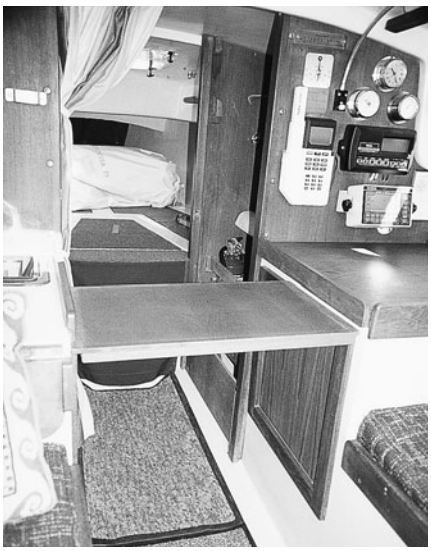
If the engine is in good condition internally but is running rich (i.e. plugs are a sooty black), rebuild the carburetor, change all the jets to the latest specification as detailed above, and soak the anti-backfire flame resistor element in Gunk. Check that the distributor ignition advance assembly is not seized (turn the rotor back and forth to test), set the ignition dwell between 31° and 34° using a dwellmeter, and then loosen the distributor clamp and adjust the ignition timing to 0° BTDC (piston at the very top) at 600 rpm with a timing strobe light (if the engine is turning over 600 rpm, the ignition advance will already be advancing the timing, and you won't get enough advance at high rpm) or by using an ohmmeter across the points with the engine stopped (points just opening at TDC). The dowel pin in the flywheel end of the crankshaft points straight up and down at 0° BTDC. If the spark plugs are still sooty, try using Champion RJ12C plugs, which are slightly hotter.

*Robert Hess, a licensed mechanic, is currently writing a book detailing the history of the Universal Engine Company, manufacturers of the Atomic 4. He operates Atomic 4 Engine Service (Tel: 604/946-0611 or e-mail: robert_hess@bc.sympatico.ca) as a sideline, specializing in new and used parts, rebuilds and repairs in Delta, B.C.*

# DIY PROJECTS

## PORTABLE WORK TABLE

Those who spend much time on their boats, particularly owners who live aboard, know the importance of a good work table for doing maintenance or repairs that doubles as a galley table, a desk for paperwork or a computer table. Designed for a Contessa 26, this portable work table can be easily customized to fit most boats. On the Contessa, it installs on top of the locker doors between the galley and the nav table, or over the cushion rails between the two quarter berths.



Made of 12mm (1/2") marine plywood, this one measures 57cm (22-1/2") in length and 35.5cm (14") wide. Cleat stock glued to the underside (visible in photo) is just slightly shorter than the overall length and acts as a slider that holds the table in place. A barrel bolt mounted to one edge (wrong side) slides into 6mm (1/4") holes drilled into the locker door and berth rail and locks the table in place. Spacing the holes along the rail allows for repositioning of the table so it's reachable when seated on the berth or on a step of the companionway ladder. When not in use it stows against the hull in the forepeak.

*Vicki de Kleer,* Mollyhawk, *Bronte, Ont.*

## CORROSION PROTECTION FOR SMALL OUTBOARDS

Many outboards and stern drives often utilize a trim tab on the antiventilation plate just above the prop. Made of mostly aluminum (freshwater) or magnesium (saltwater) and zinc, the tab provides corrosion protection for the lower unit immersed in saltwater, brackish water and freshwater with high conductivity caused by pollution. Corrosion occurs when electrons flow between two similar metals connected or grounded through water, a process known as galvanic corrosion. The tab acts as a "sacrificial" anode preventing damage from corrosion to the lower unit.

***Anode mounted on Johnson 4-hp outboard.***

Smaller horsepower outboards are not always factory-equipped with an anode. Easy to install, one costs about $7 and comes in numerous shapes and sizes. Just locate the anode on the bottom of the plate, drill two holes and bolt it on.

Anodes deteriorate rapidly, especially in saltwater, and must be constantly inspected and replaced (keep a few spares on board). Make sure the anode is submerged; if not, protection for the lower unit still in the water is lost.

## CANVAS TOOTHBRUSH HOLDER

Toothbrushes and other dental notions are used regularly and should be conveniently located. This canvas holder provides practical storage and is easily removed for cleaning.

ANNEMARIE HENDRY

On board *Via Sophia*, the holder is located just below the mirror in the head. It's made of a medium-weight acrylic or other synthetic material. Strips of adhesive Velcro (hook piece) are sewn into the top corners and the mating tape portion attaches to the bulkhead with the mirror support screws. (In a marine environment, adhesive tape needs a mechanical fastener to stay fixed.) Dimensions are not critical.

*Sophia Dean,* Via Sophia, *Surrey, B.C.*

# FIXING A LEAKY PORT

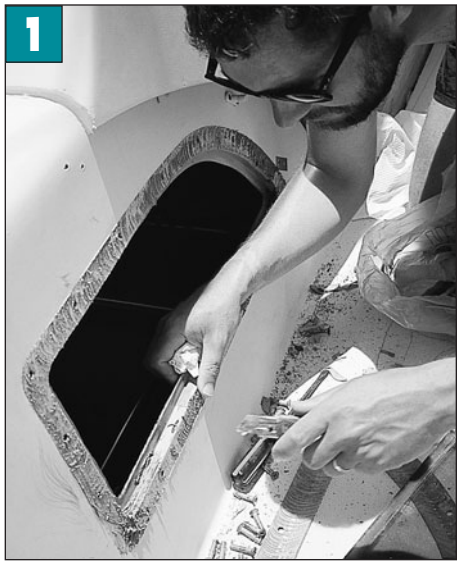
***By Paul and Sheryl Shard***

In foul weather on a passage to Bermuda last summer, we discovered we had a small leak around the port in the galley of our self-built Classic 37 sailboat. Since we were planning to continue on to the Azores from Bermuda and would be at sea for at least two weeks, we set to work repairing the leaky port when we made landfall at St. George's Harbour.

The leaking port is a fixed one of 12mm- (1/2") thick Plexiglas attached by a thru-bolted stainless-steel frame. Removing it would be difficult. We hoped that the leak was due to an unseated bolt — pretty straightforward to rebed — but no such luck. To check for the source of a leak, we applied water pressure with a hose and watched where the moisture came through.

After the water test, it was obvious we needed to remove the frame and rebed the Plexiglas. The job is fiddley but not difficult. Just be sure to check the weather before removing a port to make sure you've got a dry day. Leave yourself a couple of hours to complete the project, plus drying time for the sealant. We used 3M 5200 polyurethane adhesive sealant. [**Ed:** A better choice is to use a polysulfide sealant so the port can be easily removed.] Be sure to buy more than you think you need so you don't run out in the middle of the repair.

The important thing when removing the frame is to not bend it. Even our frames, made of 3mm (1/8") stainless steel, could bend if carelessly removed. Aluminum frames are even more susceptible to bending. We removed ours by first removing the bolts then very gently prying up a corner of the frame with a couple of fine-bladed slot screwdrivers. Then we inserted a piece of fine stainless-steel wire (i.e. piano wire) to act as a cutting tool. Paul, using gloves to protect his hands, sawed at the old sealant with the wire while I very carefully pried the frame away from the cabin side. Be careful not to






scratch the gelcoat.

Next, we removed the Plexiglas and cut away the old sealant (**Figure 1**), then carefully sanded the edges to provide "tooth" for the new bedding compound. We cleaned our stainless-steel frame and the gelcoat edges around the cutout with acetone, then masked all areas with 3M Long Mask inside and out where the sealant would ooze during the rebedding of the Plexiglas (**Figure 2**). Paul applied a thick bead of sealant all around (**Figure 3**), then replaced the Plexiglas while I stood by with the wrench down below. Working together, we first lightly bolted the four corners, then filled in the bolts in between (**Figure 4**). We tightened the bolts till the frame looked seated and the bedding compound oozed out all around, being careful not to overtighten and bend the frame or squeeze out all the sealant. The excess sealant was wiped up while it was still wet with paper towel. (When cured, any excess sealant is easily removed with a single-edged utility knife or razor.)

A day after we reinstalled the port, we checked for any new leaks with the hose. Satisfied, we set sail for the Azores and had a dry and pleasant two-week passage. ⚓

*Paul and Sheryl Shard are the authors of* Sail Away! A Guide to Outfitting and Provisioning for Cruising *and are currently cruising in the Azores. You can follow their adventures through their web site at http://www.interlog.com/~shard.*

**TIP:** Is water entering the cabin from an unknown source and saturating your cushions? Here's a quick method to find the source of the leak. Draw a horizontal line just below the sheer on the inside cabin sides with a washable, non-toxic color marker. Spray the deck with water (make sure to close all ports and hatches). Water will stain the line just below the point where it entered.

TIPS

## APPLYING SEALANTS — PUSH NOT PULL

*When applying sealant, cut the nozzle of the cartridge or tube at a 30° angle and apply the sealant by pushing, not pulling, ahead of the nozzle over the seam. Pulling the nozzle can result in voids beneath the caulked surface.*

POWERBOAT RIGGING

# RETROFITTING HYDRAULIC TRIM TABS

## New maintenance-free mechanical trim tab offers an alternative to most hydraulic systems.

*By Jeremy Crews*

**TOOLS**

*Assorted screwdrivers*
*Drill and bits*
*Wrench or socket set*
*Holesaw or jigsaw*
*Polyurethane and silicone sealant*
*Wire cutter and stripper*
*Electrical connectors*

Typically, well-balanced boats do not need trim tabs. However, when a boat is loaded with gear and personnel, the convenient distribution of such loads often leaves the boat bow high and chine down, which calls for correction. An appropriate and well-engineered solution is two individual trim tabs — one mounted to port and one to starboard — that provide lift at the stern, port and starboard sides, and are controlled by the driver at the helm. Manipulation of these tabs, individually or together, is effective in correcting list or trim angle.

Operation is simple. When underway, if the boat leans to port, downward deflection of the port tab will produce a port side upward force, which raises the port side and levels the boat. Also, if the bow is too high, downward deflection of both tabs produces an upward force on both sides of the stern that lowers the bow.

The original trim tabs, going back 50 years or so, were activated, or deployed, by mechanical jack screws. While they worked very well, the machinery was bulky and took up valuable space on the forward side of the transom. When this bulk became a problem, a move was made to hydraulic systems which, while adding more flexibility in the placement of components, also added equipment complexity and hydraulic maintenance.

A new design from Lectrotab eliminates all of the bulk with nothing to be installed inside the boat. It replaces a hydraulic system with a highly refined mechanical actuator that is maintenance-free and permanently sealed against corrosion.

The Lectrotab product line includes 12-gauge stainless-steel tabs in 22.8cm (9″) and 30.4cm (12″) chords (that's the dimension fore and aft) with each chord size available in four widths from 22.8cm to 91cm (9″ to 36″). Custom sizes are also available. Actuators are available in four-second or eight-second stroke, or extension time, and in 12- or 24-volts DC.

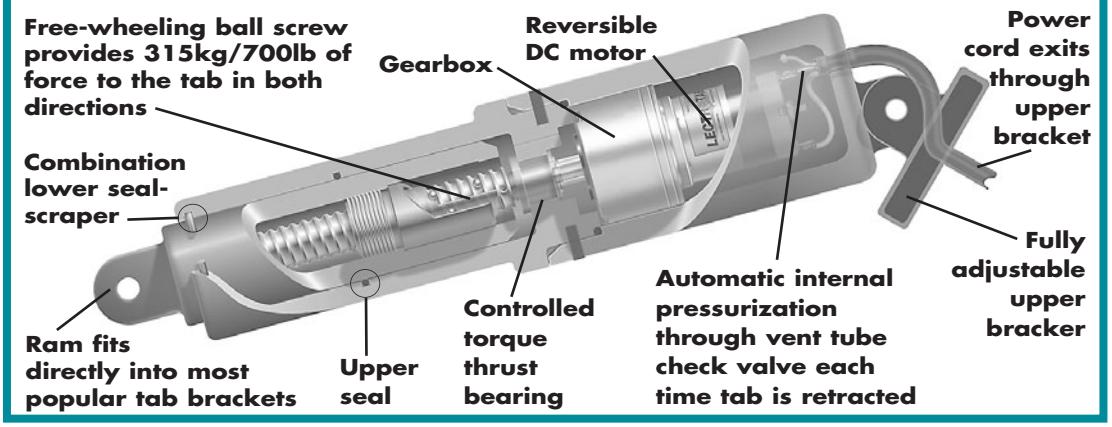
### Hydraulic Versus Mechanical

So how does the Lectrotab work? Take a look at the cutaway illustration on this page. Note that all components are in the actuator, that there is nothing to install inside the boat and that no oil can leak — there is none!

Advantages of the Lectrotab product over hydraulic types are many. Components are contained in the actuator and it requires no space inside the boat. Installation time is about half and no hydraulic fitting preparation expertise is required. When needed, the Lectrotab actuators can be cross controlled — one can be retracted while the other is being extended. Hydraulic systems cannot do this.

Unlike hydraulic systems, when positioned, the actuator is locked into place and will not move, even if the tab, for instance, is used as a step. Also, when backing down, the tab is

**CUTAWAY OF THE NON-HYDRAULIC LECTROTAB ACTUATOR**



locked against folding under, a frequent failure of hydraulic types. Providing 315kg (700lb) of force in both directions eliminates the need, in many cases, for two actuators per tab.

For those who want to retrofit to a non-hydraulic mechanical system, the Letrotab actuator ram fits directly into the Bennett lower bracket. The Lectrotab's actuator length and upper bracket also fit the Bennett-style footprint with the same upper bracket screw pattern. Also, the wire fits through the former oil line hole.

## Installation

Retrofitting, using the existing tab, can be done without hauling the boat if the upper portion of the actuator is not below the waterline (see steps 3 through 6). Installation from scratch on a boat not equipped with trim tabs is easily done with a few basic tools and about three or four hours of labor. The following instructions assume the tab size has been previously determined. (Size selection varies based on engine configuration and horsepower, weight distribution, type of boat and use. See DIY FALL '95 issue for sizing guidelines.)

**Step 1** Haul the boat for access to lower transom area.

**Step 2** Secure the tabs to the transom with the outer edges about 5cmm (2") inboard. Bed the fasteners with a generous amount of polyurethane sealant. Position the plane of the tabs, when parallel to the bottom of the boat, 6mm to 12mm (1/4" to 1/2") above the bottom of boat.

**Step 3** Place the lower bracket of the actuator over the studs on the tab, position the tab surface parallel to the boat's bottom, place the actuator upper bracket against the transom and mark the three screw holes. Now, predrill the screw holes, drill the wire hole and then secure the actuator to the tab and the transom. Bed the upper bracket and fasteners in sealant.

**Step 4** Inside the boat, connect the two actuator wires to the terminal strip included in the hardware kit.

**Step 5** Install the control switch in a convenient place, accessible to the driver, and connect the included four conductor wire between the control and the terminal strip at the transom.

**Step 6** Connect the two wires from the control to the appropriate 12-volt or 24-volt power source and the installation is basically complete.

## The Bottom Line

Compared to hydraulic units that start at US$400, the Lectrotab system, at about US$500, is more costly to buy but installs in less time, so, on an installed basis, price is usually competitive. However, if you do the installation yourself, the hydraulic unit will be less costly by about 20% or around $100. But if you are the installer, you will probably also be doing the maintenance, which, with the hydraulic type, can be ongoing. With Lectrotab, however, there is no maintenance, so the added convenience may be worth the additional cost. And the environment will appreciate your consideration.

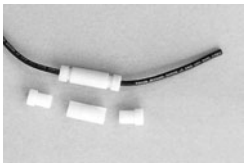
A microprocessor-based auto-retract module is also available for about US$125. This module is easily installed and provides automatic tab retraction at full retract speed. It has inputs such as a one-touch button, transmission neutral, when the engine gauge switch is turned off, or from numerous other inputs. The module also supports a retraction process, which is easily programmed at the helm station, to retract the tabs in a stepped or intermittent fashion over a period of up to 25 seconds. The driver typically activates the auto retract feature from a one-touch button on the dash. On larger boats, this program will coordinate tab retraction with power reduction providing positive control over trim angle as the boat slows down.

Letrotab is manufactured by Linear Devices Corp., 8790 Park Central Dr., Richmond, VA 23227; Tel: (804) 261-3888, Fax: (804) 264-3070.

*Jeremy Crews, a mechanical engineer and active boater, is the designer of the Lectrotab. In 1960, he founded Marine Development Corp., which designs and markets the Cruisair air conditioning and Sentry marine battery charger product lines.*

# DOCKSIDE New Products

## SMART PUMP SWITCH



Bilge Buddy (US$39.95) is an electronic manager for a bilge pump. Should it detect any gas, oil or diesel fuel in the bilge water, it instantly turns off the pump. The pump remains off until the pollutants are removed or until additional water enters the bilge. Installation is quick: Mount the watertight switch at any angle as close to the pump as possible, then connect the three wires to the bilge pump and battery. Bilge Buddy draws eight milliamps and operates on AC or DC power. Comes with a seven-year limited warranty. Contact: Product Innovators, Box 412, Mongaup Valley, NY 12762; Tel: (800) 793-4122 or (914) 796-4526, Fax: (914) 796-1974.

**Write #201 on Product Info Card**

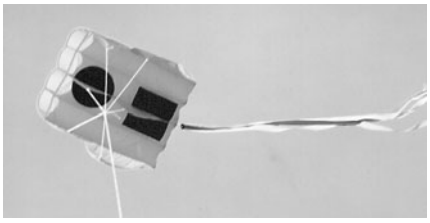
## FUEL CATCHER

If you're not extremely careful when fueling, excess fuel often spills out the vent when the tank reaches full. Not only is the lost fuel dangerous to the environment, but it's also illegal. No-Spill (CDN$26.50/US$18.95) is a fuel-resistant plastic bottle that temporarily attaches to the hull over the fuel tank vent. Any fuel spilled from the vent while fueling is captured in the bottle, then poured back into the fuel tank. Oversize suction cups hold No-Spill securely in place and a large rubber gasket ensures a tight seal over the vent. Designed for diesel or gasoline fuel, it fits boats with vents up to 3.8cm (1-1/2") in diameter. Contact: Davis Instruments, 3465 Diablo Ave., Hayward, CA 94545; Tel: (510) 732-9229, Fax (510) 732-9188.

**Write #202 on Product Info Card**

## HELPING HANDHOLD

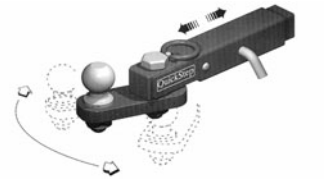
Shop Tested



Hol-Tite (US$11.95/CDN$16.95) is not a new product but makes a very practical additional to your maintenance kit. It gives a secure handhold on the side of your boat while in the water to clean the hull, work on the propeller or when swimming or diving. Suction cups, made of a non-staining polyurethane, hold tight and are not easily released. Hol-Tite doesn't float so you'll need to attach it to a cleated line. Contact: Hol-Tite, Box 802, Clearwater, FL 34617; Tel: (417) 885-9797 or (813)522-8850, Fax: (813) 522-5771.

**Write #203 on Product Info Card**

## EASY WRAP BUNDLING



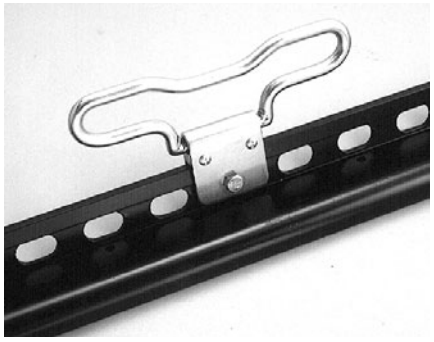
It's good practice to keep loose or exposed wires, cables and hoses on your boat bundled together and protected from abrasion and environmental wear. Flexo is a lightweight, flame-retardant, chemical- and heat-resistant expandable sleeve. Use it to bundle and protect the rigging on outboard motors, trailer chains and harness wires, engine hoses, shore-power cords, electrical wiring, etc. It expands up to four times its normal diameter so only a few sizes are needed to cover most applications. Available as a continuous sleeve or with hook and loop fasteners in 16 different colors, and in a variety of kits ranging in price from US$4.95 to US$119.95. Contact: Techflex Inc., 50 Station Rd., Sparta, NJ 07871; Tel: (201) 729-6253 or (800) 323-5140, Fax: (201) 729-9320.

**Write #204 on Product Info Card**

## QUICK FIX WHEN CLEATLESS

The Toe Rail Folding Cleat (CDN$69.95/US$49.95) is the ideal midship cleat for spring lines. Made of T-316 stainless steel, it easi-

## DOCKSIDE New Products



ly mounts over most symmetric and asymmetric aluminum toe rails. A silicon-rubber insert gives rattle-free operation and the husky 9mm (3/8") diameter tubular cleat conveniently folds out of the way when not needed. Contact: C. Sherman Johnson Co., East Haddam Industrial Park, East Haddam, CT 06423; Tel: (860) 873-8697, Fax: (860) 873-8589.

**Write #205 on Product Info Card**

### CHEAPER THAN A MAX


The M-P Composite two-blade propeller has similar feathering and adjusting functions as the Max-Prop Classic, but the propeller and casing blades are made of a hybrid polymer. This material is said to provide excellent durability and decreases overall weight and cost. Blades incorporate machined bronze alloy (Nibral) spindles that engage the Nibral hub, nut and cone gear. Props are available in 12" to 16" diameters with 3/4" to 1-1/8" tapers plus metric equivalents, custom tapers and props for saildrives. Prices range from CDN$1,275 to CDN$1,455. Contact: MS Marine Enterprises, 1756 S.E. Marine Dr., Vancouver, BC V5P 2R8; Tel: (604) 327-5674, Fax: (604) 327-6475.

**Write #206 on Product Info Card**

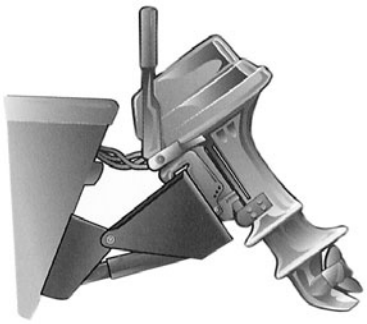
### POSITION LOCATOR

Shop Tested

*DIY* product tester Vicki de Kleer, a transatlantic sailor and holder of a Yacht Master Ocean certificate, found the Navy Point Chart Plotter (US$49.95) an easy-to-use tool for navigators. It's a device that locates your boat's position on a chart using the waypoints from a loran or GPS. You can also easily plot a course or calculate distance. The long arms are convenient to use with Mercator and Polyconic charts, regular or strip charts. Locking tabs hold the arms at right angles but these are not very positive so you must hold the plotter firmly so it doesn't shift. It comes apart easily for storage in the supplied vinyl case (a Velcro closure would be nice to have). Instructions are somewhat misleading: If you purchase one and need some help, give us a call and we'll gladly forward de Kleer's revised instructions. Contact: Simpson Lawrence USA, 6208 28th St. E., Bradenton, FL 34203-4123; Tel: (941) 753-7533 or (800) 946-3527, Fax: (941) 746-7166.

**Write #207 on Product Info Card**

## RAISE AND LOWER WITH POWER



When you want power trim and tilt and your engine is without, Panther's Trim & Tilts are an affordable solution. They're available in three sizes, one for motors up to 55 hp (model 55) or up to 135 hp (model 135), either bolt- or clamp-on outboards, and another that fits 40 hp or smaller clamp-on kicker engines. Made of high-strength aluminum alloys with stainless-steel hardware (a zinc anode kit is recommended for saltwater) and weighing less than 14kg (30lb), they can deliver up to 2,250kg (5,000lb) of thrust for high-speed trimming. Models come complete with a drilling template, pre-drilled bracket with the standard BIA bolt hole pattern, push-button electronic switch, wiring harness with plug-in connectors and easy-to-follow instructions. You'll need to supply fasteners particular to your installation, sealant and grease. Units are easily installed with a drill, wrench and screwdriver in four to six hours. You'll also need a hoist to lift heavier motors out of the way during installation. As Panther units place the outboard 17cm (7") off the transom, installation gets more complicated if the engine's original hoses and cables are too short. Suggested list price for the Panther 135 is CDN$930/ US$549; the 55 and Auxiliary Motor Lift are CDN$861/US$499. Contact: Goldeneye Products, 6213 Bury Dr., Eden Prairie, MN 55346; Tel: (612) 934-7000, Fax: (612) 934-7001.

**Write #208 on Product Info Card**

## SOILFREE CABLES


Star brite Power Cable Cleaner/ Protector cleans, seals and protects shorepower cables. It contains no harsh chemicals that could dry out, crack or soften cable insulation and UV additives protect cables against fading. A 237ml (8 fl.oz.) bottle sells for CDN$9.75/ US$6.95. Contact: Star brite, 4041 S.W. 47 Ave., Ft. Lauderdale, FL 33314; Tel: (954) 587-6280 or (800) 327-8583, Fax: (954) 587-2813.

**Write #209 on Product Info Card**

# Technical CD-ROM Library for Boat Owners

# MRT Series

*CDs contain articles from past issues of DIY Boat Owner Magazine*

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UPDATED

22 Projects and Fabrication Techniques: The ideal choice for replacing wood components onboard – won't delaminate, rot or splinter and requires no paint.

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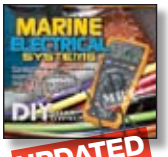
## DIY Mechanic


Gasoline and diesel engine service. How to maintain, troubleshoot and repair outboard engines, sterndrives and diesel inboards.

## AC/DC Electrical Systems




UPDATED

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

## Painting & Refinishing


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

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

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

## Fiberglass Boat Repair


How to survey, repair and prevent cosmetic and structural damage in fiberglass hulls, decks and transoms. Includes the step-by-step repair of minor cracks and gouges, large holes, water-soaked decks, delaminated hulls and proper installation of hardware.

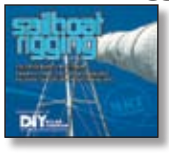
## Nautical Necessities


From cleaning to fuel filtering to waterproofing charts, you'll find ideas and inspiration in this compilation of tips to do-it-yourself boat maintenance, repair and troubleshooting. Divided into 20 categories to make look up easy.

## Better Boats


More than 200 do-it-yourself projects. Practical solutions to deck and cockpit refitting, interior renovations, rigging upgrades, space-saving equipment storage, safety add-ons and other nifty items to customize your boat.

## Sailboat Rigging




A practical guide to deck layouts, equipment repairs, performance upgrades, rig tuning, sail controls and steering systems.

## 1995 – 2007 52 Issues of DIY: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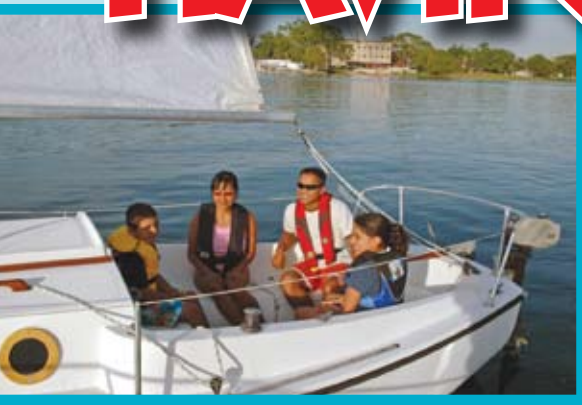
# HAVING A BLAST



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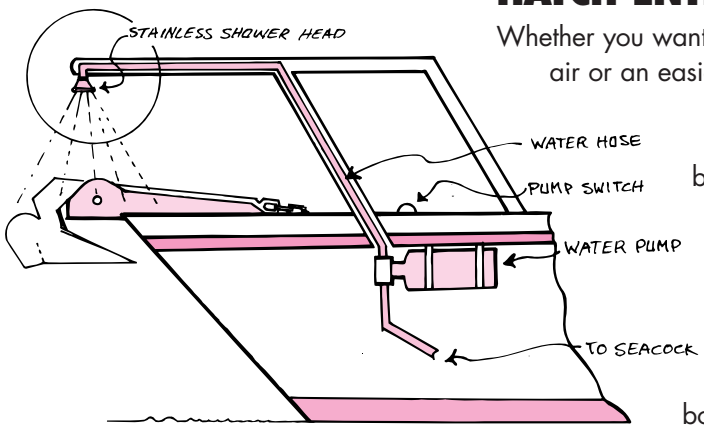
# Good Boatkeeping

## ANCHOR WASH



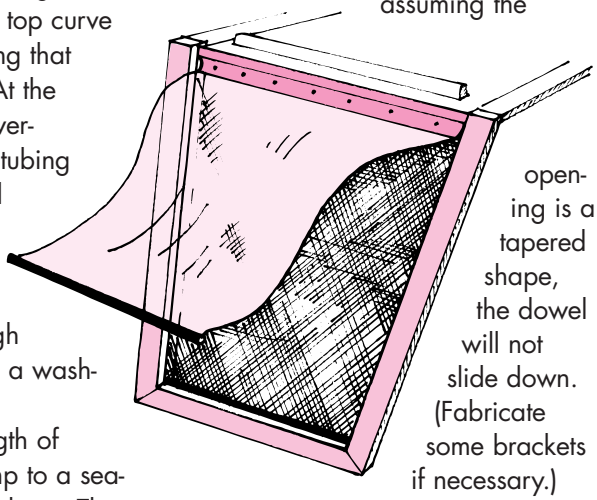

The reason for an anchor wash system is obvious: to get rid of mud and muck before it comes aboard. The system can be as simple as a basic bucket on a line or as sophisticated as remote controls. Here's one system that's somewhere between those extremes, achieving its purpose efficiently without being at all obvious.

Run a water hose through a stanchion and along the top curve of the stainless-steel tubing that shapes the bow pulpit. At the bow, where the pulpit overhangs, cut a hole in the tubing so the hose can exit and attach a showerhead. Feed the other end of the hose down through the stanchion and through the deck and attach it to a washdown pump installed belowdeck. Another length of hose leads from the pump to a seacock to act as the intake hose. The pump switch is a waterproof, foot-button type (typically used for a windlass) installed on deck. As you bring in first the rope, then the anchor, you can rinse everything with toe-tip control.

## ALTERNATIVE HATCH ENTRY

Whether you want more light, more air or an easier entry, here's a practical alternative to hatch boards.

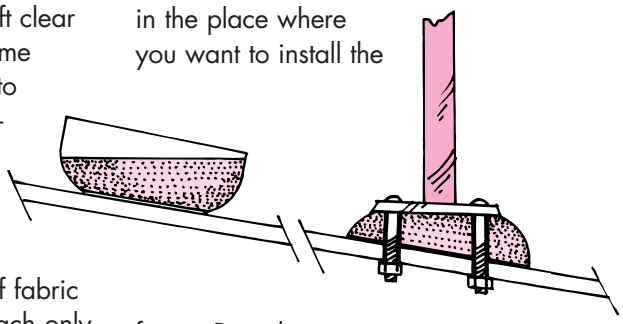
Cut one length of dowel to fit across the top of the hatch opening and another for the bottom width. Cut a piece of nylon screening and a piece of soft clear vinyl (20ml thickness, the same material used for windows) to the shape of the hatch opening. Sew a fabric tube to hold the top dowel. Attach the top of the screen and the top of the vinyl to the fabric. Use another sleeve of fabric for the bottom dowel but attach only the screen to this one. Place the top dowel into the hatch frame grooves; assuming the opening is a tapered shape, the dowel will not slide down. (Fabricate some brackets if necessary.)



Now you can use the screen only, if you want a breeze, or you can drop the plastic if you also want some protection from wind or rain. If you don't want either hatch cover, just roll them loosely up and out of the way.

## LEVEL CAST BASE

You want to install a fitting or winch to stand in a true vertical position but the base must attach to a slanted deck. You can use wood to make a wedge-shaped base, but that takes a lot of fitting time. Instead, make one out of resin. Find an appropriately sized, low-sided casserole dish. Spray the inside with nonstick cooking spray or coat it with paste wax to prevent the epoxy from bonding to the dish. Mix up a batch of epoxy resin thickened with microballoons. Set the dish on deck in the place where you want to install the fitting. Pour the epoxy into the dish to the amount required. The resin will flow naturally and level out on top. When it hardens, pop it out of the dish and turn the blob upside down. The angle side now matches the deck slant and the dish-bottom side is a true horizontal surface for your fitting base. Sand and paint, then glue and fasten the base to the deck and attach the fitting.



*David and Zora Aiken are the authors of* Good Boatkeeping *and* Good Cruising *published by International Marine. The books are compilations of hundreds of practical boating tips acquired from nearly 22 years of living afloat. The Aikens currently live aboard a 1963 10.5m (35') Chris-Craft sloop,* Atelier, *berthed in Grasonville, Maryland.*