DIY boat owner

1998 - #2 (SUMMER)

the MARINE MAINTENANCE MAGAZINE

Features

ANCHORING made easy

An electric anchor winch is a worthwhile upgrade if you do a lot of anchoring. Here's a step-by-step account of how to install the Powerwinch 45.

By David & Zora Aiken

PROJECT BOAT

REPLACING A SOGGY DECK

A water-saturated cored deck poses a safety concern and reduces a boat's resale value. If your boat is in such condition, don't despair. Here's a solution that is not too costly.

By Don Campbell

T-BIRD GETS A NEW BOTTOM

Delamination is not usually a serious problem in boats made of plywood but a steady flow of water in the bilge is a good indication that it's time for a replanking job. Here's how.

By Nick Bailey

THE ART OF Topside Painting

Time to paint your boat's topsides or deck? Here's how to get professional results everytime.

By Paul Noack

Columns

Shop Talk

Recanvassing Decks or Cabin Tops: Follow these easy steps when it comes time to lay a new canvas deck.

By Wayne Reddit

Electronics

The Most Charging Amps for the Least: Consider a high-output alternator if you spend time away from the dock or have a sizable electrical load.

By Kevin Jeffrey

Engine Troubleshooting

Water Pump Servicing: It's good preventative maintenance to replace the water-pump impeller every two years. Follow these 10 easy steps to a cool running engine.

Powerboat Rigging

Repower with an Outboard Bracket: You can easily retrofit a bracket-mounted outboard and significantly enhance boat handling, performance and safety.

DIY Projects

Two-Way Dock Lines: Make a single dock line to replace two bow or spring lines.

Good Boatkeeping

Insulate the cabin ceiling in style; Build an instrument cover storage locker

By David & Zora Aiken

Departments

TALKBACK Q&A

Fuel Tank Installation

Q: I'm installing a Tempo (model #tp25L) fuel tank in my 5.7m (19') skiff. How high does the vent need to be above the fuel tank? Also what is the maximum length the fuel line can be? I am mounting the tank in the bow. It will be about a 6m (20') run to the 1985 90hp Yamaha.

Frank Wise, Remedy, *Cape May, N.J.*

A: According to the standards published by the American Boat and Yacht Council, the tank vent system must be "self draining and connect to the highest point of the fuel tank as installed in the boat under conditions of normal operations and normal trim." You should be certain that the vent is higher than the tank (as high as you can get it). This means that if the boat heels and fuel goes up the vent line, it will drain back into the tank by gravity. You don't want any loops that would create a trap for liquid fuel in the vent line. In most cases the vent fitting is placed just under the rub rail. The tank is best placed as low as possible in the hull. The difference in height is usually enough to ensure the vent works properly. The second part of your question should be answered by the engine manufacturer's literature. I don't think that the fuel pump will have any trouble pulling fuel along what is virtually a horizontal run of fuel hose. The difficulty for any pump is "head," which is vertical lift. I don't foresee any problem with your boat and the installation you are proposing.

— *Wayne Redditt*

Carb Troubles

Q: I bought a 1987 Starline boat with a 140 hp 3.0L MerCruiser. I bought it new and have had trouble with the carburetor ever since. The dealer rebuilt it twice while under warranty and shortly after went out of business. I have rebuilt it three times since and still it seems to load up and the engine cuts out when I apply full throttle. I even changed it to an '88 model carb with no help. The engine has 120 hours on it and the boat is still in mint condition and performs outstanding with the exception of the carb. Any suggestions for solving this problem?

Tom, Orange Park, Florida

A: Most likely you need one of three things: an accelerator pump adjustable lever if over-fueling on acceleration; if running rich all the time throughout the band you may need a modified venturi cluster; or if flooding in hard corners or rough water, you need the three-piece inlet needle and seat part that allows fuel into the carb. The carb on your engine is a Mercarb, an evolution of the Rochester two-barrel. That unit when installed on the 3L, had a 4cc accelerator pump. Mercury installed the same pump on its 4.3L and 5L engines which worked fine but it's far too rich for the 3L. Mercury has an adjustable accelerator pump linkage that you can purchase. The linkage has three position holes and each hole changes the amount of fuel that's discharged through the accelerator pump by a 1/2cc, so you can reduce the fuel flow by 1cc from one extreme to another. For 3L engines that bog on acceleration there was a Mercury bulletin on a modified venturi cluster. This part installs with three screws. You need to establish which venturi cluster you currently have before ordering.

— *Steve Auger, Mercury Marine*

Water in the Bilge

Q: We have a 1969 4.8m (16') Traveller stern-drive runabout. There's a lot of water, about 38L (10gal), sloshing around in the hull that will not drain out of the bilge no matter how long we leave the boat propped up. Before we pull the floor up, have you any ideas on how we can get our hands on the construction plans for this boat?

Jon Staples, Wynndel, B.C.

A: Traveller boats were built in Peterborough, Ont., and I'm unaware of any archive of construction plans for boats of this era. Ten gallons of water is quite a bit; it would weigh over 45kg (100lb). Water trapped inside the bilge under the floor means the limber holes that drain the water from above the lowest longitudinal stringer are blocked. Before lifting the entire floor I would get a large holesaw (10cm (4") or so) and cut an inspection hole or two towards the rear of the boat on the centerline. Peer down into the bilge and look for a blocked limber hole. If you find this, scrape the blockage open. This should let the boat drain to the center portion of the hull and out the transom drain. If there was flotation foam inserted into the bilge areas under the floor this could be the culprit. You should be able to determine the location of the longitudinals by finding screws or other fasteners in the floor. Try not to cut into the stringers when making your inspection hole. Usually, if the water

has been in there for a long time the plywood in the floor structure is pretty ripe. If you have to remove the floor and replace all of the underlying structure, try to remove the old stuff as gently as possible. You may be able to use the old materials for patterns for the replacements. This is not a terrible job, but it takes some time.

— *Wayne Redditt*

Tab Selection

Q: Would you please recommend a size of trim tabs for a 1973 7.5m (25′) Trojan with a 2.6m (8′8″) beam and a single 318 Chrysler inboard. The boat cruises smoothly at around 10 knots, but then doesn't seem to get going again until it's on plane at around 23 knots. In between these speeds it seems to be too noisy and stern heavy for comfort. A back issue (FALL '95) said that the wrong size tabs don't help much at all.

Patrick O'Neill, Brampton, Ont.

A: A boat equipped with trim tabs planes faster and at slower speeds. As the tabs are driven into position the upward pressure raises the stern and lowers the bow. This improves the running attitude of your boat, reduces engine strain, pounding and drag. Size and selection varies based on engine configuration and horsepower, weight distribution, type of boat and use. Use the manufacturer's general sizing recommendations as a general guide when purchasing trim tabs. You should choose at least 2.54cm (1″) of trim tab per size for every 30.5cm (12″) of boat. A 6.6m (22′) boat, for example, requires 61cm by 22.8cm (24″ by 9″) trim tabs. Tab widths or chord length (fore and aft measurements) are available in 20cm (8″) to 30.5cm (12″) while lengths are based on boat length. For heavy boats or boats with twin engines and limited transom space, the larger 30.5cm (12″) chord is recommended.

— *Jan Mundy*

Webbers Info Wanted

Alan Skidmore of New York City, just purchased a Webbers Cove 34 Downeaster built in the mid-70s and is looking for information on the history of Webbers Cove Boats. Send e-mail replies to wskidmore@snet.net.

Parts for Marinette

Jeanne Gaines of Orchard Park, N.Y. is in need of parts for her 9.6m (32′) Marinette. Send e-mail replies to JLG-7@webtv.net.

INFORMATION HOTLINE

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

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

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

E-MAIL: info@diy-boat.com

Needs Sterling Info

Alvin Binuya of Seattle, Wash., recently purchased a '93 Sterling 2100 bowrider. He is looking for information on the builder, hull design, construction and options listing. Send e-mail replies to 62t-bird@msn.com.

TECH TIPS

SPOT TOUCH-UP: When you need to repair a minor chip or scratch in a painted finish, simply clean the area with a cotton swab dipped in solvent then touch-up the spot with a dry swab dipped in the appropriate coating.
Bill Lindsay, Hollywood, Fla.

FINE FINISHING: How do you know when you've sanded a piece of brightwork enough? Rub pantyhose over the wood and if it snags, you'll need to sand a little more.

CURE FOR PLANK CRACKS: When two-part polyurethane paints are applied on wooden boats the surface often cracks along the planking seams due to the natural "working" of the boat. You can prevent this by drawing a very sharp razor blade through each seam to cut the paint after it has dried.
Doug Powles, Bear, Bellingham, Wash.

LIQUID I.D.: When doing work on board that requires removal and reinstallation of original parts, reach for a bottle of correction fluid (i.e. Liquid Paper). When servicing spark plugs, for example, place one dab of correction fluid on the first spark plug, the plug wire and the corresponding plug hole on the cylinder head. Put two dabs on the second plug and so on.

DRIP CATCHER: Place a plastic or aluminum plate under your paint can to catch spills that run down the side.

SANDING SMALL SPACES: To sand small crannies or the edges of curved areas or joints, use a wooden dowel, sharpened in a pencil sharpener and wrapped in a piece of sandpaper.

TANK LEVEL GAUGE: To quickly and easily determine how much fuel remains in your propane tank, pour hot water over the tank. Wait for about 30 seconds, then feel the tank. The tank will be warm where it's empty and quite cool up to the uppermost level of propane.

FACTS ON MAT: Chop-strand mat has a binder that's dissolvable in styrene, which is why it's never used with epoxy.

HAND SAVER: If you don't have gloves (or prefer not to wear them) and want to protect your hands when painting, wash them with soap, rub the suds into your hands, let them dry then paint.

COVER ALL: To protect non-treated areas when sanding, painting, varnishing, gluing, fiberglassing or other messy jobs, purchase a roll of white paper "table cloths" available at party supply stores. The paper is coated on one side and comes on a huge .92cm- (36"-) wide roll that should last a very long time.

BRUSH RESTORER: To soften brushes that have hardened from polyurethane paints, soak in Interlux 333 Brushing Thinner.

PLUG STOPPER: If you strip the threads in a spark plug hole an inexpensive fix is to have a service shop install a stainless steel insert for about $20.

OUTBOARD BRACE: Trailering can exert significant forces on your outboard that can cause damage to the trim and tilt mechanism and to the outboard itself. Always trailer with the motor in the fully lowered position (if there's clearance), or use a transom support bracket such as a wood block or other commercially available bracket.

BRUSH REST: When you're ready for a lunch break, wrap your brushes loosely in aluminum foil or plastic wrap. This will keep your brushes fresh and ready for use when you return.
Bill Lindsay, Hollywood, Fla.

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

RECANVASSING DECKS OR CABIN TOPS

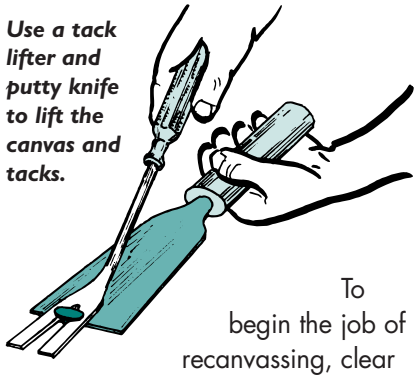
Follow these easy steps when it comes time to lay a new canvas deck.

By Wayne Redditt

Cotton canvas offers a watertight covering for wooden decks and cabin tops when correctly applied and maintained. Tears in the covering and paint that has cracked allow water to seep between the fabric and the deck causing rot. When a fabric-covered deck begins to leak or show signs of water penetration, it's time to recanvas.

Canvas is measured in ounces per yard, with the most common being 10 oz. fabric in either 32" or 60" widths. If the width is insufficient to cover the entire deck have a canvas shop or sailmaker sew the strips together so the seam lies down the centerline of the deck. The seam should be overlapped and double stitched.

Figure 1



Use a tack lifter and putty knife to lift the canvas and tacks.

To begin the job of recanvassing, clear the deck of all hardware. Carefully remove the trim and coamings around the deck edge, hatches and other deck openings. Now remove the old canvas and tacks holding the canvas. The easiest way to do this is to cut the canvas close to the edge of the tacks, leaving a narrow continuous strip of canvas under the tacks. Using a tack lifter, gently lift out the tacks. Place a thin putty knife under the heel of the tack lifter to prevent gouging the wooden deck (**Figure 1**). If the tacks break, you may either attempt to dig them out (preferable) or hammer them in. If you must pound them in, countersink the heads with a nail set. Fill the nail holes and cracks along the tack line with a thickened low-density epoxy or vinylester resin mixture.

Plane (if necessary) and sand the deck to fairness. Fill any hollows with thickened filler. Any bump or ridge will be transmitted through the canvas and will be unsightly. Clean the deck and vacuum thoroughly. The deck must be completely clean, as any small lump of sawdust or other detritus will be visible through the canvas.

Cut the canvas using the old piece as your pattern. Add a foot or so extra along the outside edges for a handhold when tensioning.

There are two methods for applying the canvas. The "wet" layout involves placing the canvas over wet paint. A better method and the one that I've always used, is to lay the canvas over a dry surface, tack it, then shrink the fabric taut before painting.

To apply canvas using the "dry" method, begin by stretching the fore and aft ends of the fabric at the centerline. Pull the canvas as tight as possible in this direction, then secure with tacks. This requires more than one person in order to stretch the fabric tightly and evenly (**Figure 2**). Continue down the sides, pulling the

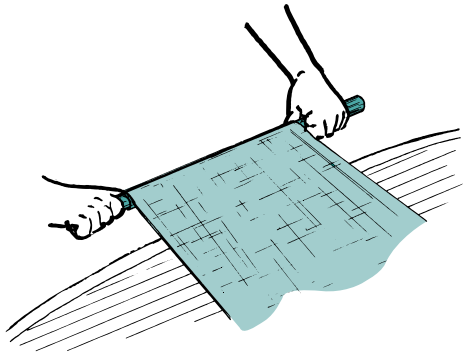


Figure 2

Tightly stretch the canvas using a batten.

fabric from opposite sides until taut, eliminating the wrinkles and tacking. Use 12mm (1/2") long copper "canoe" tacks. Don't use steel upholsterer's tacks that will rust. Tack spacing depends upon the weight of the fabric. Tack heavier weight canvas at 5cm to 7.6cm (2" to 3") intervals

along the edge. Lighter cloth (i.e. 8 oz.) requires closer spacing. Reinstall the coaming or covering boards over the trimmed edge, bedding with a polysulfide sealant to ensure water-tight integrity.

Deck openings are usually canvassed over and the openings cut after tacking the edges. Trim the excess cloth away from the edges, near the tacks. Remember to leave the cloth long enough to be folded under the hatch trim pieces (sort of like flashing on a house roof) or leaking may occur.

The ability of the deck fabric to resist wear and water penetration is dependent upon the finishing. Again, there are differing opinions on what constitutes the best approach to finishing. To prepare the fabric for finishing, first moisten it lightly and let dry. The fabric will shrink somewhat and become quite taut. Moisten again (lightly, not sopping wet) and apply the first coat of semi-gloss or flat yacht enamel directly onto the moist fabric. This will "float" the paint and produce a nice smooth surface that bonds quite well to the top of the fabric once the moisture dissipates. Apply only one or two more coats. Do not apply more coats hoping for a really flat shiny surface. By the time you have applied enough paint to achieve that, it's so thick that cracking is sure to follow as the wood moves under the fabric. Carefully bed all hardware and trim and you have a nice new waterproof deck that should last for years.

Canvas and tacks can be purchased at Noah's (416/259-7555) and most tent and awning suppliers. Canvas sells for about CDN$16.50 per yard for the 60" width; a 2 oz. package of tacks costs CDN$7.10.

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

ELECTRONICS

THE MOST CHARGING AMPS FOR THE LEAST

High-output alternators deliver maximum output for minimum engine running time. It's a worthwhile upgrade if you spend large amounts of time away from a dock, are planning some serious cruising or have a sizable electrical load.

By Kevin Jeffrey

If you have an inboard auxiliary engine and want the most charging amps for the least expense and maintenance, you should consider replacing your standard alternator with a high-output model. Boaters who do so typically receive up to four or five times the power of their existing alternator for a relatively modest investment.

Standard alternators are fine if you use your boat like a car — that is, you go aboard, motor to your destination, then either leave the boat or plug in to dockside power. But most sailors and a large percentage of powerboaters need more from their engine-driven charging source — they need to produce the most electricity they can during the times when the engine is on.

High-output alternators aren't just alternators with more amperage. They have heavier wire windings, better cooling characteristics and higher output at lower engine rpms. Unlike standard alternators, they are made to run at their rated capacity indefinitely in a hot environment.

There are a number of models currently on the market to choose from. Many independent power system suppliers have their own brand of high-output alternators, although in most cases they are privately labeled versions from one of the few high-output alternator manufacturers such as Lestek and Powerline. Before adding it to your list of new gear to buy, determine if you really need to upgrade to a high-output alternator, and if so, what you should look for.

Small Case Alternator Output Curves

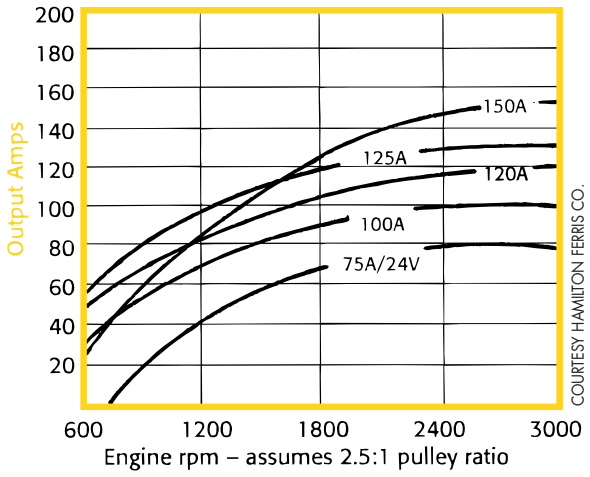


Figure 1

Alternator Output Curve

Selection

My guidelines to follow are: you probably don't need to upgrade if you spend most of your time at the dock, if your electrical load is light or if you don't want to run your engine for battery charging and have sufficient alternate power sources to do the job.

You probably would benefit from upgrading to a high-output alternator if you spend large amounts of time away from a dock, if you are planning some serious cruising, if you have a sizable electrical load (i.e. refrigeration), or if you simply want a high-power, engine-driven back-up to your renewable chargers (solar, wind, and water power).

It would be a great help in the decision-making process if you knew just how much (actually, how little) power your standard alternator produces. An accurate ammeter on the output line of the alternator is needed, yet few boats are equipped with this simple device. Typically, a 35-amp alternator driven off an engine running at idle speed for battery charging, produces about 1/3 to 1/2 its rated capacity for a few minutes as starting current is replaced. As voltage rises, alternator output quickly diminishes. After 15 minutes or so, output is usually down to a small percentage of rated capacity, mostly due

to the type of voltage regulation inherent in standard alternators. I estimate that a 35-amp standard alternator driven off a 25-hp engine at idle speed for battery charging has only about a 2% energy-conversion efficiency from liquid fuel to stored amps in the battery. High-output alternators with performance charging controls can increase this efficiency up to 10%. (Solar panels have 16% energy-conversion efficiency from sunlight to amps produced.)

If you decide a high-output alternator should be part of your charging mix, you need to select the right type for your needs. High-output alternators come in small-case and large-case models. Small-case versions, which include all models up to about 150 amp rated capacity, are direct replacements (often bolt-for-bolt) for your standard alternator. They can usually be driven from a single pulley and belt set-up, although some suppliers recommend only high-grade belts such as the Gates Green Stripe brand for this application. Large-case versions, usually all models above 150 amps of rated capacity, have a slightly larger body diameter and may not fit the space you have available. It's best to check the measurements before purchasing a large-case design.

Alternators are typically "cold rated," which means their actual output decreases by about 10% to 15% after they warm up. They are also rated at a relatively high engine rpm, which means at engine idle speeds they produce much less than their rated output. To make matters a bit more confusing, each model of alternator has its own output curve that determines how much current it produces at various speeds. Some alternators build power slowly, then increase rapidly at higher rpms. Others power up quickly, then level off in the higher rpm ranges. By studying the output curves of the models you are considering (**Figure 1**), you may find that a 125-amp alternator that builds power quickly actually produces more power at low engine rpms (when you'll be doing most of your battery charging) than a 150-amp model that builds power more slowly. Your alternator supplier should be able to provide you with output curves for the models it sells.

An engine of sufficient size is required to drive a high-output alternator. For example, an alternator that produces 100 amps after it's warmed up can rob the engine of about 4 hp. Keep in mind that the horsepower an alternator takes from the engine is proportional to the alternator's output — when the regulator cuts off the alternator's field current (or if you do it with a simple on/off switch), it can't produce any power and, consequently, places no load on the engine.

Many cruising sailors ask me if they could simply use a manual alternator control (remember the Auto-MAC) for their existing standard unit instead of buying a new alternator. The original idea behind those controls was to temporarily over-ride the voltage regulator of a standard

ELECTRONICS

alternator so it would produce maximum output. These devices are still available, but why spend about $200 for a control where you have to manually boost the output of a 35- to 55-amp standard alternator that isn't even made to run at full capacity for extended periods? You can buy a 125-amp high-output model that will give you 4 to 5 times the output for around CDN$400/US$350.

Monitoring Output

Some high-output alternator suppliers include an adjustable, two-step control with their alternators. These low-cost controls have the first two steps of a "smart" three-step control (available from Ample Power, Balmar, Cruising Equipment and Heart Interface) and are not nearly as convenient to use.

Step one is bulk charging up to an adjustable cut-off voltage (**Figure 2**), typically set at 14.1 volts for gel and 14.4 volts for wet batteries if you want performance charging. During this cycle the alternator is producing maximum current for a given engine rpm and battery voltage is rising as the battery becomes charged. Step two is absorption charging, where the voltage is held constant at the cut-off setpoint for a specified length of time, while alternator current is correspondingly reduced (it has to be reduced or the voltage would continue to rise). Missing in a two-step control is step three, where the voltage automatically drops to a safe float voltage after the absorption cycle, typically to around 13.2 volts. Lowering the voltage in this manner eliminates any possibility of overcharging the batteries during long periods of motoring.

Two-step controls maintain the cut-off voltage indefinitely as long as the engine is running. This can be a problem if the cut-off voltage you select is too high for the type of motoring you are doing. This is set by adjusting the cut-off voltage setpoint (usually with a small screwdriver and a digital voltmeter). The higher the setpoint, the higher the performance, up to the battery manufacturer's recommended maximum setpoint. However, that higher voltage setting can lead to battery damage during long stretches of motoring. But if you are motoring for long periods of time, chances are you don't need performance charging and can reduce your liability for battery damage by lowering the voltage setpoint temporarily. I'd recommend reducing the cut-off voltage of a two-step control to around 13.8 when you know you'd be motoring a lot. If your elec-

trical load is large and much of that load is used when you're motoring, you may be able to bump that voltage cut-off up a bit without harm. The main advantage of a "smart" control (US$150 to US$300) is automatic battery protection from the effects of excessive voltage. If you are in doubt about which approach is right for you, go with the automatic three-step control and eliminate the worry.

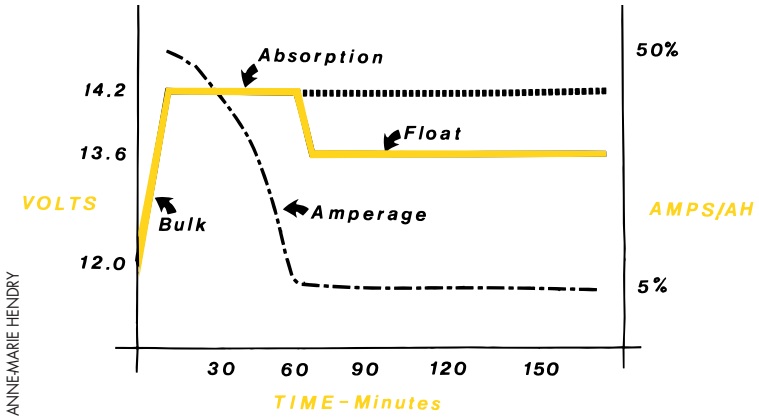


Figure 2

Diagram of Control Sequence

Hook-up

There are a few other considerations when switching to a high-output alternator. You'll probably need to increase the size of the alternator output wire. You should also have some method of monitoring alternator output, either with a system monitor or a single ammeter placed in-line in the output wire.

Correct pulley size and width are important, since the ratio of engine pulley diameter to alternator pulley diameter determines the alternator shaft speed. Too large a pulley on the alternator will cause it to turn too slowly with less current output. Too small a pulley causes the alternator to turn too fast with the potential for damage at high engine rpms. Large-case alternators require dual pulleys and belts, so you might have to change the pulley set-up on your engine shaft. A professional electrical power expert can ensure that the alternator you are purchasing is properly matched to your existing engine and its pulley set-up.

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

ANCHORING made easy

An electric anchor winch is a worthwhile upgrade if you do a lot of anchoring. Here's a step-by-step account of how to install the Powerwinch 45.

TOOLS

Drill and assorted bits
Holesaw
Hammer
Pliers
Multi-tester (VOM)
Wire cutters
Crimping tool
Vise-Grips

By David & Zora Aiken

Whether you're fitting out a brand new boat or fixing up a favorite old one, an electric anchor winch is a significant addition. Convenience is the most obvious advantage, but others may be even more beneficial. There's a safety factor (power and speed for dropping and retrieving the anchor) and there's the no-more-aching-back factor, one which grows in importance with each boating season.

We recently traded our manual anchor windlass for a Powerwinch 45 and found the installation process to be well suited to the abilities of the average do-it-yourselfer. If you're planning a similar upgrade, here are some things to consider before you start.

As with any new gear addition, careful planning is the first and possibly most important step. If an anchor winch is not positioned exactly behind and on the same line as the bow roller, the rode will not feed properly between the gypsy and roller. If the winch is not positioned correctly over the anchor locker, the incoming rode won't feed below. Either way, the winch can't do its job. Any miscalculation regarding the wiring can mean wires cut too soon (too short) or misconnections that translate to no power at all or a shorting out of the entire system. And a misplaced switch will not allow the helmsman to operate the winch while watching and steering.

None of these possibilities would brighten your boating day. Fortunately, all are avoidable. For the unit we installed, all instructions are clearly presented in a series of numbered lists. You can purchase and assemble all the wiring parts according to one of the lists or you can buy the preassembled wiring kit — a much better choice from the perspective of saving trips to the store for forgotten parts.

Mounting Guidelines

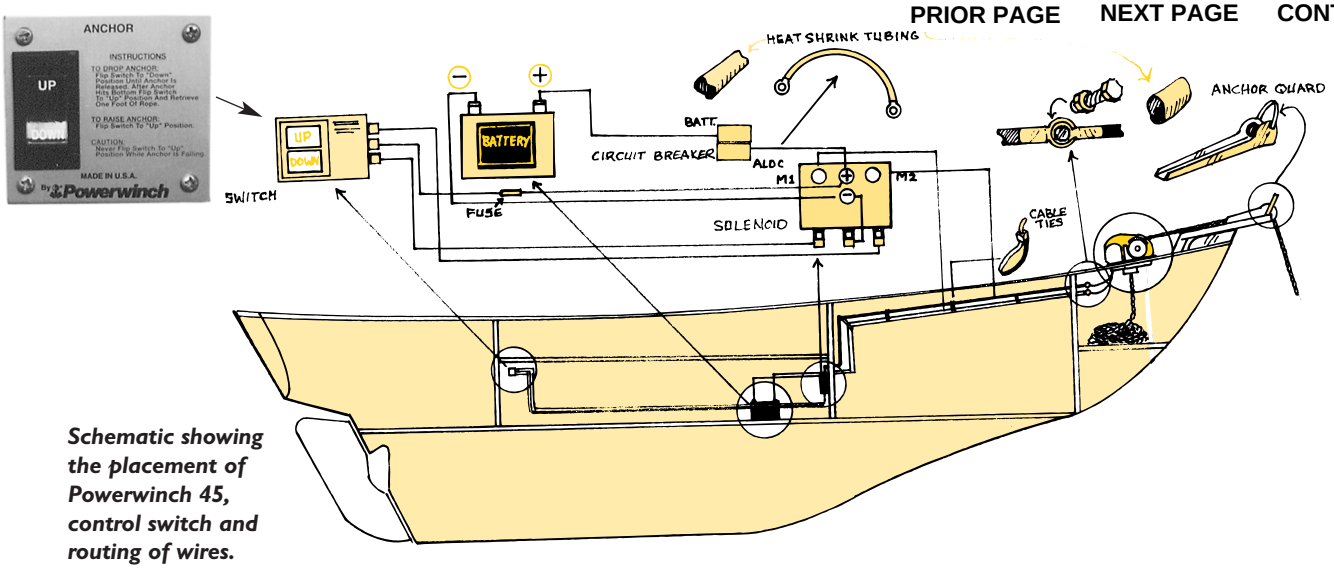
Begin by reading the installation instructions and studying the diagrams. Carefully choose the best place on your boat for each component: winch, solenoid, circuit breaker and switch.

Our boat already had a bow roller positioned to starboard of the headstay. Powerboats do not have the offsetting influence of a stay or furling drum. The existing bow roller established a centerline location for the gypsy; naturally, it must be placed directly behind and inline with the roller.

Next, you need to know how far back to place the winch. It must be clear of cleats or stays, and the thru-deck opening must be situated over the anchor locker where the rode can drop freely.

Placement of the switch raised the most questions. Too far from the wheel and the helmsman would not be able to steer while watching forward and operating the winch. Too low and the helmsman could not watch while steering and operating the winch. Even though "operation" is a simple push-button control, the helmsman must be able to reach the button. Our boat's cockpit already had ignition and engine gauges

The sleek, low-profile shape of the Powerwinch 45 blends nicely with traditional (in this case) or contemporary deck designs.



Schematic showing the placement of Powerwinch 45, control switch and routing of wires.

DAVID AIKEN

placed immediately to starboard of the pedestal and luckily, there was just enough space above the instrument panel to accommodate the winch switch. A seat locker behind the panel area ensured ample space for wiring connections on the back of the switch.

Once the two end elements were positioned, the other items could fit between. The solenoid should be placed between the winch and the battery, and about 1.8m to 2.4m (6′ to 8′) from the switch plate. A convenient engine room bulkhead is the ideal location. The circuit breaker would be wired in between the battery and the solenoid.

Installation Checklist

1 Now that all the critical decisions are made, the first active step would be to run the wires. Lead #6 AWG black and red wires through the boat. Prepare to spend a lot of time at this and have Band-Aids handy for scraped elbows and skinned knees. As you route the wires, make sure they don't touch any sharp edges in bulkheads or lockers to avoid chafing. Don't cut the wires yet.

2 Use the template provided by Powerwinch as a guide for drilling the holes to attach the winch. If the deck has a pitch, hold the drill perpendicular to the deck pitch so the winch will sit flush to the deck when bolted.

3 Use a strong backing plate for the winch bolts: a piece of stainless steel, marine plywood, a teak block or large oversized washers. Depending on the height of the toe rail, you may have to raise the winch with a teak or fiberglass base.

4 Make certain there is good, clear space belowdecks underneath the winch, so wires can be connected easily and not be crowded close to a bulkhead.

5 Place the solenoid as close to the battery as practical.

6 Cut the hole and mount the control switch in its chosen location.

7 When the items are in place, attach all wiring according to the manufacturer's diagram. Use a large crimping tool on the #6 wires or use Vise-Grips. When attaching the circuit breaker, be sure it's positioned so the side stamped "batt" connects to the battery and the side stamped "ALDC" connects to the solenoid. The last connection to be made is bolting together the two

wires that lead belowdecks under the winch. Wrap these separately with heat-wrap tubing to prevent a short. After wiring is finished, double check all connections before turning on power.

8 Once everything is in place and the system is functioning, insulate all the electrical fittings with heat-shrink tubing supplied with the wiring kit. It not only helps to keep out dampness, it also keeps connections from vibrating loose. Be sure to leave a little extra wire in case you find that you want to move something after you've operated the equipment.

Depending on how difficult it is to route wires, it should take four to five hours to complete the job. This does not take into consideration any adjustments that may need to be done if you're replacing another windlass, especially if you need to patch a hole or make a new mounting pad. If you like dropping things into inaccessible places, buy some extra electrical fittings.

If you're installing the bow roller at the same time, be sure it has a strap/loop that prevents the anchor from over-riding the roller. When using new line, you may notice it tends to slip initially. Soak it for a while; it will swell a bit and the gypsy will get a better bite.

After the winch was installed and connected, we were glad to see how well it worked. The "free fall" system is amazingly fast. We were also glad to see that the winch does not look misplaced. With any new addition to a 35-year-old classic boat, there's the risk of creating a minor monster, but that is not the case with the winch — the Powerwinch 45 has a simple, sleek, and low-profile design that fits just fine.

With the winch's stainless-steel components we don't anticipate a lot of calls to the company, but it's nice to know technical help is accessible with a toll-free number (888/MY-WINCH).

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

FREEFALL MEANS FAST ANCHORING

Powerwinch's new line of anchor winches is particularly appealing to boats of all sizes because of their "freefall" feature. A patented system, it's the fastest and easiest way (and saves power too) to anchor. Just press "down" on the switch control and the anchor automatically drops at a rate of up to 90m (300') per minute or as much as four times faster than a conventional "power down" unit.

Two sizes are available for powerboats and sailboats: the Powerwinch 35 (US$749) for boats up to 10.5m (35') in length and the Powerwinch 45 (US$999) for 13.5m (45') boats. The Powerwinch 45 installed in this article uses 5/8" line and 5/16" ACCO G4 Hi-Test chain. Power consumption is 10 to 18 amps. Both winches feature aluminum housing, stainless-steel drive shafts, one-piece, heat-treated, oil-impregnated gear system, replaceable deck flute, rubberized deck gasket and a removable side housing for maintenance. Prices include the helm-operated control switch. A wiring harness is optional and recommended. Made in the U.S., these winches come with three-year warranties. — *Jan Mundy*

PROJECT BOAT

REPLACING A SOGGY DECK

A water-saturated, cored deck poses a safety concern and reduces a boat's resale value. If your boat is in such condition, don't despair. Here's a solution that is not too costly, provided you have the time and patience to learn and do the repairs yourself.

TOOLS AND MATERIALS

- Hammer
- Chisels
- 7-1/4" circular saw with saw blade and Multidisc
- Tape measure
- Drill and bits
- Holesaw set
- Jigsaw
- Belt sander
- Low-rpm (2,500) orbital sander
- Screwdrivers
- Wrenches
- Taps and tap handle
- Scissors
- Knife
- Pencil
- Markers
- Fairing board
- Epoxy and polyester resin
- Laminating supplies including: rollers, squeegees, tongue depressors
- Rubber gloves
- Dust mask

By Don Campbell

After many years of dinghy sailing, Don and Phoebe Campbell decided to look for a larger boat that could be cruised and raced on the Great Lakes. They narrowed their choice to a 30-footer or larger with a full keel and a budget below $25,000, then went boat shopping. Of the available boats they discovered two classes: those that were structurally unsound and those that were above their budget. They found a 1973 Alberg 30 in Niagara-on-the-Lake, Ont. The hull was sound but the deck and cockpit floor were "mushy." Water weeped out of the stanchions, which were movable through as much as 35°, and a moisture meter read higher than 60% on half of the deck.

A survey revealed no surprises. Water saturation had decayed a large portion of the balsa-cored deck. Preliminary estimates from boat repair yards started at CDN$6,000 for the known conditions and more if things were worse once the deck was opened up. Knowing all of their options, they purchased the boat at a giveaway price, trucked the boat home and put it into an unheated equipment shed to do the repairs themselves.

Don had built two Mirror dinghies from kits and so had some experience with epoxy and polyester resins. He had a considerable amount of other building experience making equipment for his vegetable farm processing lines, but had never undertaken a project such as this. Here's how Don replaced White Opal's *totally saturated cored deck.*

The first step of the repair was to visit a local boat repair yard for some professional advice. Generally, most repairers are willing to give advice and help if asked. Even if there is a cost, it will save both time and money on the job.

Strips of the outer deck laminate showing the rotted core.

I was advised to fully scaffold the entire hull. It was expensive to do but saved much time and wear and tear on the hull from ladders, and my knees from climbing, and simplifies working with power tools and chemicals. The pros also recommended using diamond-cutting tools to remove the outer skin of fiberglass, leaving some of the original top sur-

PROJECT BOAT

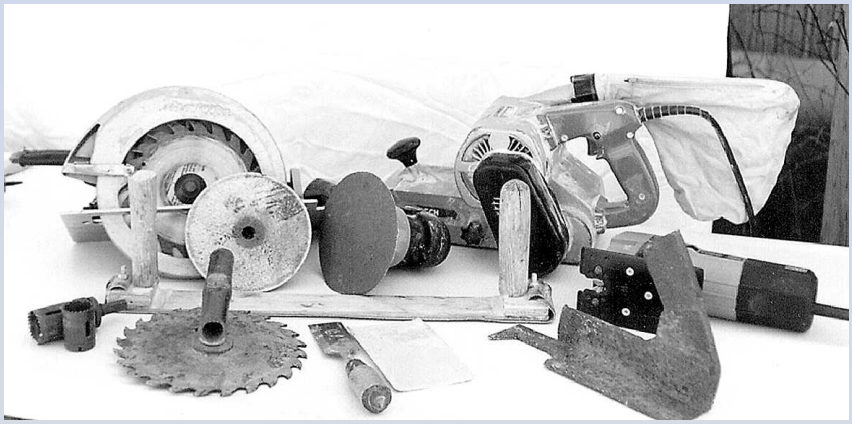
face for bonding the final layers. (Glass fibers quickly dull carbide and steel cutting blades.)

Repairing a delaminated deck involves stripping the outer skin, excavating the wet, mushy core and replacing it, then rebuilding the laminate. On some boats it may be necessary to brace the deck with vertical supports placed in the cabin before removing the outer skin to prevent sagging and to maintain the original deck shape.

Preparation

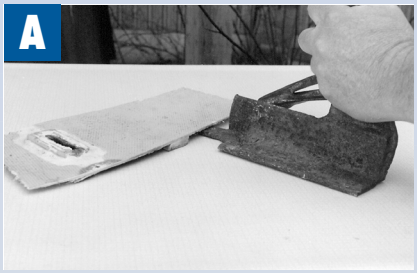
Before starting the repair, photographs of the deck were taken in series so that the whole deck could be reassembled in one composite. Next, all fasteners and hardware were removed and labeled, then stored in marked boxes. The outer skin of the entire deck and cockpit floor was cut into about 30.4cm (1′) sections through to the core using a Multidisc (it has diamond chips in the blades) in a 7-1/4″ circular saw. A 5cm- (2″-) wide strip was left on the outside edges along the cabin, cockpit and toe rail. (One cutting disc did the entire deck, about 34m (114′).) The deck was then peeled off where it was weak and chiseled away where necessary. Removal of the balsa core, 6mm (1/4″) in the deck and 9mm (3/8″) in the cockpit floor, was done with a 5cm (2″) chisel. A wider, homemade chisel made of a truck spring would have been quicker. The hardest job was to remove the core between the skin layers left on the edges and for that I made the necessary tools (see "The Right Tools for the Job"). The edges of the outer skin were then beveled to give as wide a scarf joint as possible.

Side deck prepped for balsa core after coating the inner skin with polyester then epoxy resins. Note the beveled edges.



THE RIGHT TOOLS FOR THE JOB

As the laminate was left intact around the edges for matching and bonding surfaces, removing the core between the outer and inner skins was a big problem. After trying several tool shops without success, I initially tried a circular saw blade on a variable speed drill. This was too unsafe and hard on the wrists and it tended to make holes in the inner skin. After two days of drawing and an hour with the cutting torch, I transformed a piece of 6.3cm (2-1/2″) heavy angle iron into a horizontal chisel (**Figure A**) with a flat top for hitting with a hammer. I then made a mirror image, rather than use my left hand on the hammer, and that was effective for most of the removal. A saw blade was fitted with a handle (**Figure B**) and that worked well to gouge out the mushy core. A fairing board was made of hickory, cut thin enough to flex and yet strong enough to be useful. A broken shovel handle was sectioned for the handles.



Lay up

After thoroughly vacuuming the deck twice, a layer of polyester resin was brushed on the inner skin and while still "green" (uncured), overcoated with West epoxy applied with a notched squeegee. While the yard recommended using polyester resin, I choose epoxy instead so this step was necessary to insure good adhesion.) A layer of 2-oz woven cloth was laid in and "wetted out" with epoxy followed by a layer of 6-oz cloth (**Figure 1**). The 6mm (1/4") balsa core was then fitted and epoxied to the laminate. A coat of epoxy was then rolled over the top surface to seal the core. All thru-hulls were marked and at least 2.54cm (1") of the core surrounding the fittings was removed and the cavity filled with a thickened epoxy mixture so the core would be sealed when the thru-hull was fitted. I then applied two layers of 6-oz cloth and the surface was faired with epoxy mixed with microspheres. A final 6-oz layer of cloth was applied and when fully cured, the surface faired with epoxy and microspheres. Two coats of epoxy were then rolled on to seal the fairing compound and lightly sanded and prepped for painting.

A similar procedure was carried out for the cockpit floor with two extra layers of fiberglass tape feathered onto the vertical sides. (Cores in most decks are normally used only for the horizontal surfaces.) Because of the deck's long narrow shape, we cut the cloth into 45cm (18") strips or smaller and butt joined the ends. One large piece was used for the foredeck. These were all cut and set in place. If two layers were applied "green on green" (while still tacky), the second layer was set close to the work area before mixing the resin. Care was taken to taper and stagger the joins of each layer. Resin was mixed in small batches that were usable before they heated. Fillers included cabosil, microfibres and microballoons used to thicken the epoxy, increase bonding strength, facilitate sanding or decrease sagging, depending upon the need. Smooth squeegees and rollers were used to apply epoxy to cloth and notched squeegees were used with a lot of pressure to apply fairing compounds. Ridges were intentionally left in fairing layers to reduce sanding time and once fair, a layer of epoxy was applied with rollers or smooth squeegees or both to fill in the low spots. As many of the resin and cloth layers as practical were applied "green" to avoid the waxy amine blush, a bi-product of cured epoxy; otherwise, it was necessary to wash and lightly sand before applying the next layer.

Final Finishing

Extra effort was made to have the chainplates better than original. A positive blank cut from a plastic chopping board of the desired shape was used for all seven chain-

DIY REPAIR BILL

The cost to repair a delaminated deck depends on the size of the repair and the prices of materials at the time. For this job, which was done in '96 and '97, the following costs in Canadian dollars were incurred:

10gal West System epoxy and hardener	$ 850
Polyester resin and hardener	$ 40
Fillers (cabosil, microfibres and microballoons)	$ 100
2-oz and 6-oz woven roving	$ 300
Balsa core, 6mm (1/4") and 9mm (3/8")	$ 300
Scaffolding materials	$ 450
Deck paint	$ 75
Miscellaneous supplies, gloves, pots, sandpaper, brushes, rollers, etc.	$ 150
TOTAL	$ 2,265
LABOR	350 hrs

PROJECT BOAT

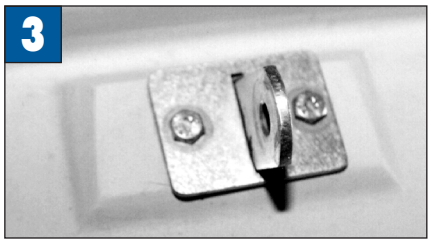


plate risers. Plasticine was shaped over the blank to form a mold, then coated wih polyvinyl alcohol (PVA) and filled with solid epoxy mixed with coarse fiber fillers (**Figure 2**). This process was repeated to make the seven risers. These were then bonded at the appropriate places to the deck with epoxy. Stainless steel cover plates were fastened with bolts, tapped into the epoxy and sealed with a polyurethane adhesive sealant (**Figure 3**).

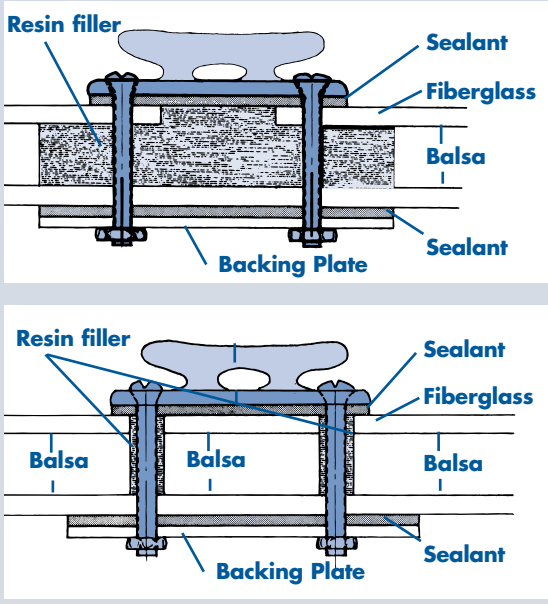
The final look is up to the boat owner. The original gelcoat had a

BEDDING HARDWARE IN BALSA-CORED DECKS

A deck that squishes when walked on, has water weeping out the laminate at a fitting or water dripping into the interior are sure signs of saturation of a cored deck. Water usually seeps into a cored deck when the outer skin was built too thin and fractures (visible by the telltale "webs") or from hardware and thru-hulls that were improperly installed by the builder and/or not maintained by the owner.

Balsa has good compressive strength, which makes it a desirable core material, but it must be sealed to prevent water migration. Any holes drilled into or through a cored laminate must be completely sealed with marine adhesive sealant, either a polysulfide or polyurethane when you don't plan on removing the fitting. Apply an ample amount of sealant under the fitting and backing plate (if used) and coat the threads of the fasteners.

It's recommended installing all thru-bolted hardware with a backing plate to distribute the load on the underside of the laminate. Backing plates are made of stainless steel, bronze or aluminum. Backing plates can also be made of hardwood but these must be thick enough so they don't bend and they require oversized washers. These are sized slightly larger than the base of the fitting (about 2.5cm/1")



ANNEMARIE HENDRY

Two methods showing the proper installation of hardware in a balsa-cored deck; (top) The core is excavated and the cavity filled with thickened resin; (bottom) Where the core is inaccessible, drill oversize fastener holes and fill with thickened resin.

and installed below deck. In extreme high-stress areas, a matching plate is mounted between the fitting and the deck.

With some highly loaded fittings, such as grabrails, bow and stern pulpits, stanchion bases and dock line cleats, the core compresses and crushes under the load. To prevent crushing of the core, remove the core under the hardware, excavating a hole that's slightly larger than the outside dimensions of the fitting, then fill the cavity with a mixture of thickened epoxy, polyester or vinylester resin. Heavy hardware (windlasses, etc.) may also require fiberglass reinforcing of the laminate.

Preventative maintenance is your best defense against water penetration. Occasionally remove and rebed all fittings, trim and thru-hulls — especially hardware with cracked caulking — and add backing plates if necessary. For high-stress hardware, you should remove the core under the fitting and fill the cavity as described above. Repair any spider cracking or any damaged laminate. If your boat is stored outdoors in the winter, cover it, and level the hull so water doesn't collect on the deck or cockpit and drain through the scuppers.

— Jan Mundy

TIPS HELPFUL HINTS

- *For advice, find someone who has experience.*
- *Consider all safety and health practices before starting.*
- *For deck repairs, fully scaffold the hull.*
- *Photograph the placement of hardware on the original deck before beginning repairs.*
- *Fully understand how to use and apply the resin, fillers and related materials you choose.*
- *Be meticulous when it comes to bonding old and new layers to ensure a sound foundation.*
- *Buy the recommended tools.*
- *Be prepared to design and/or make your own tools.*
- *Cover areas that you don't want epoxy spilled on with drop cloths.*
- *To save time and materials when it comes to filling and fairing, keep the layers as fair and even as possible as you build the laminate.*
- *Plan for extra time, as much as 33%, so you can enjoy the job and not be in a panic to finish.*

pattern of raised diamonds (not easily duplicated) and the application of a sand-filled coating was more than I wanted to try without some extra air tools. I selected Sikkens Deckpaint, an inexpensive, one part gray non-skid paint that's quickly and easily applied with a roller. Although this paint was somewhat soft initially, it has been satisfactory throughout the first season without much glare and good anti-skid properties.

The last step was to rebed the hardware and this was done with backing plates and a polysulfide sealant (see "Bedding Hardware"). Thru-bolted fittings and thru-hulls were aligned from below because this repair didn't obliterate their original location. Holes were cut with hole-saws where possible and a jigsaw was used for the one large inspection port in the cockpit floor. The boat was now ready for launching.

A competitive Y-Flyer racer, Don Campbell built the first of two Mirror dinghies in 1970 to sail on the Grand River, which was the northern boundary of his farm in South Cayuga, Ont. The Alberg 30 was purchased to allow all the non-racing members of the family to enjoy sailing, and has been an interesting repair project for a retired farmer.

PROJECT BOAT

T-BIRD GETS A NEW BOTTOM

Delamination is not usually a serious problem in boats made of plywood but a steady flow of water in the bilge is a good indication that it's time for a replanking job. Here's how.

Story and photos by Nick Bailey

During the past two summers of racing, our 34-year-old plywood Thunderbird sloop, *Looney Tunes*, started taking on water. After wet vacuuming the bilge and carefully dabbing it dry with paper towels, a close inspection revealed beads of water welling up in a few spots where the bottom plywood panels join the stem and keelson.

After years of bottom touch-up and localized epoxy repairs, the plywood, though not really rotten, had areas of delamination and was soft in spots along the keel. Fall haulout revealed the epoxy bottom coating had cracked and checked — I was even able to put my penknife through a few of the known soft spots. The time to replank had come. This meant removing the keel, rolling the boat over on its deck, removing most of the old fir plywood below the chine and replacing it with modern marine ply, covering the bottom with fiberglass and epoxy resin, filling, fairing and priming the hull, then rolling it upright and reinstalling the keel.

The first prerequisite for a winter repair of this magnitude is a heated shop and I was fortunate to be able to borrow space from my employer, Bristol Marine.

Rollover

How does one remove the keel and roll the boat over? The "Tunes" was sitting on a trailer with screw jack pads. After securely tying the keel to the trailer, we removed the keel bolt nuts, then jacked the hull on the cradle pads until daylight showed beneath the keel, assuming the keel would drop after a few days. It didn't. I soon discovered that a keel won't drop unless you knock the keel bolts out of the keel flange and floor timbers from above using a 12mm (1/2") drift pin or bolt — do it carefully so you don't damage the threads. Even then a keel may be reluctant to drop if it was installed with an adhesive sealant; you may have to hammer in wedges and use the biggest pry bars you can find. A set of 5cm- or 7.6cm- (2"- or 3"-) wide heavy chisels is also useful in persuading the keel flange to release its grip.

The right tools for the job: a circular saw to cut the plywood at the waterline, bow and stern; a crowbar to wrestle off plywood held with marine nails instead of screws; a router with a straight-sided bit and guide to remove rotten areas in the keelson; and a dual-action sander to refinish the stringers.

With a chain hoist and forklift attached to 5cm (2") nylon tie-down straps serving as slings, we lifted the hull clear and wheeled the trailer with the keel out of the way. With the help of fellow Thunderbirders experienced in this process, we began the ticklish procedure of rolling the hull. There are several ways of doing this, but we chose to lift at a point as far outboard as possible with a chain hoist picking up on a nylon strap wrapped around the hull at the chain plates. This slowly heeled the boat over while the low side of the hull was supported and eased down by a 4:1 block-and-tackle.

After carefully marking and cutting the multi-bevel angles along the chine and keelson, the new plywood panels were dry-fitted before being screwed in place.

Meanwhile, the stern of the boat (rudder removed) was held in a sling supported by the forklift. The rollover was done in several stages with the slings and hoist repositioned at every step. We were prepared to lower the boat down onto tires partway through the rollover, but with backup tackle to take the load while the hoist was repositioned, this was not necessary.

Once upside down, the boat was lowered onto low cradles that supported the deck near the mast hole and at the aft end of the cockpit. Carefully placed tires would also provide an adequate cradle.

Surveying the Damage

We removed most of the old bottom paint with a grinder, uncovering the screws that fastened the old plywood. The plywood above the waterline was sound, so we carefully measured where the new ply would butt in with the old, ensuring the butt joints would be accessible inside the hull. Hundreds of screws were removed, then the plywood was carefully cut with a circular saw near the waterline fore and aft and along the chines. We were surprised to find the butt-joint areas held together with marine nails instead of screws; a crowbar was required to lift the plywood off in these areas. Once the old ply was gone we inspected the stringers, discovering only one with a bit of rot. Two of the oak 10cm x 10cm x 30.4cm (4" x 4" x 12") butt blocks tying the bulkhead to the keelson were also quite suspect, showing about 25% rot. These were secured by bronze carriage bolts and resorcinol glue, and they put up a fight coming out. The mushy lower parts of the bulkheads were sistered with new ply, epoxied and through bolted. We also scarfed in a new lamination to a rotten stringer with 6mm (1/4") ply. The stringer was prepped by carefully routing out the bad area to a uniform depth using a straight-sided bit and a carefully clamped router guide.

Unfortunately, we damaged the keelson while prying off the keel. Removing the plywood uncovered some delamination in the 5cm- (2"-) thick plywood keelson. Using a router, straight-sided bit and guide, we removed the top 12mm (1/2") of ply down to the delaminated wood, which was still soaking wet, very black and had an all-too-familiar smell of wood preservative. Obviously, many years of poisoning the bilge with copper napthelate (the green stuff) were worthwhile because the preservative was getting in and the wood, although wet, was not rotten.

Next we checked out the false stem as we had detected a hollow sound in the spring just before launch. The wood showed no signs of rot but there was a fairly large air gap between the false stem and the stem plate and keelson joint. We let everything dry out for a few days and made a new false stem from 19mm (3/4") ply using the old one as a template. With the help of a skilled friend, who arrived just as our energy and morale were flagging, we installed the new keelson piece and false stem with screws and epoxy.

Fitting the Plywood Panels

For the four plywood panels, we chose Brazilian mahogany marine plywood. Each piece was cut about 2.5cm (1") oversized along the longitudinal outside

PROJECT BOAT

A single layer of 6-oz. woven roving was placed over dry plywood, then "wetted out" with epoxy resin and spread using a large putty knife.

edges. The bevel angle changed continuously along the outside edges, particularly in the forward sections along the chine. As the chine edge cannot be trimmed off after installation — it sits recessed against the topsides' plywood — it must be cut, fitted, then installed. We marked the plywood at 30.4cm (1') stations and measured the necessary cut angle with a homemade carpenter's protractor. Angles were then traced onto cardboard and each was labeled with its corresponding station number. This angle guide quickly helped us set up the blade angle on a jigsaw to cut the plywood panels.

At this point the panels were dry-fitted. This required clamping, the help of extra hands and a "come-along" (hand hoist) to bend the forward plywood panels in place. To get the cutting lines for the outside edges, we scribed a line on the wrong side with a pencil placed along the chine of the old plywood, then added a 12cm (1/2") offset. There are more precise methods but this worked for us. A belt sander quickly reduced the finished edge dimension down to the pencil line while still preserving the angle. The chine edge was finished first and the panel again dry-fitted and held with a few screws.

We then turned our attention to the simpler angles of the keelson. The panels were again removed, the keelson edge finalized and the panel mounted with stainless-steel screws spaced at intervals similar to the original plywood. (There were a lot of screws involved — a variable-speed screw gun made short work of it!) We didn't bed the screws with sealant as the whole bottom was to be glassed and epoxied, but we did bed the entire chine and keelson lap joints with 3M 5200.

We were ready to reinforce the six athwartship butt joints with 12mm (1/2") plywood pieces, as large as was practical to fit in the confined area between the longitudinal stringers. This was a surprisingly time-consuming job, as each piece had to be fitted, epoxy-glued and screwed into place.

Laminating and Filling

All gaps were filled with West System epoxy thickened with a mixture of cotton fiber and colloidal silica fillers, as well as the screw-head recesses. After sanding the spot fillers, then cleaning the ply and work area, we were ready to glass the hull. Had I more time available, I would have first epoxy-saturated the outside of the hull. Instead, we resolved to laminate a single layer of 6-oz. woven roving to the hull in one step — a trick I had used successfully when fairing and sheathing the topsides some years before. The cloth was cut into two whole pieces (one for each side), overlapped at the keelson and trimmed off below the chine for easier handling.

On one side we wetted out the ply using East Systems epoxy, then unrolled the cloth onto the wet ply as we went along. Because this low-temperature resin was relatively thick, we found a 15cm (6") putty knife was a good tool to spread the epoxy, remove the air bubbles, smooth the fiberglass and squeegee the resin.

We had some trouble wetting and unrolling the second side because the fiberglass kept sticking to the partially cured resin overlap area along the keelson before we could pull it flat. We ended up laying the rest of the glass over dry ply then

After filling the low spots and weave pattern in the cloth with a 50/50 mix of microspheres and colloidal silica powder and epoxy resin, the hull was faired with 80-grit 3M Hookit discs on a Porter Cable dual-action sander.

The hull was prepped with two coats of Awlgrip 545 epoxy primer and, after reattaching the keel, the bottom was spray painted with three coats of white VC Underwater Epoxy.

wetted out with epoxy resin. This technique works okay with 6-oz. cloth but I wouldn't try it with anything heavier.

Don't attempt a job like this alone. You'll need at least one helper to mix a continuous supply of small batches of epoxy and to assist in handling the glass. Never mix more epoxy than you can use in about 10 minutes because once curing starts, the temperature of the epoxy increases and it becomes increasingly more difficult to handle.

After a full-day cure, we sanded with 80-grit 3M Hookit discs (a convenient hook-and-loop attachment system for easy on/off replacement) on a 15cm (6") Porter Cable dual-action sander to knock down the high spots. The surface was cleaned with acetone and plenty of clean rags followed by a spray with the air hose. To fill the low spots and the weave pattern in the cloth, we made an epoxy fairing compound of 50/50 microspheres and colloidal silica powder with epoxy resin mixed to a peanut-butter consistency and applied by trowel.

Once cured, the surface was sanded again with 80-grit paper. I didn't have time to do a manual fairing with a board sander followed by a second application of filler, but I was fairly satisfied with the smoothness achieved with the dual-action sander. The next day the rollover crew was due and we had just enough time to seal the surface with two coats of Awlgrip 545 epoxy primer. As expected, this revealed many small defects such as small pinholes that later required touch-up and spot filling.

Mounting the Keel — Twice

The rollover went without incident and the keel was dry fitted. At this point, we made a measurement error and decided we needed a 6mm (1/4") shim under one side of the keel flange. The shim was made of hardwood, the hull was lifted, the shim put in place and the whole flange and around each keelbolt was thoroughly filled with 3M 5200. The hull was lowered and the keel bolts torqued up solidly (around 80 ft./lb.) and torqued up again the next day.

There was much work filling and fairing the keel and hull joint. One day when I was just about to glass over my nicely faired joint, I decided to check the offset dimension from the chine to the lower trailing tip of the keel — it was out 3cm (1-1/4") from one side to the other. Since this is a racing boat and, ideally, equally happy on port and starboard tacks, this really disturbed me. Some quick geometry showed that the asymmetry was caused by — you guessed it — the 6cm (1/4") shim. I spent a lot of effort removing the keel again, extracting the shim, mounting the keel and refairing the joint. It's now within 6cm (1/4") of symmetry. This exercise proved two things: if your keel is attached with 5200, the keel bolts may be strictly decorative; and don't just double-check your measurement, quadruple-check it!

Finishing

Once the keel was completely fair and as close to perfection as I could manage, the bottom was spray painted with three coats of white VC Underwater Epoxy. This paint goes on as a semi-gloss and contains Teflon, which makes it nice to wet-sand. The downside is that it has no antifouling properties whatsoever. Don't use it unless you drysail your boat or are willing to haul it out and wash it every week or so.

The new plywood inside was left bare to breathe and carries only a light coat of green wood preservative to discourage spores and microbes. The biggest thrill of all was the discovery a week after launch that the bilge was dry and dusty — a first for the Tunes in a long while.

The cost of materials was approximately CDN$3,000, including the keel fairing materials. Labor supplied by myself and my wife Wendy (the skipper of *Looney Tunes*, I'm just the crew) came to over 200 hours, not including the occasional stalwart friend who stopped by to help out and the equally dedicated rollover crew.

Nick Bailey has been in the marine service profession for more than 20 years and currently is service manager of Bristol Marine in Mississauga, Ont. He and his wife Wendy Loat own and competitively race Looney Tunes, *a 34-year-old wooden Thunderbird.*

ENGINE TROUBLESHOOTING

WATER PUMP SERVICING

It's good preventative maintenance to replace the water-pump impeller every two years. Follow these 10 easy steps to a cool running engine.

By Jan Mundy

TOOLS & MATERIALS

7/16, 1/2, 9/16 and 5/8 sockets
1/2 and 5/8 wrench
Slot screwdriver
Water-pump gasket
Petroleum jelly
Waterproof grease
Heat gun
Cable ties

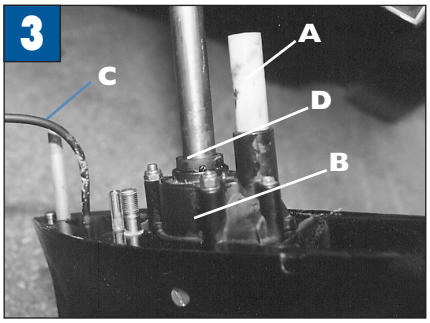
Have you changed your water-pump impeller lately? There's no way to tell if it needs replacing before your engine either overheats, water stops coming out of the exhaust overboard (telltale "peehole") or exhaust relief holes (on older engines). If your boat is equipped with a water pressure gauge (for complete installation instructions see "Cool Running," DIY 1997-#1) then you need not worry. Boats rarely come factory-equipped with a water-pressure gauge, yet it's arguably one of two must-have outboard gauges (the other is a tachometer). Without a water pressure gauge, changing the impeller every two years is cheap insurance against an overheating engine.

Before replacing the impeller, check that you don't have a blocked water intake, clogged overboard or plugged powerhead passages on the discharge side of the engine (caused by hard water or salt build-up). To clear a blocked discharge line, ream out the discharge orifice with a stiff length of wire (a straightened paper clip works great).

The following procedures apply to Mercury or Mariner V-6 outboards as performed by Rick Frank, co-owner of Barrick Marine (416/798-8411) in Etobicoke, Ont., and who specializes in servicing all makes of outboards and stern drives. Guidelines for replacing impellers on other brands are included but you'll need to follow the instructions carefully in your service manual for your specific engine. Replacing the impeller is not difficult and takes about two hours if it's your first time, an hour if done by a pro (about a $100 flat fee) or longer if your outdrive has a hydrofoil or trolling plates. To prevent any accidental starting of the engine, make sure the key switch is in the OFF position or remove battery leads, and disconnect spark plug leads.

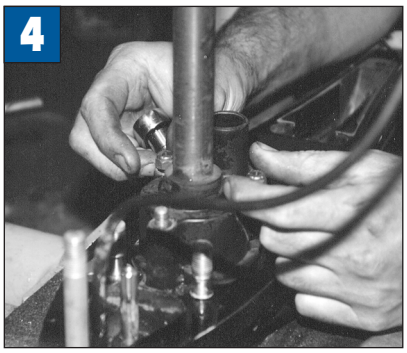
1 Pry off the plastic plug above the trim tab and remove the fastener holding the tab. Before removing, scribe a mark (or use correction fluid) on the anti-ventilation plate and trim tab to ensure proper reassembly positioning.

2 Holding the gearcase (lower unit), slightly loosen the six lock nuts, alternately and equally. Disconnect the speedometer hose and cut wire ties holding it to housing; if you can't remove the hose, use a heat gun or cut it if there's enough length. Hold the lower unit firmly and remove the nuts and washers. Carefully separate the housings, pulling straight down so you don't bend the drive shaft. On Evinrude and Johnson (except on late models) engines it's necessary to disconnect the shift rod prior to dropping the lower unit. Suzuki and Yamaha engines are released at the powerhead. Check your service manual for correct procedures.

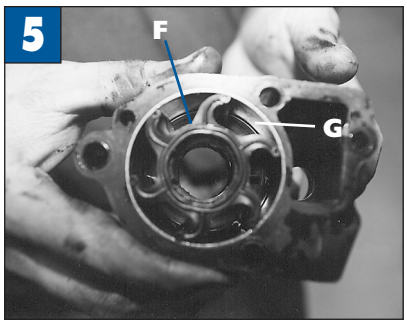


3 Inside the lower unit, you'll find

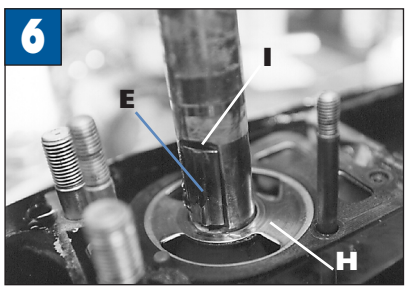
the water guide tube (**A**), water pump body (**B**), speedometer hose (**C**) and centrifugal slinger (**D**). If you don't see the guide tube, it's stuck in the drive shaft housing and must be pulled out, otherwise you cannot reinstall the lower unit.



4 Clamp the lower unit in a bench vise or use C-clamps, placing some soft wooden blocks between the jaws and the anti-ventilation plate so you don't mar the matting surface. Remove the water tube guide. Remove the O-ring on the base of the drive shaft splines. Loosen the slinger and slide it over the drive shaft. Remove the four lock nuts that retain the water pump body. Lift off the body — insert slot screwdrivers in pry slots found on some units in the front and back of the body — then slide the body over end of shaft. Remove impeller drive key (**E**) and gasket.



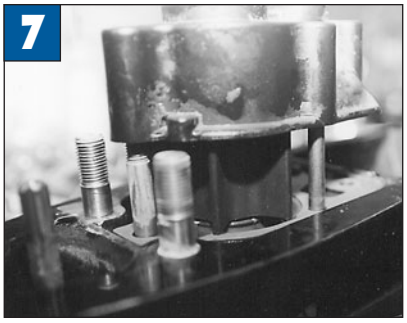
5 The impeller (**F**) will likely come off with the pump body. Before removing, make a note of the rotation of the impeller vanes or check your service manual. Inspect the impeller — if any vanes are broken you'll need to locate and remove them as they will block water circulation. Examine the inside surface of the pump body (**G**) for scoring caused by overheating and replace if badly damaged. Note: firing an engine for even a few seconds without water can score the water pump and damage the impeller.



6 Inspect the impeller plate (**H**). If it's scored or grooved, it must be replaced and you'll need to purchase a water pump kit from your dealer. To reassemble, use some petroleum jelly (Vaseline) to hold impeller key in the shaft slot (**I**). Install a new gasket (not

ENGINE TROUBLESHOOTING

necessary, but might as well). Coat both sides and vane tips of the new impeller and the inside of the pump body with Vaseline to protect the impeller on initial start-up.



7 Lift the impeller over the shaft, aligned with drive key, making sure it stays in place. Slide pump housing over drive shaft. Push downward on the water pump body, while turning the drive shaft slowly clockwise (looking down on the lower unit) so the impeller vanes assume the proper position inside the pump body and the pump body is seated on the impeller plate.

8 Coat the bolt threads with sealer (i.e. 1000 Sealer) and tighten nuts until snug. Be careful not to over tighten

and check manual for torque. Apply Vaseline around the inside of the water guide tube and insert in the hole in the pump body. Slide the slinger down the drive shaft onto the pump collar and tighten. Clean the drive shaft splines and apply waterproof grease (use grease recommended in your service manual). Don't grease the top of the drive shaft — tolerances are critical and added grease increases length of the shaft or can exert downward pressure and damage the gear set. Reinstall the O-ring on the base of the splines.

9 To reinstall the gearcase to the drive shaft housing, first check your service manual for the proper gear positioning. Although Mercury recommends reinstalling the housings in forward gear, Rick prefers placing both the throttle and drive shaft in neutral. Align the water guide tube and the upper and lower drive shaft splines. Check that everything lines up before sliding the lower unit up into position. This can be tricky and a second pair of hands is a big help. Thread the speedometer hose through the housing. Now, slide the lower unit into place. Don't force it. If the housings won't slide together easily, something is misaligned. You may have to turn the drive shaft to align the splines or the shift rod may have dropped. On engines with a threaded shift rod, the height adjustment is critical. If you turned the rod while changing the impeller, check your service manual for the correct measurement. It's unlikely the housings will go together the first time. It may take two or more tries before getting everything in alignment. Coat bolt threads with sealing compound to prevent corrosion and attach lock nuts. Tighten bolts alternately and equally to the correct torque as specified in your service manual. Reinstall trim tab, then install plastic plug. Reattach the speedometer hose, heating the end if needed so it slides on easier, and use cable ties to attach it to the housing.

10 Attach flush ears or reinstall the propeller and launch your boat, then run the engine, letting it idle for five minutes. Check water flow at the exhaust, looking for a steady stream of water out the telltale "peehole."

POWERBOAT RIGGING

REPOWER WITH AN OUTBOARD BRACKET

When it comes time to repower, you can easily retrofit a bracket-mounted outboard and significantly enhance boat handling, performance and safety.

By Jan Mundy

TOOLS & MATERIALS

Large carpenter's square
1.8m (6') straight edge
Wax pencil & putty knife
2" masking tape
Drill & bits
Center punch
Socket set & wrenches
Polyurethane sealant
Solvent & rags
Stainless steel bolts, lock nuts & washers
Backing plates

Repowering a boat rather than purchasing a new one is a viable option for many owners of older boats. One solution is to replace an "expired" transom-mounted outboard, stern drive, Sea Drive or an outboard on a non-flotation bracket with an outboard mounted on a bracket.

Aside from the obvious advantages an outboard has over other powerplants — no chance of fuel leaking into the bilge and causing an explosion and no openings in the hull that can sink a boat — most boats larger than 6m (20') benefit from moving the engine outside the boat on to a bracket. The engine can be mounted up to 10cm (4") higher than a transom-mounted outboard. Depending on the type of repower application, the increase in speed can range from 5% to as much as 100% in some dual stern-drive replacements. The setback of the engine bracket places the outboard 61cm (2') or more behind the transom. The extra cockpit space gained from eliminating the motor well is an added advantage, especially in center console boats. And retrofitting a boat with a bracket allows you to completely seal the transom against swamping in a following sea.

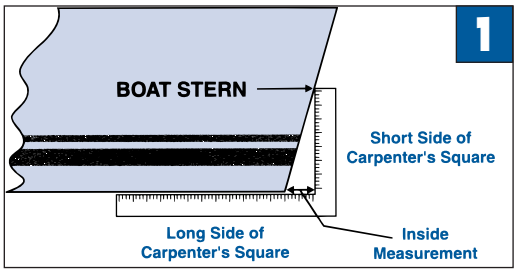
Selection & Options

Today's high-tech brackets are constructed of marine grade aluminum or fiberglass and have flotation chambers. Some have vee-shaped bottoms that bring the bottom of the bracket closer to the bottom of the boat, increasing lift and planing surface. Options include swim platform, boarding ladder, kicker bracket and choice of color.

When ordering your bracket, the manufacturer will need to know the shape and angle of the transom (**Figure 1**), horsepower and model of the original engine (to determine amount of buoyancy), and the new engine plus the shaft length. Mounting options vary with each boat and the bracket manufacturer can help design the proper setup.

Installation

The best time to install a bracket is when you're repowering because you'll save money on derigging and rerigging the engine(s). Installation is not difficult and starts with removal of the existing engine, cleaning up and plugging the old engine holes (stern drives and Sea Drives), filling in the notched transom (outboards), fitting and mounting the bracket and remounting and rigging the engine(s).



To measure the transom angle, place a large carpenter's square with the long side under the keel. When the short side comes in contact with the transom, measure the distance between the inside corner of the square and the transom. Hold the square perfectly straight fore and aft. Each 6mm (1/4") is equal to 1° in transom angle.

Plan on five to eight hours to do the job, not including any structural or cosmetic fiberglass work or rigging of engine(s). These tasks should be handled by competent professionals if you have any doubts.

The procedures below provide general guidelines to mount an Armstrong bracket on a Sea Vee runabout with a single, V6 engine with a 63.5cm (25") shaft as performed by John Greviskis and Matt Barkley of *Ship Shape TV*. Refer to the instructions included with your bracket for complete installation details.

Clean the engine compartment then fiberglass the transom (if needed) using the normal structural fiberglass procedures (**Figure 2**). The transom must be solid and at least 5cm (2") thick. If structural integrity of the transom is suspect, consult a professional. Remove wiring, hydraulic cables, pumps, hoses and any other equipment that could interfere with the installation.

The proper mounting height of the bracket is determined by the position of the engine anti-ventilation plate in relationship to the bottom of the hull. Considering that water rises 2.54cm (1") for every 30.4cm (12") the engine is moved aft of the transom, a standard bracket with a 76cm (30") setback would require mounting the engine so the anti-ventilation plate is 63mm (2-1/2") above the keel.

Mark a vertical line with a wax pencil from keel to gunwale in the center of the transom. This line is the

ARMSTRONG NAUTICAL PRODUCTS

Motor well is filled in with marine-grade plywood encapsulated in layers of fiberglass and resin to build a reinforced panel of at least 5cm (2") thick.

engine center for a single engine application. For a 63.5cm (25″) shaft motor, measure up 58cm (23″) from the keel on the centerline and mark the position. This is the mounting height of the bracket (not the centerline of the holes). Using a square, draw a horizontal line 90° to the vertical engine centerline. Also mark the centerline on the bracket.

Now support the bracket in place against the transom, matching the centerlines. Place a 1.8m (6′) straight edge under the keel, aligned with

Drill pilot holes for bolts, then check for clearance.

your vertical line marking the engine center, so it extends .9m (3′) out from the transom. Measure from the top of the bracket where the engine mounts down to the straight edge. The recommended measurement for this Armstrong bracket is 68.5cm (27″). This lets you adjust the engine so the anti-ventilation plate is positioned 5cm (2″) to 10cm (4″) higher than the boat's keel. Carefully measure and mark the mounting height line (use a level) on the transom with a wax pencil. Before removing the bracket, double-check your measurement and mark the two outside bolt holes.

Drill the outside holes with a 8mm (5/16″) bit (**Figure 3**), then check

Transom prepped with wide masking tape, tab cylinders and thru-hulls covered, and bolt holes drilled.

inside the boat for any obstructions. If all is clear, drill the holes using a bit that is 1.5mm (1/16″) bigger than the bolt diameter. As a safeguard, you may want to mark and drill the second hole down from the top edge; if you need to lower the bracket, the holes won't be exposed. Ventilate the bilge and make sure it's free of gas fumes before drilling.

Lift the bracket into place, insert bolts, attach "work" nuts (non-locking) and hand tighten. Check the fit and make sure the top of the bracket is parallel to your marked line. Now mark the remaining bolt holes on the transom. Remove the bracket and count the holes on the transom and on the bracket to ensure you haven't missed any. Drill pilot holes for the bolts perpendicular to the transom. Check the transom from inside the hull to ensure you have access to all bolt holes and there are no obstructions. Holes that pass into a stringer require a lag bolt; mark their placement on the outside of the transom with a wax pencil. Make sure you have clearance for backing plates and trim if needed.

Dry-fit the bracket again. Apply 5cm (2″) masking tape to the transom, 3mm (1/8″) above the outside edges of the bracket (**Figure 4**). Remove the bracket and tape the top surfaces. Finish drilling all bolt holes. Protect trim tab cylinders and thru-hulls from spilled sealant with tape or plastic.

Apply polyurethane adhesive sealant (i.e. 3M 5200) to the transom, the mounting face of the bracket, around all fastener holes (**Figure 5**) and inside each drilled hole on the transom. Assemble the bolts: slide on a stainless steel washer and coat the

ARMSTRONG NAUTICAL PRODUCTS

3M 5200 is applied liberally to the mounting face of the bracket and around all fastener holes.

mounting face of the washers, backing plates and shaft with sealant. Spread anti-seize compound (Tef-Gel) on fastener threads to prevent galling.

Bolt the bracket to the transom. Tighten the bolts, beginning at the center of the bracket and working outward. Tighten all bolts a second time. Run a bead of sealant around the perimeter of the bracket and remove excess sealant. Remove masking tape immediately and clean up any spilled sealant with mineral spirits. Your bracket is now ready for mounting of the engine.

Be sure to seal the engine bolt holes with sealant when mounting the engine. Install your engine in the second hole from the top. Double-check the location of the plate and adjust engine height if necessary. Use a flexible rigging tube to route the cables and wiring harness from the transom to the engine (**Figure 6**).

On-Water Check

Launch the boat, run at full speed with the engine trimmed for the conditions and check the anti-ventilation plate — the leading edge must be just on top of the water. If the plate is submerged, the engine should be raised. When there is excessive water spraying off the front of the engine, the motor is too low. If the prop cavitates in a tight turn or rough sea with the motor trimmed normal, it's too high.

Ready to launch, the bracket gives new life to an older boat.

INSTALLATION COST

The following shows the typical cost to install a standard aluminum bracket on a 6.6m (22') boat with a single V6 outboard. Prices listed are in U.S. dollars.

Materials

Bracket	$990
12 3/8" stainless steel bolts, lock nuts, backing plates, washers	$100
3M 5200 sealant	$13
Rigging Tube Kit	$30

Options

Swim platform, 48"	$360
Ladder, stainless steel	$260
Kicker engine bracket	$100

Labor (professional)

Derigging	$250
Bracket installation	$500
Rigging	$250

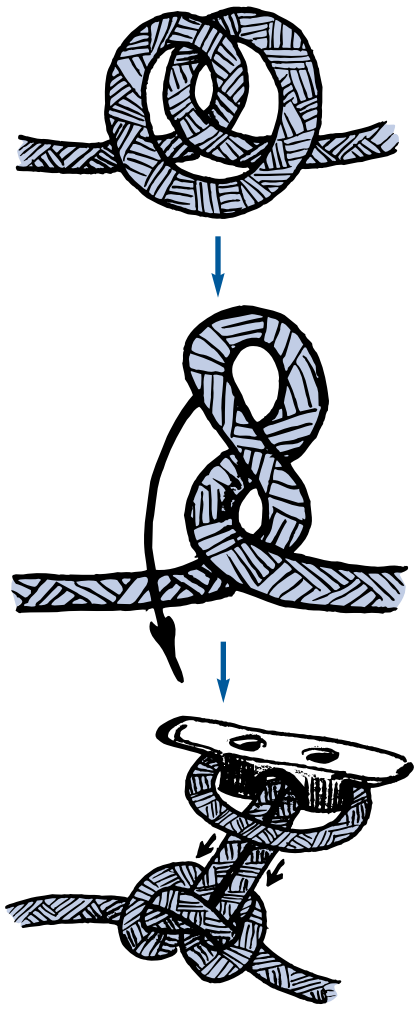
DIY PROJECTS

TWO-WAY DOCK LINES

Make a single dock line to replace two bow or spring lines.

By Jan Mundy

Many boats have undersized deck cleats with insufficient depth to hold two dock lines. A two-way dock line has a loop in the center that fits over a single bow or amidships cleat.



ANNE-MARIE HENDRY

Figure 1

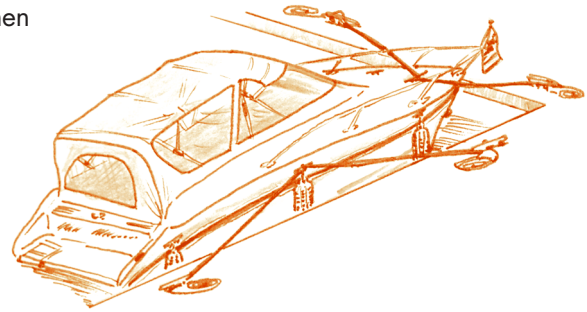
A butterfly knot forms a loop in the center of a line.

Either end of the line is then secured to separate dock cleats.

To calculate the length of your two-way bow line, multiply the boat's beam by three; for a spring line, multiply the boat's overall length by 1.5. Lines are made of three-strand nylon or braided nylon, which is a better choice as it's easier to handle and won't kink. Use 9mm (3/8″) diameter line for boats under 7.8m (26′), 12mm (1/2″) line for boats up to 10.5m (35′), and 16mm (5/8″) line for larger boats. These diameters are guidelines only. Actual sizing depends on your type of boat, water conditions where you dock and your comfort level (I prefer large lines).

There are two methods to forming a loop in the center of the line: tie a butterfly knot or make an in-line eye splice. The butterfly knot (**Figure 1**) is easy to make and it won't slip or jam. Hold the line at the midpoint in one hand and grab the two lines with the other hand 25cm (10″) away for a 20cm (8″) loop. For a 25cm (10″) loop, the distance away would be 30.4cm (12″). Twist the line clockwise 360° at the midpoint. At the bottom of the eye, fold the top line over the bottom one to make a second loop. While holding the bottom of the eye, pass the midpoint over the top, then up through the center of both loops. Pull both sides of the loop tight and smooth the lines so they lay flat.

To make an in-line eye splice in braided line, use a Brummel splice (**Figure 2**). Measure where you want the eye from the midpoint and



insert your fid through the line. You'll need a fid that's two sizes larger than the normal splicing size. Tape one end of the dock line, insert into the fid and push the fid and line through the opening. Pull on the line to form the desired loop size. Insert the fid through the line just pulled through, about 12mm (1/2″) from the bottom of the formed eye. Insert the other line into the fid and push it through. Pull the line tightly to lock the splice.

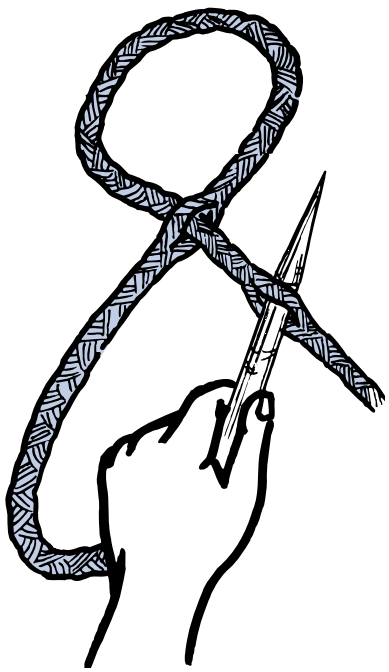


Figure 2

The Brummel splice for making an in-line eye splice.

THE ART OF Topside Painting

Time to paint your boat's topsides or deck? Here's how to get professional results everytime.

WHAT YOU NEED

Paint
Primer
Roller and foam roller refills
Paint brushes
Paint tray
Paint strainers
Cloth wiping rags
Tack rags
Stir sticks
Masking tape
Fairing compound
Solvent for cleaning brushes
Solvent for thinning paint
Additives for paint (non-skid, flattening agent)
Gloves
Respirator with charcoal filters
Goggles
Dust masks
Paint suit
Well-ventilated area
Power random sander with 6" or 8" foam pad
Sandpaper, 120 to 140 grit
Sanding blocks
Extension cord
Putty knife
Hammer
Opener for paint cans
Batten for marking waterline
Plastic drop sheets (to protect non-painted areas)
Scaffolding

Polyurethane paints produce a superior gloss and extremely durable finish.

By Paul Noack

When sanding, compounding, using a color restorer, then waxing or polishing fails to restore the color and gloss of your boat's topsides, consider applying paint. Painting your boat's topsides will greatly increase its appearance and value. With quality paint and the proper techniques, you can easily achieve a professional-looking finish.

Painting a boat is time consuming but it has to be one of the most gratifying jobs you'll do on your boat. It's like washing your car by hand — you will know where all the imperfections are but when you step back you won't see them.

Yacht Paint Development

Historically, boat owners have always sought the perfect topside finish, desiring color brilliance, gloss and durability. For many years, pigmented varnishes were the only enamels available. They were relatively easy to apply and required no professional knowledge. However, they were limited in gloss and durability.

Alkyd enamels came next. These offered longer-lasting protection but lacked the desired ease of application and gloss. These paints were then modified with silicone and/or polyurethane, which offered better water resistance and shorter drying time, but sacrificed gloss and color retention. They were also difficult to apply.

To overcome some of these drawbacks, two-part polyurethanes were developed. Composed of a

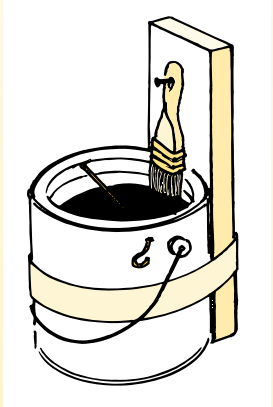
THE ART OF Topside Painting

base and reactor, when mixed, the result is a chemically-cured paint film with superior gloss, keener color and an extremely durable finish. Most recently, single-part polyurethane technology has evolved to produce superior gloss and lasting performance that's similar to two-part polyurethanes but with the application ease of conventional enamel. Today's technology offers you a choice of both one- and two-part polyurethanes.

Single-part paints will last three to seven years and two-part paints between five to nine years. The longevity of the paint depends on where your boat is kept: the finish on boats in southern climates where the sun is more intense will not last as long as those finishes in northern regions.

TIPS — BRUSH TEST

Nail a finishing nail to one end of a strip of wood and using an elastic band attach it to a can of brush cleaner. Hang the brush on the nail and adjust the wood so the brush hangs in the cleaner without resting on the bottom.



ANNE-MARIE HENDRY

Materials

TWO-PART POLYURETHANE PAINTS (i.e. Awl Grip, Interlux Interthane Plus, Interspray, Sterling) would be an excellent choice for topsides, decks, aluminum masts or any area above the waterline where a durable, high-gloss or abrasion-resistant finish is required. Two-part polyurethane is the finest all-around coating that can be applied by brush and roller, but it can also be sprayed with the proper safety equipment. Two-part polyurethanes must be thinned out quite dramatically with the manufacturer's specified thinner. It's important never to mix different manufacturer's products. Two-part paints should never be put over single-part paints or primers as the solvents will attack the single-part paint causing poor adhesion.

SINGLE-PART POLYURETHANES (i.e. Interlux Brightside, Pettit Easypoxy, Sikkens Polyester Yacht Paint) have built-in self-leveling characteristics as well as incredible abrasion and chemical resistance. Some manufacturers are also adding Teflon for better dirt and abrasion resistance. These paints are the most popular paint for the first-time user.

ALKYD-BASED ENAMELS (i.e. Interlux Yacht Enamel, Pettit Shipendec, Sikkens Super Gloss) have been around for more than 40 years and have a loyal following with wooden-boat owners. These paints tend to go on thicker than polyurethanes, have great hiding attributes and last about three to five years.

THINNERS are added in order to get proper flow of the paint. Paint manufacturers will have a suggested thinner based on the paint you are using and whether you are brushing and rolling or spraying the paint. The amount of thinner needed varies between 5% to 55% and

TIPS — COMPATIBILITY TEST

With any refinishing product, it's a good idea to do a test patch before tackling the entire hull. This lets you ensure the hull is correctly prepared, perfects your application technique and checks drying times and coverage. Select a less conspicuous area, such as under the transom for your test.

it's wise not to stray away from the manufacturer's suggested quantity.

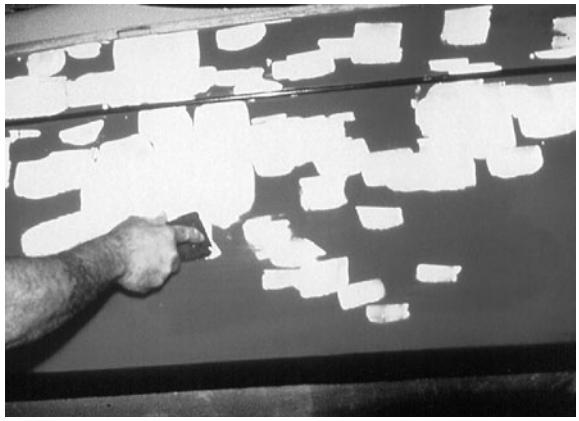
Safety

Polyurethane paints contain isocyanates, which contain VOCs (Volatile Organic Compounds), and I cannot stress enough how important it is to wear the proper safety items. These include thick rubber gloves, goggles, safety glasses or other eye protection, long sleeve shirt and pants (tape the cuffs) and a respirator rated for toxic fumes (see "The Air You Breathe"), and when spraying, a vapor-tight suit and use supplied air — check the laws regarding VOCs for your part of the country.

Always read the precautionary statements on the container labels before using. Work in a well-ventilated area and observe all warnings. Solvents contain hazardous chemicals that can be absorbed through your skin so use them only in painting, not for washing your hands.

Surface Preparation

Painting a boat is not difficult. By purchasing quality marine paints from well-known companies, you are



INTERLUX

After dewaxing, dents and gouges are filled with a fairing compound.

assured of great results as long as you follow the manufacturer's instructions. Some companies supply a Boater's Painting Guide free of charge.

Topside paints should never be used on parts of the boat which will be submersed in water for long periods of time; the paint will blister if this happens. It's best to divide your boat into two parts: above the waterline, which this article deals with, and below the waterline.

Topside paints can be used on any surface (wood, metal, epoxy, gelcoat) as long as the surface is prepared properly. It's said that preparation is 99% of a successful job, and it's true. Before you start, it will help to build a scaffold around your boat to ensure easy access to the boat and to allow you to apply the paint without any interruptions or delays.

If your boat has previously been painted and you are unsure if it was done with a two-part or single-part paint, use a single-part. Two-part paints are not compatible with single-part paints.

The first step is to wipe down the surface with a dewaxer (i.e. Interlux 202 Solvent Wash, Pettit 15095, Sikkens M600). Don't substitute a dewaxer with acetone as it flashes too quickly and does not remove all the surface contaminants. Apply the dewaxer using the two-rag method: one rag to apply and one rag to remove. You'll need plenty of clean rags and change your rag often. Wiping a 61cm (2') section at a time is suggested. Fill any dents or gouges with a fairing compound.

The next step is to sand the entire surface with 120 to 180 grit sandpaper, depending on the hardness of the surface. When powersanding, a variable-speed, random-orbital sander with a circular foam pad works best. Hold the sander perfectly flush on the surface or you'll create dips and swirl marks. Avoid the temptation of tilting the sander from the flat position when sanding areas where filler was used.

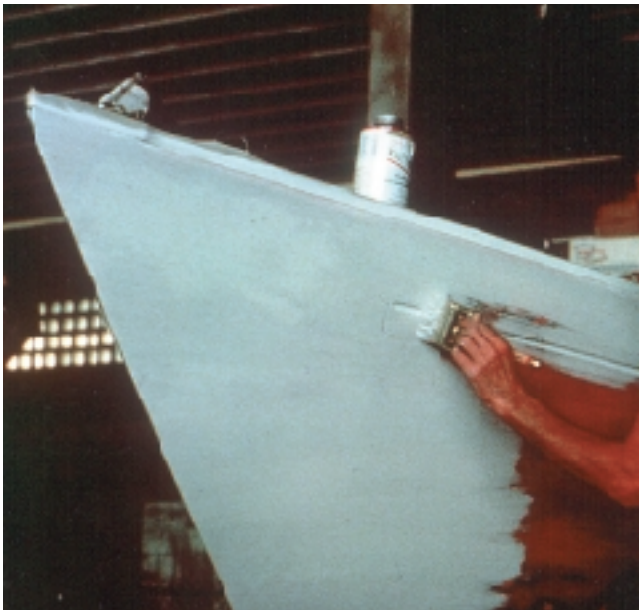
When handsanding, always use a sanding block (rigid or foam) to ensure that you don't add any dips in the surface that may appear in the finished surface. Remember, you are sanding to rough up the surface so the primer will have something to adhere to. Wipe off the sanding residue with a solvent (use your dewaxer for this). Mask off the waterline and gunwale with 3M Long Mask or other solvent-resistant tape. Be sure not to touch the surface

Ready-made drop cloth: 3M Marine's Ready-Mask pre-taped plastic film unfolds to cover surfaces when painting. Specially treated, this film clings to surfaces and is pre-taped with 3M masking tape or Long-Mask.

COMMON PAINT FAILURES - CAUSES AND SOLUTIONS

PROBLEM	CAUSE	SOLUTION
PAINT PEELS OR FLAKES	Surface has not been cleaned and degreased properly. Not sanded or sanded insufficiently. Applied to a wet surface.	Incompatible products in the system. Remove loose paint, clean and degrease. Sand, clean and apply a new coat following instructions.
STRIPING (BRUSH MARKS)	Poor-quality brush. Temperature too high or too low. Paint applied too thin.	Sand smooth and apply a fresh coat with a suitable brush at the recommended working temperature and paint consistency.
FISH EYES	Substrate is contaminated with silicones or oil.	Degrease and clean, then sand with abrasive paper until the contaminated surface can be degreased again. Allow to dry thoroughly and apply a fresh coat.
LOSS OF GLOSS (CHALKING)	Poorly mixed paint. Use of wrong cleaners and polishes. Long-term exposure to UV radiation.	Clean and degrease, sand and clean with abrasive paper, then apply a fresh coat using thoroughly mixed paint. Keep the finish clean with mild, non-scouring cleaning agents. Wash down thoroughly.
ORANGE PEEL EFFECT	Paint applied with an unsuitable roller (i.e. lambswool). Too little thinner, too high a wind or too low a temperature. Paint begins to set before it's smoothed (rolling only).	If rolled and tipped: if the paint hasn't set, smooth with a good brush. If sprayed: incorrect pressure or spraying distance and/or thinner, premature recoating. In all other cases: sand smooth and apply a fresh coat following the instructions.
SAGS AND RUNS	The paint has been applied too thick or has been thinned too much.	Sand off sags and runs and after cleaning, apply a fresh coat following instructions.
WRINKLING	Paint is too thick or has been applied in direct sunlight. Solvent has been trapped.	If the paint is not yet dry, scrape it off and clean with thinner. If the paint is already dry, sand it down well and clean, then apply a fresh coat.
CRACKING	Sudden drop in temperature during working or drying. Incompatible systems: hard over soft layer, two-part over one-part.	Remove coat of paint completely, clean surface and apply a fresh coat. Do a patch test to ensure compatibility.
PAINT WILL NOT DRY	Temperature of hull or surrounding atmosphere is too low. Insufficient ventilation. Premature recoating. Wrong thinner. Wrong mixing ratio in the case of two-part paint.	Improve drying conditions (temperature, ventilation). If the paint is not yet dry then remove the whole coat and, after cleaning and sanding, apply a fresh coat.
PAINT NOT HIDING, SEEMS TRANSPARENT	Paint thinned too much. Not enough coats.	Put on more coats. Check the paint can label for recommended coverage.
PAINT SETS BEFORE TIPPING	Person rolling is getting too far ahead of person tipping. Painting in direct sun. Temperature is too hot to paint.	Let paint dry, sand with 220 grit paper and apply another coat.

after cleaning or you'll spread contaminants that can affect the cure. Now, spray the floor with water to minimize flying dust particles and change into clean clothes. You're ready to paint.



A primer is applied before painting to smooth the surface and improve adhesion.

Priming

Gelcoat becomes porous over time therefore, it's a good idea to prime the surface before you paint. If you're going to use a two-part polyurethane you'll need a two-part primer. Primer is used to smooth out the surface as well as improve adhesion of the finish coat. If you have a wood or metal boat, primers will provide protection against corrosion and water penetration. If the surface is in good condition, priming isn't always necessary. But, I always recommend primer as painting your boat is not something you do very often, so do it right the first time.

After applying the primer coat, sand the surface with 280 to 320 grit sandpaper. Then wipe the surface with solvent recommended by the manufacturer. Before painting, lightly rub the surface with a tack cloth to remove any dust. Don't press too firmly with the tack cloth as you don't want any of the cloth's residue coming off and causing fish eyes in the finish.

Applying The Finish Coat

The most popular way to paint a boat is manually, with roller and brush. The paint is first applied with a foam roller then "tipped" with a brush to smooth out the wrinkles and remove the bubbles. The roller should be a low-nap foam roller with a solvent-resistant core (very important), no

THE ART OF Topside Painting

wider than 22.8cm (9"). The type of brush depends on the user — some people prefer a foam brush but I prefer a high-quality bristle brush — and should be no wider than 7.6cm (3"). If your brush is new, firmly flip the bristles several times before dipping into the paint. This will dislodge loose bristles and dust.

After mixing the paint don't put all the paint into the paint tray. This will make it easier for you to move around; keeping the unused paint in the can will also keep the solvents from evaporating and causing the paint to thicken. Start at the stern and work your way around the boat. This will give you a clean corner when you finish. Begin painting at the toerail and work your way down to the waterline, working in 91cm (3') vertical sections.

Two people are needed for "rolling and tipping." One person applies the paint with the roller and another person follows with a brush smoothing out the paint. Wet the brush with the paint before you start, wiping out the excess, to produce an even coat. Apply very light pressure and move the brush in even strokes, spreading the paint and leaving a thin film with no ridges or light areas. It's important that the "roller" doesn't get too far ahead of the "tipper," generally no further than .9m (3'), as you want to keep a wet edge at all times. Roll and tip the paint in opposite directions; for example, if rolling the paint on vertically, then tipping is done horizontally.

For the best results practice your technique on a smooth piece of wood or fiberglass before tackling the hull. These paints dry quickly so keep the working area small and work quickly to maintain a wet edge. Once the paint begins to set you won't be able to touch it up without marring the finish. Add thinner as needed (check the manufacturer's specs) to get a good flow out and don't apply the paint too thick.

Let the paint dry, come back the next day and sand the area with 280 to 320 grit sandpaper and repeat the process two to three times. The number of coats will depend on the amount of coverage you get. If it looks good after two coats, then stop. Some colors (i.e. red and yellow) don't cover as well as others and may require additional coats.

TIPS TO MAKE PAINTING EASIER

- Soak natural bristle brushes in linseed oil to renew brushes.
- After dewaxing, spray the boat with a mist of water. If water beads up, dewax again.
- Use good quality masking tape (i.e. 3M Long Mask) when taping areas you are not painting. The solvents in the paint will lift economy-priced tapes.
- Keep a paint log which consists of the primer and paint used, thinner and percentage used, temperature and humidity. It's also a good idea to record the batch number of the paint.
- Before sanding a primer, put on a mist coat of paint from an aerosol can. This will act as a guide coat when sanding.
- Don't paint in the same clothes you sanded in. Keep dust to a minimum.
- Paint a small section to check the compatibility of the paint and primer on an old surface.
- It's recommended that you strain your paint before putting your paint into a paint tray or spray gun.
- Line a paint tray with aluminum foil or use a disposable tray liner to keep the tray in like-new condition.
- Use a quality natural bristle brush (often labeled "china bristle") with tapered, fine bristles. Always buy the best brush you can afford.
- Watch the weather. A slightly overcast day when the temperature is about 18°C (65°F) with low humidity is ideal.
- Use a finishing nail and punch small holes in the rim of the can so any excess paint drains neatly back into the can.
- Do not shrinkwrap a painted boat as any moisture trapped between the plastic and the paint will be absorbed into the paint, causing the paint to blister.
- Rub a little vegetable oil or petroleum jelly on thru-hulls and hardware before painting. You'll be able to easily wipe off any splatters or drips later.
- Allow enough time for the previous coats to dry before recoating.
- To renew aging and dull paint, apply a coat of wax. This delays the painting process, but sooner or later you'll have to recoat.

THE AIR YOU BREATHE

Respirators are cheap insurance against exposure to potentially harmful substances. Effective this year, the new NIOSH/MSHA approval rating for respirators is 42 CFR 84, an industry standard that grades the contaminants and concentration levels to which the worker is exposed. We contacted 3M Marine's tech department to learn how the ratings relate to respirators boaters need to wear.

When sanding gelcoat, fiberglass, wood or epoxy, proper protection requires a N95 respirator (3M Marine 8210 Dust/Mist respirator, for example). Applying bottom paints, two-part epoxies or one-part polyurethane paints, whether by brush, roller or spray, demands a more heavy-duty respirator, such as 3M Marine's 6000 series respirators with 6001 cartridges, 5n11 filters and 501 retainer (about $30 for the set). (On page 33, DIY editor Jan Mundy wears the proper sanding headgear.) Equipped with two charcoal cartridges, the 6000 filters out potentially cancer-causing contaminants except isocyanates — two-part polyurethane paints contain isocyanates. Inhaling isocyanates can be fatal and affects everyone differently. If sensitized, conditions vary from flu-like symptoms, to permanent damage to the respiratory system to death by suffocation. You can't smell or taste isocyanates until well above safe exposure levels. According to 3M, acceptable levels of isocyanates is .02 parts per million and not until levels reach 500 parts per million can you smell this substance (a sweet smell). Two-part polyurethane paints contain less than .5 parts per million, depending on the brand (one-part polyurethanes contain no free isocyanates). Regulations impose the use of supplied air only (a respirator isn't adequate) with products containing isocyanates. This is dangerous stuff. If the product you're buying fails to indicate respirator usage on the label, ask your dealer for assistance.

When wearing a respirator, fit is important to insure maximum protection. Wearing a respirator over beards and facial stubble will adversely affect the fit and render it totally ineffective against toxic dust or vapors. All respirators restrict oxygen intake so sufferers from asthma, bronchitis or heart trouble are advised not to undertake projects requiring them to be worn. It's wise to take a "fresh air" break every 20 to 30 minutes.

Respirators with self-contained filters must be replaced frequently to ensure maximum oxygen flow and protection. If you smell the product you're using when wearing a respirator, it (or the filters) needs replacing or it's not working correctly (adjust fit or replace filters).

When painting a deck you'll need to add non-skid to the paint. Don't forget to add a flattening agent to the paint if you want a semi-gloss or a flat finish.

If you have never sprayed paint before it's not recommended that you learn by doing your boat. Do a smaller project first (a dinghy). Spraying a boat takes a lot less time than rolling and tipping but there's more room for error if it's not done properly. Make sure there aren't any contaminates in the system (drain compressor, clean gun, etc.). It's a good idea to run solvent through the gun if it hasn't been used in a while to ensure the gun is in running order (better to find out before you mix up your paint).

I prefer a conventional spray gun, but in some areas HVLP (High Volume Low Pressure) guns are mandatory as local and state governments change their clean air laws. It's best to purchase a new gun as opposed to renting a gun which may

THE ART OF Topside Painting

Rolling and tipping: The paint is first applied vertically with a foam roller then "tipped" by brushing in the opposite direction. The painters in this photo are not wearing the proper safety attire.

have been used for material that may contaminate paint and may not have been cleaned properly. Always clean your gun as soon as you're finished painting. A gun that has not been cleaned properly can ruin a paint job. Follow the manufacturer's tip size when spraying primers and paints.

Thinners and the amount used for spraying are different from those used for rolling. The viscosity of the mixed paint is very important and for the best results a #2 Zahn cup should be used to measure the viscosity. Paint manufacturers will usually give a desired time but generally 16 to 18 seconds gives you a good viscosity. Spray a board and set up your gun and spray pattern before you start.

When using two-part paints you don't have to sand between coats if you follow the overcoat times recommended by the manufacturer, generally, 8 to 16 hours when rolling and 30 minutes to 48 hours when spraying.

If at the end of the painting process you have a heavy orange peel (paint too thick or not enough thinner), or you have runs in the paint (too much paint), you can fix these imperfections by wet sanding the paint with a 1200 to 1500 grit paper (don't forget the sanding block). Apply 3M Finesse It II with a buffer and then buff on a coat of 3M Hand Glaze. Remember, you are taking paint off the boat in this process and this may affect the longevity of the paint.

Polyurethane paints are affected by temperature and humidity. You should never paint in temperatures lower than 10°C (50°F) or above 35°C (95°F). Radical temperature changes from hot to cold will cause the finish to lose its gloss. Paint in the shade as sunlight causes uneven drying and makes it difficult to maintain a wet edge. It's a good idea to build a barrier around your boat (see "Gimme Shelter" FALL '96) with plastic sheeting so you're not painting in direct sunlight. This will also act as a wind barrier too. Humidity can cause paint to dry quicker and reduce working time. It's best to paint when the humidity is below 65% but this may be impossible if you live in an area with high humidity.

Clean Up

A quality brush is a good investment and with the proper care can last a lifetime. Immediately after use, brush the bristles over a clean surface to remove excess paint, then wipe the brush with a rag. Next, clean the

TIPS

ESTIMATING COVERAGE

Use this handy formula to estimate area of topsides:

(length overall + beam) x (average height of freeboard x 2) = Area

PAINTING ALUMINUM SPARS AND SMALL ALUMINUM BOATS

To prepare an aluminum surface for painting, wipe it clean with a solvent (i.e. Interlux 216, Pettit 12121 or Sikkens CR Thinner). Using a medium-grit emery cloth, roughen the surface to a bright finish. Wipe again with a clean rag moistened with solvent. Fill all dents with a fairing compound. It's important to have the metal a bright color with no oxidization. To prime the surface, apply a thin coat of Interlux 353/354 or Pettit 6455/044, following the manufacturer's thinning recommendations and overcoat times. Apply the first of three coats of your selected paint and allow to dry overnight. Lightly sand in between coats.

TIPS

TIME TO RECOAT?

As a rule it is a good idea to paint your boat every seven to nine years. You will have some kind of guideline by looking at the hull of your boat. If you don't see your reflection or your reflection has very little depth, it's time to paint.

brush in solvent, which will get rid of any paint residue. If necessary, let the brush soak overnight hanging by its handle, not allowing the bristles to touch the bottom of the container (see "Brush Rest"). Afterward, shake out the brush (a brush spinner works best) and soak the brush in soapy water. Rinse thoroughly with fresh water for approximately 10 minutes. Once again shake out the brush and then wrap the bristles with a clean paper towel. Press out the excess water then remove the towel. Make sure all the bristles are straight, if not, use a comb to straighten them. Hang the brush by its handle and let dry. Wrap in butcher's paper and stow in a clean, dry place.

Paint trays can be cleaned with paint thinner and used again. If the paint has dried in the paint tray you can line the tray with aluminum foil and re-use or use a disposable tray liner.

Empty paint and solvent cans can be deposited in recycling containers provided they are clean and do not contain any solution. After using rags soaked with solvent, spread them out to dry or soak in water and stow in a metal container to avoid spontaneous combustion. Old solvent and paint and rags containing solvent, should be properly disposed of according to the regulations for hazardous materials in your area.

If you do a lot of painting, a brush spinner (about $30) is the most effective means to clean brushes. Get a big bucket and spin the brush inside.

If you are spraying, pour leftover paint into a can and dispose of as hazardous material. When cleaning out your spray gun with solvent, spray solvent into an old can and dispose of in a similar manner.

An avid sailor, Paul Noack sails and races his 7.2m (24') Shark on Lake Ontario. He is a sales representative for International Paints Yacht Division, responsible for Central Canada and Upstate New York.

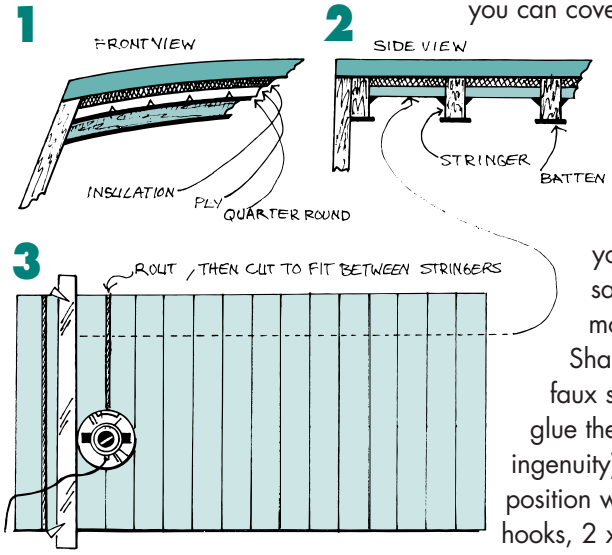
Good Boatkeeping

By David & Zora Aiken

INSULATE THE CABIN CEILING IN STYLE

You can get the benefit of insulation as you add some character to the overhead in the cabin or wheelhouse.

If your boat's overhead already has stringers running athwartships, installation is easiest. Purchase some 6mm- (1/4"-) or 9mm- (3/8"-) thick, dense Styrofoam-type insulation panels or 60.9cm- (2'-) wide roll-up sheets. Cut the pieces with a utility knife to match the spaces between stringers, then tack the pieces in position using an adhesive caulk (first test it on the insulation to be sure it sticks and doesn't melt the Styrofoam).



Purchase a sheet of 6mm (1/4") plywood. With a router, cut a series of groves into the wood at regular 2.54cm or 5cm (1" or 2") intervals, the objective being to create the look of traditional tongue-in-groove (**Figure 1**). Clamp a wood strip in place to keep the router on a straight line. Now cut the wood pieces into the same dimensions as the insulation. Paint the wood panels white or whatever color matches your boat's interior. Hold or wedge the panels up in position, then secure them with strips of quarter-round molding (**Figure 2**) placed along each edge and nailed (or screwed) into the stringers with small finishing nails.

If the stringers already have a bright finish you have the traditional look of wood-grain against white. If the stringers are white, you can cover each stringer with a 3mm (1/8") batten of varnished wood (**Figure 3**).

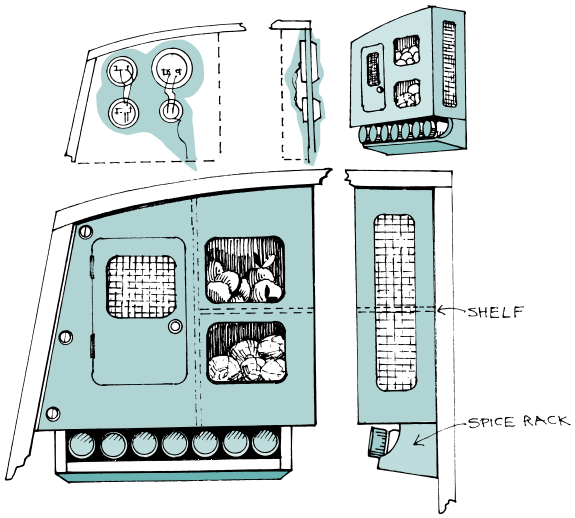
Should your boat have no stringers, you can still achieve the same look, it just takes more work and ingenuity. Shape some wood strips as faux stringers, (the work) and glue them to the overhead, (the ingenuity). Try wedging them into position with mop handles, boat hooks, 2 x 4s or anything else that will keep them tightly up until the glue sets.

Glue some of the tongue-in-groove paneling to the bulkheads to continue the look around the boat.

INSTRUMENT COVER STORAGE LOCKER

Instruments set into the bulkhead between the cabin and cockpit are practical items from the cockpit side but often unsightly dust catchers from the cabin side. You can hide these backsides with a basic round or square cap, or you can build a multi-purpose storage cabinet over and beyond the instrument backs.

Each boat's available space will be different, so each cabinet will be a custom design. In this example, the cabinet is about 12.7cm deep x 50.8cm wide x 45.7cm high (5" x 20" x 18"). It has two, open front shelves that hold produce, cookbooks, or whatever. The door opening section gives access to the instrument backs and wiring, and still has room to store small items like boxed matches, toothpicks, tea bags, etc. The section can be partitioned as necessary so nothing falls against the instruments.



The side panel and door opening have inserts of caning, which are secured to the side of the wood by covering the edges with narrow, wood-strip framing and nailing through the frame. Use U-shaped molding strips painted the same color as the bulkhead to cover the wiring that extends beyond the cabinet.

This cabinet has a spice rack add-on at the bottom, a good way to keep spice bottles away from stove heat or sunlight.

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