SUMMER 1995

DIY boat owner the MARINE MAINTENANCE MAGAZINE

INSIDE

Features

Trailering

Guide to maintaining, servicing and customizing your trailer includes pre-season maintenance, repacking wheel bearings, installing bearing protectors, troubleshooting hydraulic brakes plus some nice-to-have accessories.

Cast-Off

Anchoring signals.

Brightwork

The fine art of varnishing.

DIY Projects

End Mildew, Install a Solar Vent; Fender Boards, Automatic Head Feeder; Chafe Protection

Engine Troubleshooting

Aligning the Prop Shaft; Diesel Valve Kit; Drip-proof Stuffing Box; Troubleshooting Outboards.

Electronics

Help for Ni-cad batteries; Replacing Round Instruments; Getting a Fix on Electronic Repairs; Automatic Co-pilot for Powerboats.

Tuning the Masthead Rig

The complete step-by-step guide to mast tuning.

Powerboat Rigging

Improve handling, acceleration and planing with a hydrofoil.

Mounting Deck Hardware

Techniques for bedding and bonding fittings.

Keeping up the Teak

Protect your teak with an oil or varnish finish.

Refer to DIY 1999 #2 for step-by-step Teak cleaning and refinishing.

Departments

TalkBack
DIY boat owner's Information Exchange

TechTips
Boat-tested tips.

TALKBACK

Mail

Many thanks for all your letters. We love getting mail, either by post or E-mail. Compliments, criticisms or complaints are all equally received.

The following is a sample of what our readers had to say about the premier issue:

Congratulations! I love my DIY boat owner! I was browsing through The Store today and discovered your new magazine. It's just what I've been looking for and to think that it's totally Canadian, eh!
Oren Cole, Colewave, Richmond Hill, Ont.

I am really pleased with the first edition of DIY boat owner to the point where I'am already looking forward to the next issue. It is high time that such a publication oriented to the everyday boat owner reached the market. Keep up the good work.
Marcel Simard, HMCS Okanagan, Halifax, NS.

Congratulations! Your premier edition was an instant success in our home. The articles are informative, easy to read and understand and are designed for all boaters. We have passed your address around our Power & Sail Squadron. DIY was a big hit there as well.
Debbie Armstrong, Elliot Lake, Ont.

DIY INFORMATION EXCHANGE

Working with Plexiglas

I'm planning to make some Plexiglas shelves for my boat. Any tips for working with this stuff?
David Smith, Toronto, Ontario

Plexiglas cuts easily with power tools but hand tools, such as a hacksaw or coping saw do a better job, although they take a little longer. Leave the paper backing in place to prevent scratching the finish until you complete all cutting and drilling. If the paper was removed, cover the work area with paper and hold in place with masking tape. When using a jigsaw, a fine-tooth blade works best. Always cut or drill at a slow speed. If you go too fast, the blade or bit heats up and melts the plastic, leaving a rough edge; use a bastard file to remove the melted acrylic and saw marks. To avoid cracking around the fasteners, drill the screw holes about .8 mm (1/32") larger.

Spare parts for Atomics

Do you know where to shop for a new or rebuilt ignition and alternator for an Atomic 4?
Rodger White, Vancouver, British Columbia

Westerbeke Corp. has marine distributors across North America that carry a full line of replacement parts for Atomic 4 and Atomic Stevedore engines. Contact the company's customer service for a listing of marine distributors at: Avon Industrial Park, Avon, MA 02322; Tel: (508) 588-7700, fax: (508) 559-9323. You can also try your local auto parts store. The Atomic 4 uses GM ignition and charging systems and, apparently, the alternator is a commonly stocked part.

Now that we're on the matter of spare parts, we did some digging and came up with sources for some non-current boat lines. We'll keep looking but here's a few to start:

Tanzer

If you are one of the 8,000 Tanzer owners in North America, chances are you may need a source for replacement parts. Eric Spencer of Yachting Services has

a complete inventory of Tanzer parts for boats built from 1965 to 1986. Spencer was founder and former president of Tanzer, so he's well acquainted with the line. He can be reached at: Yachting Services, Box 1045, Pointe-Claire, PQ H9S 4H9; Tel: (514) 697-6952, Fax: (514) 695-5912. The company also maintains a duty free warehouse in Champlain, New York for U.S. customers.

Thundercraft and Doral

Richard Grenier at Jeanneau Canada (formerly Cadorette Marine) informs us that the company has a few good sources of replacement parts for Thundercraft boats built prior to 1989. As for Doral, there's not much left from pre-1992 models. Contact Grenier at Jeanneau Canada, Box 727, Grand-Mere, PQ G9T 5L4; Tel: (819) 538-0781, Fax: (819) 538-6330.

CS

Holland Marine Products has a vast collection of parts for CS sailboats, from the CS 22 to the 44. Items are not yet cataloged, so you'll need to provide complete specs with your inquiry. Send information to: 3008 Dundas St. W., Toronto, ON M6P 1Z3; Tel: (416) 762-3821, fax: (416) 762-4458.

C&C

The Store in Mississauga, Ontario has an assortment of deck castings, bow tanks, foot blocks and innumerable other odds and sods for C&C sailboats. They don't have an inventory listing, so send the exact part dimension to: 1 Port St. E., Mississauga, ON L5G 4N1; Tel: (905) 278-7005, fax: (905) 278-5758.

FOR THE RECORD

• Bombardier Inc., builders of **Sea-Doo** watercraft, purchased two powerboat builders in April. The companies are AMT Marine in Antoine-de-Tilley, Quebec, builders of all Sea-Doo hulls since they were first introduced in 1992, and powerboat manufacturer, Celebrity Boats of Benton, Illinois. The move more than doubles production of Sea-Doos.

• When French boatbuilder Jeanneau S.A. acquired powerboat manufacturer Cadorette Marine last fall, it was rumored that the company would build Jeanneau sailboats for North America. According to Kevin Zdebiak, director of sales and marketing for **Jeanneau Canada**, the first of five Jeanneau models will debut at the Newport boat show in September. The company plans to build 165 boats this year, beginning with the 28 and 34, then add a 24, 37 and 45. Marketing is handled by the existing Jeanneau sales office, located in New London, Connecticut.

Erratum

You need to make the following corrections in the Spring Issue. In **Spring Fitting Out**, on page 8 under the heading "Stoves," please note that when testing a propane system for leaks, never use a soap that contains ammonia because it deteriorates brass fittings and may cause them to crack. If you're unfamiliar with a soap's makeup, use a commercial leak detector solution. In Dockside on page 41, **Viking Marine's Cat Bags** are distributed in Canada by Intermann Marine Marketing. The company has two locations: #29-1435 Bonhill Rd., Mississauga, ON L5T 1V2; Tel: (905) 670-1177, Fax: (905) 670-7622 and 1660 Powell St., Vancouver, BC V5L 1H4; Tel: (604) 253-4125, Fax: (604) 253-7679.

TECHNICAL HELPLINE

Unable to find information on products or do-it-yourself projects?

TECHNICAL HELPLINE 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!

The cost is FREE to DIY subscribers!

Send your questions today to:
TalkBack, DIY Boat Owner
P.O. Box 22473
Alexandria, VA 22304

Or go to www.diy-boat.com

Include your name, boat name and home port.

TECH TIPS

FUME ALERT: If you have a propane leak that you can smell but can't find, pour a cup of water over the tank valve. Now, look for water droplets in the system. The water follows the gas flow and exits at the leak.

DRAWING CARD: Don't stand near your compass with a knife, keys or other metal objects in your pocket. The tin in the metal positions the boat either farther east or west of your intended course.

KEEP FILTERS DRY: Store diesel fuel filters and other filters with paper elements in waterproof containers or sealed plastic bags placed in a dry locker. The original packaging is no match for bilge water and wet filters will stop the engine dead in the water.

WASHER FIX: In quick need of a washer? Save the plastic caps from large soft drink bottles. When you need a washer, cut to size with an Exacto knife and drill a hole for the fastener. Plastic is a neutral substance and acts as an isolator preventing galvanic action between dissimilar metals (stainless screws on an aluminum mast, for example).

REDUCE EYESTRAIN: Use black nylon or wool telltales on sails. They are more highly visible than the standard orange or red ones.

SNAP-FREE: When snap fasteners won't hold its most likely because of corrosion. Clean both studs and buttons with bronze wool or a 3M Scotch-Brite pad. Let dry and spray with a moisture-displacing lubricant. Lightly pry and wiggle the button spring with an awl or small slot screwdriver for complete saturation of the lubricant.

STAINLESS THAT GLOWS: To remove salt encrusted on stainless steel rails and cleats, mix a solution of alcohol and kerosene and rub on with a soft rag. Refrain from smoking while doing this one.

MORE CAULKING SENSE: In the Spring Issue we told you about using a screw or common nail to prevent caulking cartridges from hardening after use. Well, here's another clever method: thread a cone-shaped, spring-loaded wire connector, such as a Marrette plug, over the nozzle end. Use duct tape to hold it in place, just in case.

NO MORE SQUEAKS: Are squeaking blocks, gooseknecks (boom to mast attachment) or whatever keeping you awake at night? Spray a liberal amount of a moisture-displacing lubricant on any fitting where metal rubs against metal. Pleasant dreams.

BAND-AID ANTENNA: A VHF radio is often your only communication with the outside. In case your whip antenna should break or fail, you should stow a mini antenna in your emergency kit. It measures about a foot in length and screws into the back of the radio. Cost is about $45. Another model comes with a suction cup base and a short length of cable, so you can mount it on top of the cabin.

CHART WATERPROOFING: Preserve your charts with Thompson's Water Seal (yes, the same stuff for waterproofing decks). Apply a generous coating to both sides with a foam brush. Hang on clothes line to dry. Apparently the colors won't run and it doesn't distort the chart before it dries. Do a test on an older chart first, just to be sure.

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

You can also e-mail to info@diy-boat.com

DIY boat owner

BOAT & TRAILERS

A guide to maintaining, servicing & customizing your trailer.

BOAT TRAILERS

PRE-SEASON INSPECTION

A little maintenance goes a long way in preserving the appearance and performance of your trailer. Follow these guidelines to organize your pre-season maintenance.

❏ Check your electrical system. Trace the wiring from the tow vehicle to the taillights and look for bare wires, cracked insulation or corroded terminals. Check that the white ground wire is connected to the trailer frame. Replace all worn or damaged parts. Make sure all trailer, brake and turn signal lights are operating. Replace burned-out or corroded bulbs. Apply a light coating of water-resistant grease, petroleum jelly or moisture-displacing lubricant to all plug prongs, bulb sockets, wire splices and ground connections. This provides a better seal, helps prevent rust and corrosion and facilitates replacement.
❏ To check brake fluid level, remove the cap on the actuator housing. If fluid is about 12 mm (1/2") below the top, add fluid. Use only fluids specified by the trailer manufacturer. Inspect brake shoes and rear seal.
❏ Grease the wheel bearings following the manufacturer's instructions. Use a certified water-resistant marine trailer bearing grease and a hand gun. Never use automotive grease as it is not water-resistant. Do not grease when the hub is cold as too much grease flow may damage seals and brake shoes. Overgreasing bearing protectors can cause the seal to fail.
❏ To check the wheel bearings: working on a level surface, block the tire wheels, place a jack under the axle and individually raise each wheel clear of the ground. Place your hands on the outside edge of the tire and try to rock the wheel by pushing on one side and pulling on the other. Spin the wheel and listen for noise or roughness. If the trailer has brakes, make sure the brake shoes are not dragging. The wheel should spin freely and not rock.
❏ Inspect the wheel bearings at least once a year and repack if necessary. To repack, follow the step-by-step instructions on page 10. At the same time, inspect grease seals and axles and replace any worn or questionable parts. If your trailer is not equipped with bearing protectors — which keep the grease in and the water out — consider installing them (see Bearing Facts).
❏ The boat should be resting against all trailer supports. If not, adjust the height of the bunks and rollers to fit. To reduce friction on roller trailers, grease shafts on the rollers with a medium weight oil. Examine the runners and carpeting. Replace if worn.
❏ Clean the winch and check for corrosion. Lubricate the drive shaft bearings of a mechanical winch regularly with oil and apply heavy grease to the gears and reel shaft frequently. Replace a frayed winch rope, cable or webstrap. Consider replacing wire with nylon web strapping; there's less friction and it won't rust. Check all tie-down straps for wear.
❏ Examine the coupler for rust, cracks and correct clamp adjustment. Lightly oil all moving parts such as the hand-wheel threads and the pivot points in the latching mechanism. Give them a shot of a moisture-displacing lubricant to prevent corrosion. Don't forget to check the safety chain for damage.
❏ Inspect the jack stand; lubricate if necessary.
❏ Check tire pressure (when tires are cold) and tread depth in all tires including the spare. Look for any visible cuts or bulges. Check the lug bolts for tightness (do this prior to every trip).
❏ Examine welded joints on the trailer frame for any breaks. Make sure all nuts and bolts are tight. Inspect the axle springs and attaching U-bolts for cracks and rust.
❏ For painted steel trailers, sand or wire brush any rust spots or chipped or flaking paint. Prime if necessary and apply a rust-inhibiting paint. Touch-up rust spots on galvanized trailers with cold galvanizing spray paint. Protect your trailer with a quality marine-grade wax.
❏ Make sure the ball is tight and the right size.

NOTES

_____
_____
_____
_____
_____
_____
_____

TONGUE WEIGHT

TIPS

Five to 10% of your trailer's Gross Vehicle Weight or GVW (boat, gear and trailer) should be supported by the trailer coupling ball when the tongue is parallel to a level surface. For example, if the GVW is 1,350 kg (3,000 lb), the weight on the coupler should not exceed 135 kg (300 lb) or be less than 67.5 kg (150 lb). With smaller boats you can check tongue weight with a bathroom scale. Place a wood support between the coupler ball cup and the scale. Use a level to ensure trailer is horizontal to the ground and adjust with plywood shims if necessary. For larger boats, find a trailer supplier with a scale. If you reposition the boat on the trailer, you'll need to recheck tongue weight. A slight shift in positioning can alter tongue weight enough to cause handling problems.

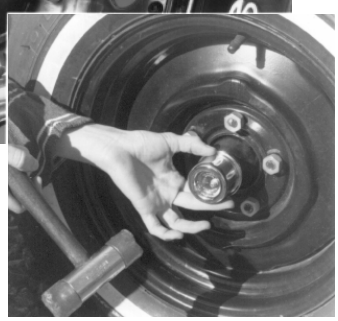
BEARING FACTS

Next time you hitch up your trailer for another long drive to the lake, consider the punishment given to the trailer wheel hub bearings. On long road trips, the wheel hubs heat up. Then you launch the boat, submerge the trailer and the hubs are suddenly cooled. This causes air inside the hubs to contract, allowing water and dirt to enter via small imperfections in the rear seal and greasecup. It's like a detergent commercial: "How many washings will it take before...?" Submerge a trailer repeatedly, and you have the recipe for bearing corrosion and premature failure.

Bearing protectors replace the simple dust caps that come with many trailers. They help avoid costly and, often, untimely bearing failure. Marketed under a variety of different names (Auto Lube, Bearing Buddy, Bearing-Protect, Dutton-Lainson, Protect-A-Bearing, Wundacap and others), Protectors maintain a slight constant pressure inside the hub, using either air or spring pressure to prevent water from seeping into the hub and causing bearing failure.

Installation is quiet simple and with a few basic tools can be accomplished in a few hours. (For complete

Using a grease gun, fill the protector with a certified water-resistant marine grease.



Bearing protectors fit tightly over the hub and are tapped into place with a rubber mallet.

installation instructions, see Repacking Wheel Bearings, Step 12.) Protectors are also easy to lubricate. Using a certified water-resistant marine grease and a standard hand-held grease gun, refill the grease fitting on the face of the cap. Press on the spring-loaded piston on the end of the bearing protector. If you cannot move the piston, add grease until it starts to move. Do not overfill which can damage seals and brake shoes; some models have a built-in feature that prevents overfilling. Depending on the protector, some products may require a slightly different lubrication procedure. Some units have a see-through

BOAT TRAILERS

casing for viewing the amount and condition of the hub grease.

Available in either zinc-plated or chrome finish, protectors are sold in pairs for less that $25 and come in a variety of sizes that fit most hub diameters.

REPACKING WHEEL BEARINGS

TOOLS REQUIRED

Jack stands
Adjustable wrench
Socket set
Pliers
Slot screwdriver
Rubber mallet
Hammer
Metal file
Emery cloth

Wheel bearings often fail as a result of frequent use at launch ramps. Water enters through worn seals or loose-fitting dust caps and is then retained inside the hub long enough to rust and corrode bearing parts and the spindle. While protectors help prevent water from entering the hubs, no bearing system is foolproof. Depending on how many times you submerge your trailer, water will eventually get into the bearings.

Manufacturers recommend inspecting wheel bearings at least once a year, preferably before storing for an extended period of time, and at least twice during the season if you frequently submerge the wheels or boat in saltwater. If hubs are not rotating smoothly, replace bearings. Trailer hub bearing kits help simplify this procedure and are available to fit most spindle dimensions. For less than $25 you get all the components necessary to complete the job on one wheel: two bearing cones, two bearing cups, a grease seal, cotter pin and sometimes a dust cap. When purchasing a kit, be sure to match the spindle dimensions and cone and cup numbers for both inner and outer bearings.

ANNE-MARIE HENDRY

Packaged kits come with all the components needed to service a wheel bearing for less than $25.

Step 1

To work on the hubs, you will need to raise trailer wheels off the ground. Working on a level surface, block the tire wheels, place a jack under the axle and individually raise each wheel clear of the ground. Place a jack stand under the axle for safety. Removing the tire is optional.

Step 2

Place plastic or newspaper under the tire to catch any parts that may fall off and to provide a clean work area.

Step 3

To remove the dust cap or bearing protector, lay a block of wood against the outer edge and gently tap it with a hammer. Then place the wood on the opposite side and hammer again. Continue alternating sides until the protector is free of the hub.

Step 4

Remove the cotter pin and spindle nut and wipe clean.

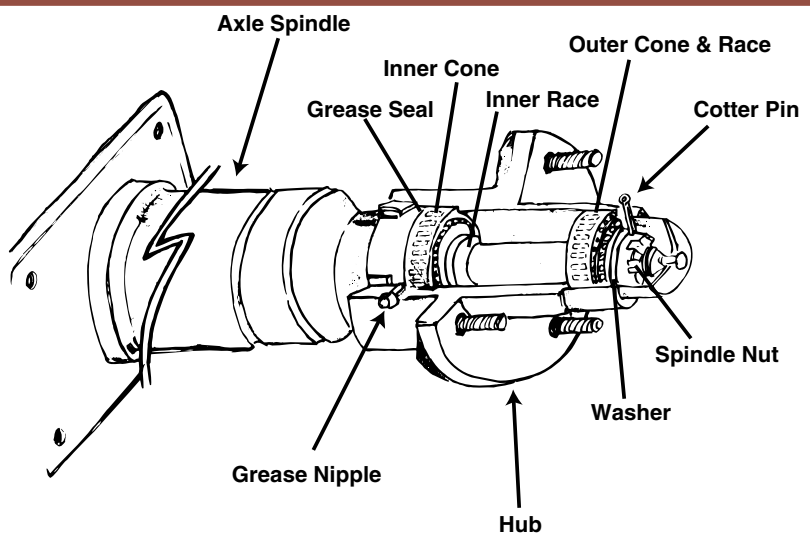
Step 5

To dislodge the thrust washer and outer bearing cone, first screw the spindle nut back on the spindle.

TIPS

Check hub lubricant level when the hub is warm. Manufacturers recommend that you check just prior to launching to be sure the hub is full of grease when the axle is submerged.

Components of wheel hub and bearings.



Grab the tire with both hands, tilt the top towards you and jerk the wheel outwards over the nut. Remove and clean. With luck, you can now remove the hub, inner cone and seal. If not, try jerking the wheel again. If this fails, tap the hub assembly from the back side, being careful not to damage the seal, or try a wheel puller that requires removing the tire and rim from the hub. Carefully lay all parts on the newspaper in the order they were removed.

Step 6

To remove the grease seal and inboard cone from the hub, place the hub (or tire rim) on two level blocks of wood, with the inside facing down. After removing grease from the center of the hub, lay a piece of wood into the hole against the inner cone and tap gently. Cover the ground with newspaper to collect the parts as they fall out.

Step 7

Wipe away excess grease and clean with a degreaser or solvent (please don't use gasoline). Inspect all parts for corrosion, pitting, scoring or watermarking. Bearing rollers should spin freely. Replace any suspect bearings and always in pairs: outer and inner bearing sets plus corresponding races. To separate the race from the hub, lightly tap it with a wood block and hammer. It's recommended that you always replace the old grease seals with new ones, so that grease stays in and the water out.

Step 8

Examine the axle spindle. A badly worn or scored spindle may indicate a seized bearing. Carefully remove any bumps with a filefollowed by emery cloth. If the seal surface on the rear of the spindle is damaged, repair it with a Spindo Seal Kit. These kits consist of a rust-free stainless steel seal ring, an O-ring and a replacement grease seal.

Step 9

To reassemble, first replace the inner and outer races (if removed), tapping into place. With clean hands (use a waterless hand cleaner), grease the inner bearing cone with quality wheel bearing grease: place a drop of grease in the palm of your hand and force the grease into the small cavities between the rollers. Use a plastic bag if you don't want to also

TOO MUCH GREASE?

If you are continually adding a lot of grease to the hub, chances are the rear (inner) seal is probably leaking grease onto the axle brakes (if equipped) and letting water in. Grease leaking onto the brake linings may cause the brakes to malfunction. Trailer manufacturers recommend replacing grease seals once a year, preferably before storing for an extended period of time. Replacement requires removing the complete hub assembly from the spindle.

BOAT TRAILERS

TRAILER SETUP

A trailer that is not correctly setup can damage the trailer and boat. An improperly aligned trailer can cause frame and roller damage, increase loading on the winch, fishtailing on the highway and general damage to the boat. Damage to the boat's hull, referred to as "wows and hooks," is often the result of incorrect support. If the boat is loading off center, check the following:

1. For roller trailers, the boat should rest evenly on all rollers. If needed, adjust only the tongue-keel rollers and side rollers so that all parts of the hull come in contact with each roller. The boat's transom should rest on the rear-most roller.

2. For bunk trailers, the long, straight bunks should evenly distribute the load. Adjust the bunks if one side is higher than the other or does not fit the boat properly. The boat's transom should be even with the end of the bunk.

3. If equipped with bow and center supports, make sure that each connects with the hull. To prevent bouncing, keep tie-downs tightly fastened.

4. Adjust the height of a mechanical or electric winch so the winch line is level with the bow eye of the boat, which is just below the bow stop roller or vee block.

coat your hands. Set the bearing into the race. Gently tap the grease seal into the inner side of the hub using a wood block or rubber mallet. Fill the hub with grease to prevent air pockets when reinstalled, then slip the hub over the spindle.

Step 10

Repack the outer bearing cone with grease (see Step 9) and install it, the thrust washer and spindle nut. Hand tighten the nut.

Step 11

Adjust the bearings as follows: spin the wheel and tighten the spindle nut until the hub begins to bind. Grip and rock the tire to ensure the hub is seated, spin again and tighten the nut until the hub starts to bind. (Check your owner's manual for the recommended amount of torque.) Back the nut off slightly so that the wheel and hub are spinning freely. Some nuts are drilled or slotted and should be turned back one notch. Check for excess play by shaking the wheel and if the bearing seems to operate without friction, insert the cotter pin (if equipped). Cotter pins are inexpensive; always use a new one unless a replacement is not available.

Step 12

Consider replacing dust caps with bearing protectors if your trailer is not so equipped. To install a bearing protector, coat both mating surfaces with a marine silicone sealant to prevent leaks, line the protector up with the hub, lay a block of wood over the front of the protector and tap the wood with a hammer. Bearing protectors fit tightly onto the hub: be sure they are carefully aligned before striking. Using a hand grease gun, fill the protector with a certified water-resistant marine grease. Check hub lubricant level by pressing on the spring-loaded piston on the end of the bearing protector. If you cannot move the piston, add grease until it starts to move. With some protectors you can visually see the grease level. Do not overfill. If replacing a dust cap, fill half full with grease before driving on the hub. Check the lubricant level when the hubs are warm (after trailering).

Step 13

Remove any excess grease from the hub or bearing protector and install a grease cover, either an off-the-shelf product or a plastic bag taped in place. Repeat the same procedures for each wheel. After lubricating the wheels, always test the braking system.

TROUBLESHOOTING HYDRAULIC BRAKES

Larger boat trailers are ordinarily equipped with hydraulic surge brakes. Regular checking and periodic adjustment will ensure proper operation and longevity.

Brakes will last longer if you don't get them wet. Brake linings become water soaked when submerged in water. Suppliers recommended that you tow the trailer a short distance then apply the brakes before parking it. This "dries out" the system and extends the life of the brake linings. Saltwater can cause severe damage to drum brake parts. A brake flush kit will help resist corrosion. Surge brakes usually do not have an automatic brake lining adjustment system and require regular adjustments to compensate for wear. Brake kits are available for DIY installation.

CAR CARE TIPS

Because your car's engine has to work harder, you may find it overheats on long grades. If this happens, do not stop and idle or turn off the engine. Instead, pull off to the shoulder of the road, shift to neutral, then step on the accelerator so your engine is idling fast. The fan causes more air to be taken in and cools the engine faster.

Symptom	Solution
Brake Noise	**Brake Noise**
Shoe chatter, linings coated with grease.	Replace grease seals, re-line or replace shoes and grind to fit drums.
Vibration noise.	Tighten hub bolts.
Noise from worn or cracked drums.	Replace drum.
Vibration from rough or loose wheel bearings.	Adjust bearings and replace if necessary.
Excessive Travel of Actuator	**Excessive Travel of Actuator**
Leaks in hydraulic lines.	Replace defective lines.
Low brake fluid in reservoir.	Refill master cylinder and bleed system.
Reservoir full of fluid; brakes will not apply.	Air lock in lines. Rebleed complete system. Restriction in line between reservoir and master cylinder.
Leading check valve fails to keep hydraulic system preloaded.	Adjust brakes or replace linings.
Pressure Build-up in System	**Pressure Build-up in System**
Contaminated fluid causing cup swelling.	Drain, flush and replace fluid. Replace damaged cups.
Hose or cylinder ports are closed or restricted with dirt or weak return spring.	Overhaul or replace.

GADGETS & GISMOS

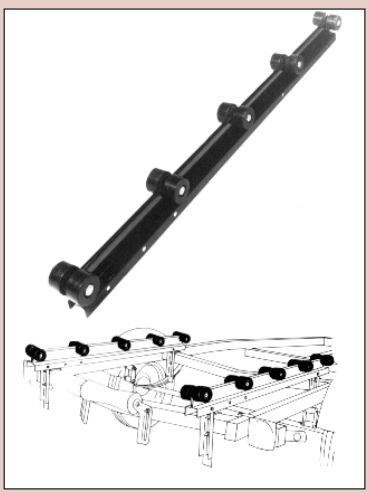
Theft-proofing

Insurance liability on trailerable boats is high due to the frequency with which they are stolen, especially smaller boats and personal watercraft. Leaving the trailer hitched to the tow vehicle without a lock of some kind is inviting trouble.

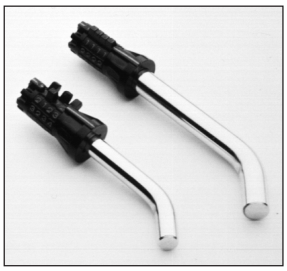
A variety of locking devices secured to couplers, hitches, wheel hubs or a jack stand help to deter would-be thieves. Kwik Tek's Combination Receiver Lock prevents removal of the draw bar from the hitch. It's integrated combination lock is preset by the factory at 0-0-0-1. No more forgotten or lost keys; you set your own easy-to-remember (hopefully) combination. Three sizes for 6 mm (1/4") and 5 cm (2") receiver boxes and a long pin for securing the bow eye of a personal watercraft directly to the trailer sell for $28. When the trailer is unhitched, Fulton's Gorilla Guard is a simple device that inserts into the socket of the coupler and locks with a key. Locking the jack stand in the down position is also a good idea. At $149, Trailock is more expensive than chains but a lot more convenient than threading bulky chain through the trailer wheels. It attaches to the lug nuts, preventing the wheel from turning. The device fits any trailer wheel with four or five lug nuts. To install, remove each original lug nut individually and replace with the supplied steel hex adapters. Mount the steel backplate and fasten the original lug nuts. This part of the system remains on the hub at all times. To secure the trailer, attach the security bar and cover plate then lock in place. Trailock is available in custom colors to match your trailer.

TRAILER CONVERSIONS

Some boat owners find roller trailers are easier to load and unload. Rollers reduce friction and minimize strain on the trailer winch. Dutton-Lainson roller bunks provide a quick, easy and inexpensive way to upgrade carpeted bunk- style trailers to rollers. Available in 1.2 m (4') and 1.3 m (5') lengths, roller diameter is 5.7 cm (2-1/4") and channel width is 5 cm (2"). Made of heavy gauge steel, they are either mounted directly on old woodbunks or in place of them. When replacing wood bunks, simply remove the existing bunk and replace with the roller bunk. If the wood bunks lay flat rather than upright,you may need to replace the bunk brackets. Optional adjustable brackets allow mounting of the roller bunks at the correct mounting angle. Roller bunks also fit directly over vertical or upright carpeted wood bunks and are through-bolted in place. After installing, lower the bunk brackets on the trailer. For either installation, check that the boat is aligned correctly on the trailer. Mounting hardware (not included) requires 3/8" cap screws, flat washers, lock washers and nuts.



BOAT TRAILERS



Set your own combination with Kwik-Tek Receiver locks.

Fulton's Gorilla Guard helps to prevent theft when trailer is unhitched.

Trailock attaches to the lug nuts and prevents the wheel from turning.

Bearing Guard

TempAler'T is a dash-mounted indicator panel that connects to a series of temperature sensors mounted on each axle or brake backing plate. The device monitors wheel bearings on a continuous basis and triggers warning lights on the control module when hub temperatures increase. A separate light array for each wheel bearing identifies the heated hub. Kits are available for single-, tandem- and triple-axle trailers and prices range from $270 to $430.

Plug Mate

Many factory equipped towing packages on sport utilities and trucks use a 6-way round socket for electrical trailer connections. Most boat trailers, on the other hand, use a 4-way flat plug. You can splice your trailer plug to the female socket end, or for $32 purchase a custom plastic adapter from Wesbar. It installs quickly onto a flat plug and is just as easily removed when not in use.

Lift and Support

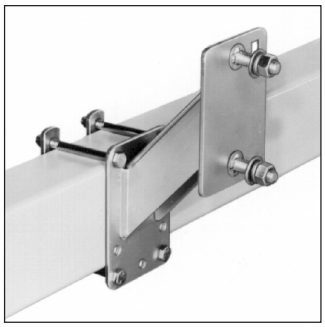
For boats equipped with power trim, a motor support bracket will help prevent damage to the transom and hydraulics by absorbing road shock and vibration. It also protects the skeg by elevating the lower unit. The V-shaped end attaches to the engine's lower unit and the inboard end is held in place on the trailer. Different models support motors up to 150 hp. Available from many trailer suppliers, a bracket costs about $50.

Load Guides

If you cruise on waters that are subject to strong currents or crosswinds or launch at a particularly steep ramp, you should consider installing load guides. These handy braces center the boat on the trailer when loading. They come in all shapes and sizes, from a crude but effective length of ABS pipe (topped with a cap to prevent filling with water), to vertical posts with rollers, to a color-matched carpeted wood bunk. All easily bolt directly to the side frame. Upright posts also double as guides, helping to align the boat when backing up or loading, particularly at steep and deep launch ramps. Some models stow flat when the trailer is empty.

Carry a Spare

All trailers should be equipped with a spare tire and a specially designed carrier mounts the tire out of the way. Carriers bolt easily to the frame without drilling and most are adjustable to fit both four or five lug wheels. Prices start at $20 for a simple U-shaped rod bracket. A more elaborate unit that carries the spare at an angle to fit along side the boat costs about $50. Look for one with a locking device of some kind that locks both wheel and bracket to the trailer.



Sources of Additional Information

Books

Boat Trailers and Tow Vehicles, A User's Guide by SteveHenkel, 134 pages, $20.95

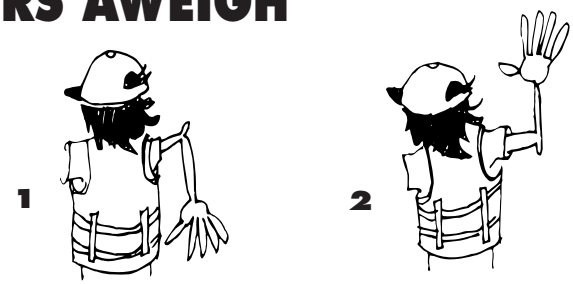
Trailerboat Guide, by Joe Skorupa, 180 pages, $21.95

Videos

Trailer Boat Handling, 75 min. Bennett Marine Video, $41.95

CAST OFF

ANCHORS AWEIGH



ANNE-MARIE HENDRY

Figure 1
Reverse throttle

Figure 2
Stop

Figure 3
Anchor broken free (when raising) or anchor down (when lowering)

Figure 4
Neutral

Figure 5
Forward slowly

I don't know what it is about anchoring that many first mates dread. Is it the business of casting anchor, which seems to bring out our worst traits, or the one-finger salutes from the helm? We see the same scenario every summer: the first mate shouting instructions to the skipper, ("Read my lips") and the skipper screaming obscenities back (never the first mate). The roar of the engine and exhaust noise makes it impossible for the person at the helm to communicate with the foredeck crew. A portable, hands-free loud hailer for the crew would be practical, but I haven't seen one yet, although surely it's on a designer's drawing board somewhere. Anchoring usually goes quite smoothly if the driver is perched on a flybridge high above the deck where he or she can see all the action. But for those boaters with a more lowly post, your only salvation is a pre-arranged set of hand signals. We checked with *Chapman Piloting*, called the Canadian Power & Sail Squadrons and surprisingly learned there are no signal standards. So we've developed a signal system based on our own experiences. It's an uncomplicated system of hand signals that lets the deck crew communicate directly with the helmsperson. Arm signals, rather than hand sign language, are clearly understood, especially when wearing gloves. You can use these signals as a starting point or develop your own. Either way, working together as a team is what boating is all about!

BRIGHTWORK

THE FINE ART OF VARNISHING

When not maintained, brightwork quickly loses its luster.

There's nothing more attractive than a gleaming, newly varnished grabrail or hatch board. But maintaining exterior brightwork, defined as "any woodwork which is kept varnished," is a tedious and time-consuming process. It involves long hours of sanding, varnishing, sanding and more varnishing. There are no miracle cures for brightwork, or at least none that I have discovered. Over the years, I have used a variety of one- and two-part protective clear coatings, generically referred to as varnish. Varnishes are generally made up of five specific ingredients: oil, resin, solvent, dryers and additives including ultraviolet (UV) inhibitors.

Ultraviolet is your brightwork's worst enemy. The sun's rays quickly deteriorate varnish, causing it to blister and peel. A UV filter in a varnish helps to protect the finish but no coating is foolproof; different varnishes offer varying degrees of protection. (Read the label carefully before buying as some products are without a UV inhibitor.) Traditional spar varnishes offer ease of application with good gloss and moderate durability. Advanced single- and two-part polyurethanes are more finicky and while they may last longer than traditional varnishes, both products require a heavy buildup of coats for a long-lasting finish. A properly applied varnish with six or more layers is easily maintained with a maintenance coat once or twice every season.

Unfortunately, with the short boating season in many areas, prime varnishing days are better spent on the water. All too often, there's time for only two or three coats. Repairs to surface damage, such as nicks or gouges, go untreated and water seeps under the coating. Neglect the brightwork and you can expect to strip what's left of it next year. The more coats you put on, the longer the finish will last and the less amount of work you'll have to maintain it.

PREPARATION

The key to a successful varnishing job is proper surface preparation. Previously varnished surfaces must be first washed with warm water to prevent rubbing the contaminants into the surface when sanding. When the existing coating is badly worn use a paint remover, such as Interlux Pintoff 199, to remove blistered and flaking varnish. Alternately, scrape with a cabinet scraper; frequently sharpen the cutting edge with a file and round the ends to prevent gouging the wood.

Sand the surface by the "numbers," beginning with a larger grit and finishing with 150- to 220-grit paper to produce a smooth, scratch-free finish. When sanding a stained surface, use a finer grit sandpaper to prevent sanding through the stain. Use a sanding block, either a commercially available hard rubber block or a chunk of soft wood, when sanding large surfaces. Sand with the grain, keep the sandpaper clean and change it often. If you must sand across the grain use a fine grit and a light touch, then finish sanding with the grain. Sand out all cracks to prevent trapping moisture that can cause discoloration of the wood and wearing away of the varnish. Round all corners to prevent varnish from chipping. To sand inside corners and edges where trim meets the deck, a bulkhead or cockpit coaming, wrap sandpaper around the dull edge of a table knife. If the inside edge is round, use a pencil or piece of 6 mm (1/4") wood dowel wrapped with sandpaper. If you need to fill the surface, spread the filler with a brush in the direction of the grain. Use a cloth moistened with brushing thinner to even out any streaks and wipe off excess wood filler before it dries. When dry, sand lightly to remove raised wood fibers caused by cleaning. On previously varnished surfaces in good condition, sand with 220-grit paper to remove the top coat of old varnish.

After sanding, vacuum the dust residue then carefully wipe the surface with clean lint-free rags or cheesecloth dampened with brushing thinner, lifting the dirt from the surface. Use plenty of rags, changing often. A brush will pick up any sanding residue hiding in the crevices. Take a break to let the dust settle, then come back in a couple of hours and vacuum again.

Having the right tools makes the job easier, faster and gives premium results. A badger-style, natural bristle brush that has a chiseled edge, rather than square, provides a finer working tip when applying varnish. Clean all brushes, rollers and containers in solvent before using to remove dirt and other contaminants. Reserve a variety of brush sizes for varnish only and never use one that was ever used for paint.

TIPS

Store varnish and paint cans upside down so the skin forms on bottom (when opened) of coating, not the top.

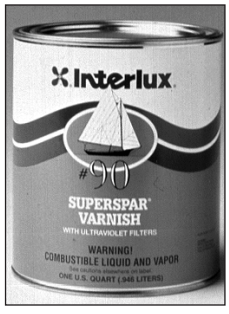
APPLICATION TIPS

Temperature, direct sunlight and humidity all affect drying times. Choose a warm and dry (low humidity) day to do your varnishing, especially if using a polyurethane coating. Some paints won't dry if the temperature is below 10 C (50 F); over 26 C (80 F) paints dry too fast, leaving highly visible brush strokes. Try to apply in the shade as direct sunlight causes bubbles in the varnish. Unless you work in a covered shed, finding shade may be impractical so apply a heavier coat to increase the working time. Strong winds bring unwanted airborne critters embedded in the fresh varnish or a too-fast cure, creating visible brush strokes and an uneven finish, all of which must be sanded out and recoated.

At last, you're ready to varnish. Shed the dusty overalls for clean ones. Vacuum again to remove any sanding dust and contaminants and mask uncoated areas with a solvent-resistant striping tape. Open the varnish container and remove any skin that has formed on the top. Never shake or stir varnish unless instructed to do so on the label; some satin and rubbed-effect varnishes may require mixing. Stirring produces bubbles in the varnish that will not brush out and causes a slight depression when dry. Strain new and old varnish through a paper filter or nylon stocking before using while pouring a small amount into a clean plastic or metal container. Just before recoating, wipe the surface with a tack rag to remove any residue. After completing the final surface cleaning, resist the temptation to draw your hand over it!

Varnish early in the day before the sun gets too hot. When working in an enclosed area, make sure you have adequate ventilation, especially when using potent, two-component systems, some of which require wearing a respirator. You should also wear protective clothing and cover your hands with gloves or a barrier cream.

To enhance wood penetration, thin the first coat and possibly successive coats by 10% to 50% with the recommended thinner; check the label for specific instructions. Thinning keeps the wet edge open longer, allowing better paint flow and leveling of brush strokes between coated areas. Oily wood like teak requires additional thinning of the first coat to ensure the varnish soaks into the wood. Using your premium badger-style brush, saturate the brush with varnish to prevent bubbles forming on the wood, then apply a thin coating of varnish. To prevent runs, don't overload an area with varnish. On large areas use a thin foam roller for the initial application of varnish and "tip off" with a natural bristle brush immediately following the roller application to smooth roller marks. Apply "wet-on-wet,"overlapping brush and roller strokes to blend the wet edges of the coated areas. If the varnish "pulls," a condition caused when the coating is too thick for the ambient temperature, add thinner but never more than recommended.



New and improved, Interlux Superspar Varnish #90 is a traditional spar varnish that now contains an ultraviolet filter.

If the weather cooperates and time permits, apply a minimum of six coats over properly prepared surfaces. Sand between coats with 220-grit paper. Again, check the directions on the can as finishing grits differ between varnishes. Sand until all gloss is no longer visible, then wipe clean with a cloth moistened in brushing thinner. If you prefer to "rub down" the varnish, use bronze not steel wool. Steel particles embedded in the surface will eventually rust through the varnish. When a fast buildup of coats and quick overcoating are necessary, use a varnish that contains an accelerator that speeds up the drying time.

Clean your brushes after every coat in the appropriate solvent, then rinse in detergent and lukewarm water, followed by a clean-water rinse. Shake well. Hang by the handle to avoid curling of the bristle tips or lay flat to dry. Brushes are now prepped for the next application.

The most important consideration when varnishing is frequency. A correctly applied varnish job will last many months before it needs a light sanding and recoating. One or two maintenance coats a season is not unreasonable when it comes to preserving the exterior brightwork and all your hard labor. A good rule of thumb to remember is when the gloss begins to dull, it's time to recoat. Make an effort to inspect the brightwork regularly and touch up as needed, especially in the fall before storing the boat for the winter. If you can maintain your brightwork on a regular basis, varnishing becomes much less of a chore and more of a pleasure.

Application Don'ts

- Varnish in direct sunlight or in strong winds
- Apply late in the day
- Varnish when surface is hot to touch
- When it rains
- When moisture content of the wood is greater than 13% to 18%

Application Do's

- When surface temperature is between 10 C (50 F) and 26 C (80 F)
- Always maintain a wet edge
- Apply in direction of grain
- Use a natural bristle, badger-hair brush
- Apply within three hours before the dew falls

Sources of Additional Information

Books

Brightwork: The Art of Finishing Wood by Rebecca Wittman, 192 pages, $50.95

Videos

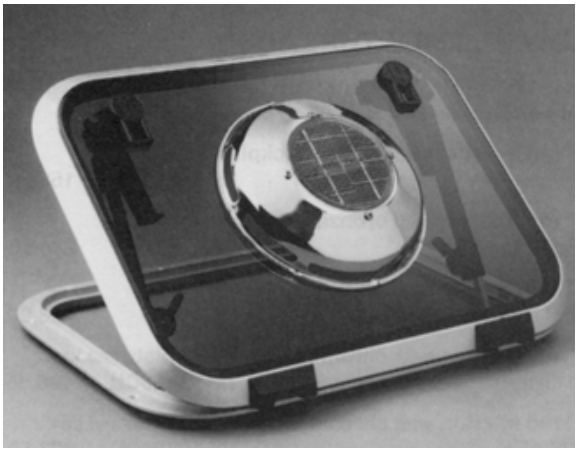
Varnishing Made Easy, 43 min. Bennett Marine Video,$33.95

DIY PROJECTS

END MILDEW, INSTALL A SOLAR VENT

Condensation is a serious problem in the interior of most fiberglass and some wood boats. In fact, nearly 95% of all pleasure boats are inadequately ventilated. Hot, humid daytime air in a tightly sealed cabin cools at night producing a greenhouse-like effect. Excessive moisture eventually mildews fabrics, corrodes metal and rots wood.

The best way to prevent mildew is to add ventilation. The leader in marine ventilation is California-based Nicro Corp. which makes a variety of plastic, stainless steel and bronze vents. Of all the models, solar-powered vents are the most effective means of increasing air flow and controlling mildew. These vents deliver a constant supply of fresh air into the cabin. Not cheap, solar vents cost $100 and up, but it's worth the investment for the increased comfort below.



Vents mount easily in just a few hours. Installation involves cutting a hole in the deck or hatch cover. When marking the hole, pay particular attention to placement of all electrical wires, headliners and fittings located either below or around the cutout. Cut the hole with a jigsaw or hole saw to the exact size, otherwise the deck ring will not lie flat. Where there is excessive deck camber, add shims to flatten the mounting surface. The procedure is actually quite easy and every vent comes with comprehensive, step-by-step instructions for marking, cutting and mounting vents in fiberglass, Plexiglas or wood. Also included are all necessary hardware and a deck ring. Optional accessories include deck plates, Teak Trim Rings and Hole Liners for thick decks. When properly installed, the vents are completely rain-proof. A shut-off damper stops the air flow and water from entering the cabin.

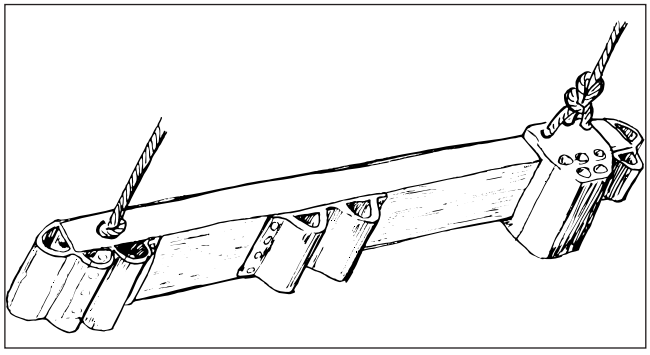
For 24-hour ventilation, some vents have a Ni-Cad battery, charged by solar power, that runs the fan on overcast days or at night. The 10 cm (4") model moves up to 850 cubic feet of air per hour. Interchangeable blades allow either intake or exhaust ventilation. If your boat already has dorade or cowl vents, an exhaust vent removes stagnant, humid air while increasing the flow of fresh cabin air.

FENDER BOARDS

If you do a lot of cruising, docking at foreign ports, even traveling through a lock or two, it's a good idea to have extra hull protection on board. Made of pressure-treated fir, fender boards are easy and cheap to make. Take a standard 2 x 4 about 1.2 m (4') to 1.8 m (6') in length. Drill holes in the ends and pass 9 mm (3/8") line through the holes, tying knots at the bottom and top to prevent the board from sliding up the line. Purchase some heavy duty dock edging and fasten to the ends and middle, about four per board. Now you've got an extra measure of defense when docked against a jagged pier or vertical pilings.

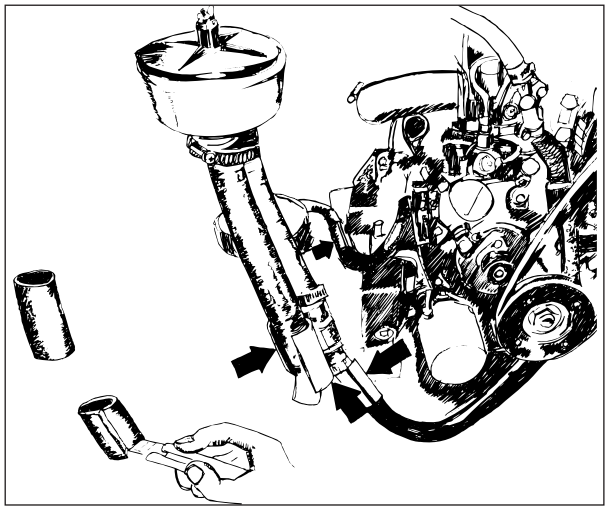
AUTOMATIC HEAD FEEDER

One of the best products I've installed of late is an automatic head treatment device. It's a convenient, easy to use auto feed system for heads with holding tanks. Attached to the intake line between the head and the seacock, it automatically releases the exact amount of chemical every time you pump or flush the head. Easy to install, simply cut the hose and slide over the hose fittings, then insert a cartridge filled with head chemical. The chemical turns the water blue and when the water starts to run clear, it's time to add a new cartridge (about one month).



ANNE-MARIE HENDRY

duplicate hose or one with a similar inside diameter and slice in half along its length with an Exacto knife. Spread open, then slide over the existing hose any place where it rubs against another fitting, bulkhead, engine mount or the hull. The snug fit ensures the hose strip stays in place.



ANNE-MARIE HENDRY

new cartridge (about one month). There's no more measuring and pouring messy liquids into the bowl and no more telltale blue-stained fingers. With a consistent supply of chemical, head odors are reduced or eliminated. Two products are currently available. The Head-O-Matic Tank-ette kit includes a two-part magnum bullet that sells for $89.95. A six-pack of replacement bullets costs $35.70. Head Treatment, a similar but less expensive product ($12.95), contains a screw bottle filled with liquid chemical that lasts up to 300 flushes.

CHAFE PROTECTION

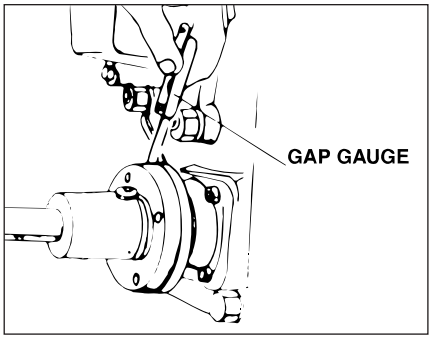
Vibration quickly causes chafing of rubber hose where it contacts a hard surface. To protect engine and plumbing hoses from wearing through, use strips of slit hose. Cut a length of

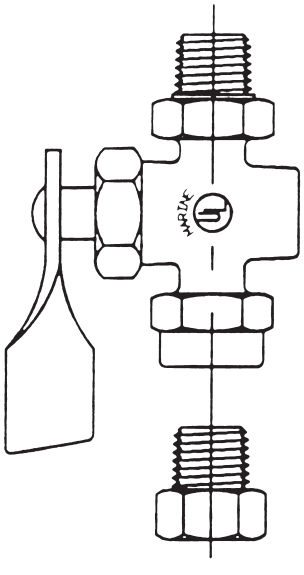
ENGINE TROUBLESHOOTING

SHAFT ALIGNMENT

It's a good idea to check the shaft alignment every spring after launching and during the season if there is excessive vibration. A misalignment of a mere .10 mm (.004") can cause wearing of the stuffing box and cutlass bearing. If your body trembles from vibration when sitting in the cockpit, it's definitely time to check the shaft alignment.

Using a socket, loosen the nuts on the transmission coupling, remove the bolts and washers, and pull back the shaft coupling. The flanges should separate easily; if not, there may be a ding on the mating surfaces or the engine is misaligned, causing the join to bind. Use a strong, thin knife, like a putty knife, inserted into the gap and force the two flanges apart. Do not use a slot screwdriver which may nick the coupling edges. To realign, match the face of the flange on the shaft coupling to the flange on the transmission. With a gap gauge, measure the gap between the faces at the top, bottom, right and left. Check your owner's manual for the exact maximum tolerance allowed. If you're without a gauge, a square of regular bond paper doubles as a gap gauge in a pinch. (It's about .010" thick.) The paper should slide evenly around all points between the couplings. If the gap varies or the paper binds anywhere along the mating surfaces, you need to adjust the height of the engine on the mounts. This may require both horizontal and vertical adjustments until the distance between the coupling flanges match equally. Use washers as spacers if you need to raise the engine. When the gap is equal on all sides, attach the coupling bolts, washers and lock nuts. Do not force the bolts into place if the shaft coupling does not line up with the transmission coupling. Tighten firmly and evenly.





SHUT-OFF VALVE KIT FOR DIESELS

For boats equipped with a Racor fuel filter/water separator, a $50 plug simplifies draining the collection bowl and prevents spilling fuel on your hands or into the bilge. Easily retrofitted to most Racor filter/separators, the Marine Shut-Off Valve Kit, part number RK 19492, includes a drain valve with shut-off and plug that replaces the original drain plug. To install, first remove the drain plug from the filter/separator and attach the valve kit using thread sealant to prevent leakage. To use, remove the valve plug, open the valve to discharge contaminants into a collection jar, close the valve and replace the drain plug.

SAY GOOD-BYE TO LEAKING STUFFING BOXES

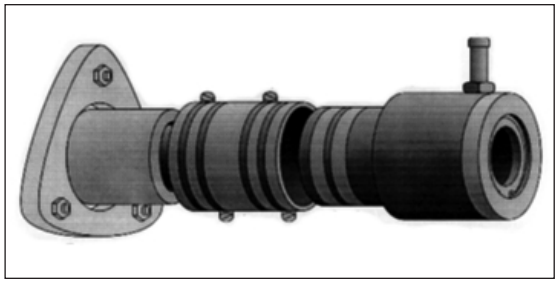
How many times have you taken a flashlight, peered into the bilge and counted the drips falling from the stuffing box? And when the stuffing box dripped steadily and tightening slightly by hand did not stop the water flow into the bilge, you had to replace the packing material. Conventional stuffing boxes rely on water to cool the packing. A 90s alternative to dripping stuffing boxes is Tides Marine's Strong Shaft Seal.

Strong Shaft Seal is a watertight, self-aligning shaft seal. The patented, one-piece unit has no moving parts and is maintenance-free. It consists of a water-lubricated shaft bearing machined into the housing. The bearing aligns the shaft and seal and prevents misalignment and shaft wear. Made of a non-corrosive rubber material, the seal is resistant to electrolysis. Best of all, it's watertight — now you can have a dry bilge.

Installation of the Strong Shaft Seal is fairly simple. Detailed, step-by-step instructions are outlined in the company's brochure. The most difficult task will be extracting

the propeller shaft from the shaft coupling. For most shafts the propeller will be fairly stubborn. Do not hammer the propeller or the shaft which may bend. Use a shaft puller. If you are without a puller, have a marine technician remove the shaft for you; the rest of the job you can easily complete with a few basic tools. The shaft must be free of corrosion, saltwater residue and any sharp edges, nicks or burrs, especially the portion under the old hose, stuffing box and the coupling keyway. Use a flat file or emery cloth to smooth shaft. Following the instructions, you then attach the new exhaust hose and Shaft Seal. Providing the shaft comes out easily and is not badly scored, you should be able to complete this job in an afternoon.

Strong Shaft Seals are available in a range of both imperial and metric sizes from 20 mm to 76 mm and 3/4" to 5". A 7/8" seal costs US$93; a 2" is US$364. Strong also offers bearings for rudder shafts that replace leaking and corroded bearings for wheel- or tiller-steered systems. Contact Tides Marine at (800) 420-0949 or fax, (954) 420-5234



OUTBOARD ENGINE TROUBLESHOOTING

A guide to identifying and solving some of the basic problems encountered by outboard owners.
For engines not equipped with electric start, omit references to starter and battery.

Symptom	Check-over
Motor will not start	Fuel gauge (low fuel) Fuel line connection or pinched fuel line Fuel filters and/or screens clogged Water or dirt in fuel Air vent on portable tank closed Choke setting incorrect Loose spark plug wire Gear shift position (neutral for starting) Faulty electric start Loose or corroded battery cable connections Battery needs recharging Emergency kill-switch lanyard not correctly attached or shorting the electrical system
Motor hard to start	Fuel tank vent closed Fuel line pinched Fuel line not primed or lost prime Low in fuel Choke malfunction Water or dirt in fuel (add a conditioner and replace fuel filter) Loose spark plug wire Fouled spark plugs: try a new set Needs a tune-up
Motor runs rough	Water or dirt in fuel Incorrect fuel/oil mixture Carburetor idle needle needs adjustment Fouled park plugs or loose wire Loss of power Propeller fouled with weeds or fishing line Broken sheer pin (if equipped) Low in fuel Weeds or debris clogging water intake on lower unit Loose spark plug wires
Motor vibrates	Loose mounting clamps Bent or broke propeller blades Plastic bag or other debris snagged on propeller
Motor stops	Low fuel supply No oil in fuel (for 2-stroke engines) Broken spark plug wire Water intake blocked or malfunctioning water pump

ELECTRONICS

RENEWED LIFE FOR RECHARGEABLES

After three seasons of use, the Ni-Cad battery in our hand-held VHF radio was dead. The back-up battery was not fairing much better, as it would not hold a charge for long. Upon consulting an electronics expert we soon discovered it was our mishandling of the batteries that had created the problem.

With proper care, a Ni-Cad battery will give upwards of 10 years of service. Misuse it, however, and it dies prematurely. Ni-Cad batteries have the strange ability to memorize charging procedures. If you use your radio for only a few hours then recharge it, the battery may not fully charge. Do this repetitively and the battery will develop a preference for not being fully charged or not hold a charge for long.

The best way to maintain performance and ensure longevity of Ni-Cad batteries is to totally discharge them to a nearly "dead" state before recharging. The solution is to charge your hand-held VHF radio only when it needs it and never leave the battery attached to the charger when full. It not only reduces battery life but also acclimatizes the battery to a light charge.

Replacement batteries range from $50 and $130, depending on the radio make and model. Before discarding the old one, consider having it inspected by a battery specialist. Reconditioning costs about $50 and many shops do not charge for a battery they cannot revive.

SQUARE PLUG IN A ROUND HOLE

Many of the newer instruments for sailboats are surface mounted and almost all are square units. Fitting a square into a circular hole is fairly simple if the new unit is the same size or larger. But when a replacement is slightly smaller than the original instrument, modifications are more difficult. Unfortunately, newer instruments are substantially smaller in size and manufacturers do not provide adapters that replace older round-faced instruments. Depending on the construction of the bulkhead, you can quite easily retrofit square instruments without sacrificing
cosmetics.

When replacing older instruments you should remove the old unit, fill the hole and cut a new one. This is the ideal procedure, but matching the original laminate or even filling the gap with a fiberglass and epoxy mixture is extremely time consuming. A less costly and speedier method and one used by many installers, is to cover the offending hole with a Plexiglas or teak pad. A 6 mm (1/4") pad is glued and screwed to the outside and the new hole cut out with the help of a drill and jigsaw. Use white or smoked Plexiglas or select a color that closely matches the instrument or bulkhead. Oiled or varnished teak will look great the first season but requires regular maintenance to retain its luster. Inside the cabin, the new instrument will stand somewhat proud of the bulkhead. If it's installed on a teak bulkhead and highly visible, fashion a teak box to conceal the instrument. Otherwise, cut a Plexiglas pad that covers the round hole.

There are some companies still offering traditional, round-faced instruments: Datamarine, SR Mariner, Horizon and others. But these instruments operate on older analog technology. If you want to take advantage of new digital technology or network with other instruments, you'll need to join the cyber age.

ELECTRONICS REPAIRS:

Getting the best bang for your buck

Manufacturers build marine electronics to withstand harsh conditions, but even with high quality controls some units break down. Repair costs vary, depending on the age and type of hardware and extent of the damage. Irene Robb, service manager of Ocean Distribution, offers the following advice when electronics fail and how to best deal with a repair facility.

With new VHF radios costing around $250 for a

TIPS

To cut a square hole with a jigsaw, first drill a 8 mm (5/16") hole in each of the four corners, carefully positioning the drill so it dissects the vertex. Insert the saw blade in each hole and cut along the vertical or horizontal line to the corner. Reposition the blade in the connecting hole and continue cutting. When completed, you will have a square cutout with perfectly matched corners.

basic system, these are frequently a throwaway item, especially when the unit is an older "crystalline entity."

do not fair much better: a repair can average 50% of the replacement value and if it requires an entire circuit board, this can cost more than a new radio. As for depthsounders, the biggest complaint is an intermittent signal caused by aeration bubbles interfering with the transducer. As you probably are a little gun-shy of removing the transducer while afloat and do not want to haul the boat, this becomes a winter project. Many older autopilots and lorans are repairable providing replacement parts are available. Improper alignment is the most common problem with lorans. Units have a temperature-controlled oscillator and when this becomes misaligned the receiver is no longer able to pick up and lock on a signal.

When returning any equipment for repair, you need to provide the service technician with a complete analysis of the problem. First determine the symptoms. Does the unit come on when power is applied? If it does, what operation is malfunctioning? With radar, for example, will it operate in close range but not long distance? Sometimes a unit that fails to run in the boat operates perfectly in the shop. Provide the technician with as much information as you can collect and include a written analysis with the unit. Also supply a day-time telephone number. Most companies provide a repair estimate for about $50 but will not order replacement parts until the estimate is approved.

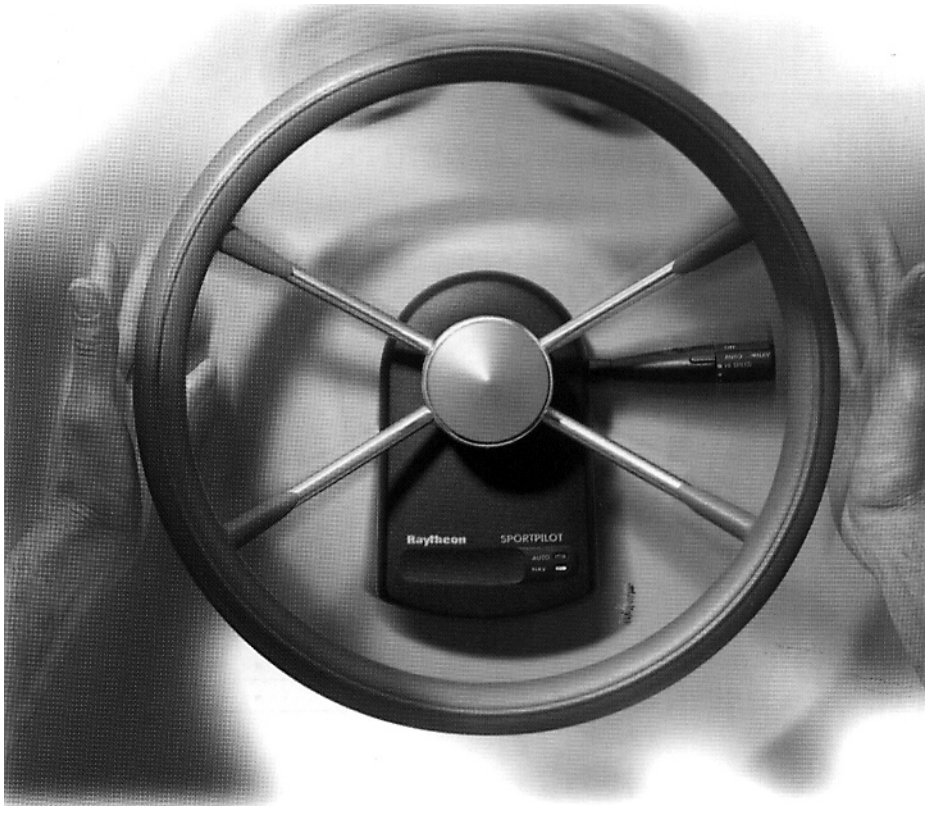
AUTOMATIC CO-PILOT

The SportPilot Plus from Autohelm is designed for single-steering-station 5.4 m (18') to 9 m (30') powerboats, such as sports cruisers, sportfishermen and rigid inflatables. The price is high (suggested list is $2,200) but the advantages to a small-boat owner are many. When you need to tend the downrigger, untangle the ski tow line or check the charts, an autopilot will keep the boat on course and traveling in a straight line.

Easy to operate, it works much like cruise control in a car. When you need a break from steering, line up the helm, move the switch on the control lever to Auto, dial in the correct speed factor and let go of the wheel. An external fluxgate compass (supplied) feeds the unit with heading information. To avoid a hazard or another boat, just move the wheel to disengage the autopilot and steer manually. Once clear, return the boat to the original course and the SportPilot Plus automatically resumes control. Speed control, located on the lever, determines the amount of rudder applied when making course changes. Audible alarms warn the

any GPS or loran receiver. When linked to either of these devices, the SportPilot will steer to waypoints following a user-defined route. Options include a remote control, SeaTalk speed instruments for automatic speed settings, rudder reference unit (required with hydraulic helm pump) and choice of rotary (for hydraulic inboard steering systems) or linear (for hydraulic outboard steering systems) transducer. The unit fits mechanical or hydraulic steering systems, 19 mm (3/4") and 25 mm (1") steering shafts and wheels up to 54 cm (21").

Designed for do-it-yourself mounting, installation is easily completed in a weekend. The unit comes with templates, drill bits, adhesive, all hardware, wires and connections. You'll need to supply a selection of screwdrivers, wrench and socket sets, pliers, vice grips (just in case), drill and jigsaw. Instructions are easy to follow and well illustrated. Installation gets more complicated if you cannot install the fluxgate compass on the boat's centerline or away from interference from the boat's main steering compass. Also allow extra time if you need to build a mounting base for the rotary rudder reference transducer.



Tuning the MASTHEAD RIG

Mast tuning is extremely important to the handling of a boat under sail, and safety of those on-board. A properly tuned mast contributes significantly to the boat's performance and is less likely to fail or break.

To fully comprehend rig tuning, you need to understand a few basic principles. All masts can only lean or bend in two ways: either forward-and-aft or sideways. The goal is to set up a rig so the mast is as straight as possible when sailing in moderate wind conditions and to also achieve an acceptable helm balance. To this end, mast tuning is divided into two components: lateral tuning and rake.

Lateral tuning involves getting the mast to stand straight without leaning or bending sideways. Side lean, or the amount a mast tilts to leeward, is caused by improper tuning. A mast leaning to leeward increases heeling which induces weather helm. Since most boats have too much weather helm in a breeze, it's important to minimize lateral side lean with the correct rig tension. Sideways bend is usually caused by too loose or stretchy upper shrouds. As the wind increases, the shroud tension required to hold the mast up also increases. With more tension comes more stretch and more side bend. With the mast now out of column comes the risk of damage or complete failure. Correct lateral tuning also prevents the mast from buckling or pumping sideways.

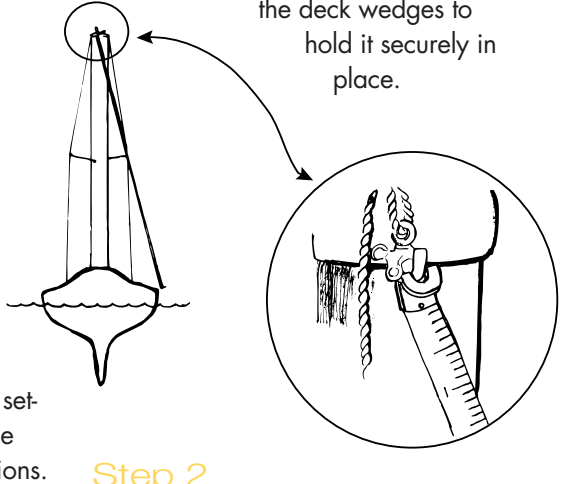
Rake is the tilt of the mast in the fore-and-aft direction. Headstay length primarily controls the amount of rake. A mast standing perfectly plumb in the boat has no rake. Moving the mast shifts the entire sail plan and, in turn, affects the helm balance. Raking the mast aft increases weather helm (and reduces lee helm) and vice versa. The amount of rake is dependent on your boat type and local sailing conditions. Ideally, you need to find a setting that gives good helm balance through a broad range of conditions. Ask other owners and your sailmaker for input.

Mast bend refers to the amount the mast is bent aft from a straight column. It controls the overall fullness of the mainsail, particularly the upper two-thirds of the main, and is adjusted by backstay tension. Boats without adjustable backstays can add bend by moving the mast aft at the step or forward at the partners.

The following step-by-step instructions are for tuning a single-spreader masthead rig that is deck or keel stepped. Some of this information is based on the *North Cruising Course* manual published by North Sails (240 pages, $35).

Step 1

Center the spar. First, ease the backstay to a low load and lightly hand-tighten the upper shrouds. Attach a metal tape measure to the main halyard (provided the sheave is in the center of the mast) and hoist to the top. Measure the distance to the gunwale on each side. Adjust the uppers until the mast is equidistant from both gunwales. On keel-stepped masts also check that clearance at the mast partners is equal on both sides. Remove the side wedges or chocks and measure from the spar at deck level to either rail. Since some boats may be a little lop-sided, there is no foolproof way to get the spar straight. Combining both checks reduces the chance of error. When the mast is laterally straight, replace the deck wedges to hold it securely in place.



ANNE-MARIE HENDRY

Step 2

Tighten the uppers to eliminate lean and bend. Tension both uppers equally, counting the number of turns on the turnbuckle as you tight-

en. Make as tight as you are comfortable with; final adjustments will be made on the water.

Step 3

Get the rig straight. On a single-spreader rig, begining with loose lower shrouds and working on opposite sides, tighten each shroud until the spar is straight.

Sight up the mainsail luff groove and eyeball the alignment. To tension-test the rig, stand directly behind the mast and pull each shroud beginning with the uppers, followed by the intermediates (if equipped) then single or forward lowers. Working side to side, "play" the shrouds and listen for the "tune." The uppers should be the tightest, followed by the intermediates, then the single or forward lowers. Save the final tuning for the sailing test. On double lowers (fore and aft), the aft lower should be barely slack. It acts as a preventer, limiting mast bend when the breeze freshens. Now, tighten the headstay until snug.

Step 4

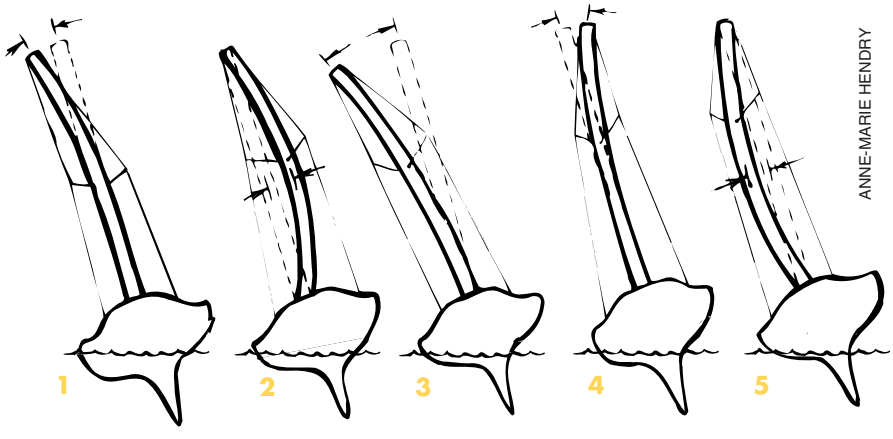
Fore-and-aft tuning. This involves both rake and mast bend. To measure rake, set the adjustable backstay (if equipped) to the normal sailing load and hang a plumb bob from the main halyard. Check the amount of rake at the boom. Another method is to attach a tape measure to the jib halyard and hoist to the top. Measure the distance to the tack fitting. This provides an accurate head stay length to compare with other boats. Make sure the boat is level on its designed waterline. Try to find an average setting that induces weather helm in light air and decreases it in heavy air. Adjust the double lowers if you change the mast rake.

Step 5

Mast bend. Tensioning the backstay increases mast bend. The amount of bend to use depends on your mainsail, the wind and sea conditions, and is only limited by the structural design of the spar. Before determining if the bend is sufficient, go for a test sail. When additional mast bend is required, adjust the step position or deck wedges on keel-stepped masts. This involves forcing the mast forward at the partners (deck level) or moving the butt of the mast aft while fixed at the partners. With deck-stepped masts, you will need to shim the tabernacle or mast butt. Adjust the double lowers when changing mast bend.

ON THE WATER

Select a medium-air day and sailing upwind, tack back and forth. Check the tension on the leeward upper shroud and tighten the slack if necessary. Tack and check the other upper. Count the number of turns and tension both uppers equally. Adjust lower shrouds, as needed, to prevent



Rig adjustments under sail: 1. Uppers too slack 2. Lowers too tight 3. Uppers and lowers too slack 4. Uppers and lowers too tight 5. Lowers too slack

buckling. When sailing in a moderate breeze (20 degree angle of heel is a good rule), the leeward upper should be just snug, without slack, but not tight. Continue sailing and check the lowers. Tighten the leeward lower then tack to check your results. The spar should be straight with 20 degrees of heel. Use the mast luff groove as a sight line. If the lowers are too loose, the mast will sag at the spreader when under load.

Check the headstay sag. The amount of sag increases exponentially with the wind and pulling the sail tighter with the sheet forces the headstay aft. Tensioning the backstay tightens the forestay and reduces headstay sag; decreasing sag flattens the genoa and improves upwind performance in heavy air. About 7.6 cm (3") of sag in a 15-knot breeze is acceptable. Maximum headstay tension should be about 16% of the wire's breaking strength. On a boat equipped with 5 mm (3/16") wire with a breaking strength of 2,115 kg (4,700 pounds), for example, the headstay tension is around 337.5 kg (750 pounds). If your boat is not equipped with an adjustable backstay, wait for a breeze and tighten the headstay until sag cannot be reduced by further tightening. This should provide an average setting that gives your genoa an acceptable shape under a wide range of conditions.(Better yet, install a backstay adjuster.)

Tensioning the backstay also increases mast bend which flattens the mainsail. When bending the mast with

RIG TENSION

Tensioning the rig until it's "drum-tight" puts tremendous loads on the hull. While this is an acceptable practice for racers, cruisers should opt for a slightly looser rig. Leaving some room for stretch in the wire provides a shock-absorbing effect when hit by a gust. A sure sign that the rigging is too tight: deformed or crazed fiberglass around the mast step.

RIG Tuning

an adjustable backstay, make sure the lowers are not under load and affecting the setting; adjust lowers if necessary. The forward lowers double as a babystay and can be tightened so that the mast bends slightly forward at the spreaders. If you are unable to flatten a deep mainsail in a moderate breeze, consider either increasing mast bend or recutting the mainsail. If you decide to change the bend, do this at the dock.

With tuning completed, replace the cotter pins with new ones. Use stainless steel pins and open to a minimum of 30 degrees, then wrap all exposed pins and turnbuckles with rigging tape.

DEFINITIONS

Lateral tuning: getting the spar to stand straight athwartships.

Rake: adjusting the forward or aft lean or tilt of the spar to control helm balance.

Bend: adjusting and controlling the fore and aft bend or curvature of the mast to change mainsail shape.

Weather helm: the rudder helm at a positive angle to the boat's heading. Some sailmakers recommend 3 to 5 degrees of weather helm when sailing upwind and zero when reaching.

Headstay sag: the distance the forestay is pulled aft by sheet tension measured from a straight line between the tack and genoa head fitting.

MAINTENANCE PRODUCTS

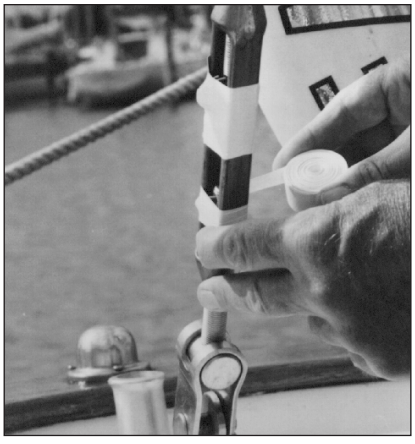
TRACK LUBRICANT

To reduce friction and prevent mainsail bolt ropes, slides or slugs and travellers from binding, you should apply a quality Teflon grease or specially formulated lubricant. Fastrac is a new product that is not soluble in fresh- or saltwater and works in a wide range of temperatures. To use, first thoroughly clean the slugs, traveller, etc. and apply a thin film of lubricant to the edges. To clean a mast that is already stepped, have your sailmaker make a small square plug of sailcloth dressed with an upper and lower crinkle and luff tape or slug that matches your mast. Attach this plug to the main halyard and a downhaul and hoist and lower it, repeating several times to clean the

groove. Wipe the bolt rope or slug clean, apply a generous coating of lubricant, and run it up the mast. Repeat three or four times, applying a fresh coat of lubricant between hoists. This should be repeated two or three times a season, depending on use. We cannot verify how well it works, but is was tested by major sail lofts in the U.S. and received high marks. A 14 ml (1/2-oz) tube sells for $8.95.

RIGGING TAPE

With mast tuning completed, you should now wrap all exposed split pins, spreader ends, turnbuckles and toggles with rigging tape. This not only prevents tearing and damaging sails, canvas or catching a line but saves your feet and hands from injury. One of the best rigging tapes available is Mariner's Choice ($10.50 for 5 m/15'). This unique tape contains no adhesive. When applied under tension it bonds to itself. To use, unroll about 7.6 cm (3") of tape, hold it against the turnbuckle and stretch the tape until the width is reduced by half. Spiral wrap the tape while holding the end. To remove, simply cut off with a knife or scissors. It leaves no adhesive residue and won't deteriorate in sunlight. The tape requires no surface preparation and even works under water. Available in black or white and in 10 cm (4") width for mast boots, it can also be used for electrical applications to bundle, join or repair wires and connections.



Sources of Additional Information

Books

Sailing Rigs and Spars by Matthew Sheahan, 160 pages, $31.95

Videos

Inspecting Your Rig, 85 min. Bennett Marine Video, $41.95

POWERBOAT RIGGING

HYDROFOILS

Foils offer a quick fix that improves handling, acceleration and planing on most boats.

Our 22-foot walkaround cuddy cabin has a modified deep-V hull that runs smooth, tracks straight and handles like a trooper in rough water. Powered by a 150-hp outboard mounted on an offset bracket, it performs well but is slow to get on plane and would fall off plane easily at lower running speeds, especially when loaded with all our weekend camping and fishing gear. When planing, the bow lifted high in the air blocking visibility. Overall, performance was exceptional at high speeds, except in tight turns where the propeller would ventilate. Such anomalies may seem minor to some owners but for us it was important we find a solution.

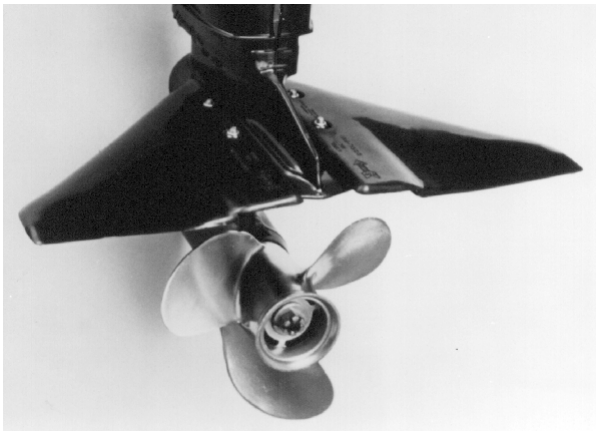
A hydrofoil stabilizer solves some common performance problems such as poor planing, engine cavitation in rough water or when cornering at high speeds, propeller slippage at high speeds, faster hole shots and porpoising at low speeds. Designed to lift and hold the stern on plane (lower the bow) and stabilize the boat, a foil forces the boat to plane faster and keeps it on plane at lower speeds. Better planing helps lightweight runabouts such as inflatables and utilities that need weight moved forward to plane. Hydrofoils also benefit larger fishing boats and cruisers that are sluggish out of the hole; getting on plane faster reduces bow rise and increases visibility. For pontoon boats a foil eliminates cavitation and propeller ventilation. Since there is less drag and the boat planes faster, fuel consumption decreases. Independent tests record fuel savings of 10% to 40%, depending on how the boat is used.

Hydrofoils function much like an aircraft wing. The top surface is longer than the bottom, forcing the water flow under the foil. High pressure beneath the foil pushes up to fill the vacuum, creating lift, keeping the bow down and stern high. This is accomplished without increasing drag or sacrificing top-end speed. The foil's wide wing span stabilizes a boat in turns. Side slippage and prop cavitation are eliminated by keeping the stern out of the water and the boat on plane.

These winged wonders come in a variety of designs and brand names: Doel-Fin, Hydro-Stabilizer, Nordic, Sting Ray and others. Made of heavy duty, injection-molded plastic, hydrofoils attach to the engine's cavitation plate. Most brands fit any manufacturer's outboard motor or stern drive from 1-1/2 hp to 300 hp on single or twin installations.

Working with another boating magazine, we installed a Doel-Fin hydrofoil. The boat was then tested by Mark Rotharmel, a 10-time North American powerboat racing champion and former Formula One racer. With the foil attached, time to plane and acceleration improved slightly. The effects of the foil were more noticeable at lower throttle settings. With less bow rise on take off, visibility was markedly improved. We could now easily maintain a plane with less speed and a lower rpm. Running at speed, the foil also decreased the running angle of the boat to the water; the bow dropped while the stern remained high. Engine rpm dropped by about 300, reducing fuel consumption. The foil also stopped cavitation when cornering. There was no increase in top-end speed and no noticeable drag.

Hydrofoil stabilizers can improve handling of most boats. Overall control varies depending on hull shape and engine horsepower. With a selling price of $100 or less, foils are an affordable option for any owner looking to improve boat performance.



INSTALLATION

Attaching a hydrofoil stabilizer to an outboard or stern drive unit is easy and takes about 30 minutes. All you need is a drill and bits, screwdriver and socket set or adjustable wrench. Depending on the model, the hydrofoil is either sandwiched between the aluminum cavitation plate or mounted on top of the plate. Following the manufacturer's instructions, line up the foil with the back edge of the plate. Using the foil as a template, drill through the plate. Insert a bolt to hold the foil in place and drill a hole on the opposite side. Hold the foil stationary with the bolts and drill the

remaining holes. Stainless steel bolts (provided) are inserted from the bottom up with washers and nuts on top. Aluminum is fairly easy to drill; if your drills are sharp, pilot holes are not required. On boats without power trim, reposition the manual pin setting on the engine slightly higher as the foil holds the bow down.

You should be aware that installing any hydrofoil may void the engine manufacturer's warranty. There is the possibility of damaging the lower unit should you hit a submerged object. Under normal use you shouldn't have any problems. We've been running our boat for three years without any noticeable damage.

POWER TRIM

When used correctly, power trim improves acceleration, reduces steering loads and increases planing speeds, top-end performance and fuel economy.

On most small-boat engine controls, the power trim button is located on the throttle control and easily operated in combination with the throttle. To trim in (or Bow Down) tilts the top of the engine away from the boat and moves the propeller closer to the transom. When you trim out (or Bow Up), the engine moves away from the transom and lifts the bow.

To plane a boat, begin with the boat fully trimmed in and the engine idling or running slow. This forces the bow down, the stern up and the boat planes quicker. Once the boat is on plane, slowly trim out and the bow rises. This reduces friction between the hull and the water, and the boat instantly gains speed. As speed increases, continue trimming until steering response is light and the boat is riding smooth and high. At wide-open-throttle, the engine should run in the middle of the RPM range as recommended in your owner's manual. If trimmed out too far, the propeller may ventilate. In extreme cases, the boat may porpoise: the bow of the boat pounds hard on the water, rising and falling in a rhythmical motion. Conversely, when the drive unit is trimmed in too far, fuel economy decreases, top speed drops and the boat may oversteer or loose stability.

When throttling down, trim in all the way. This brings the bow down, slows the boat and reduces strain on the engine and transom. When cornering at speed, you should also trim the motor in to increase stability and prevent cavitation. Experiment this summer with different trim positions to determine your boat's optimum performance settings under a variety of load and water conditions.

Keeping up exterior TEAK

Teak is one of the "perfect" woods. Oils inherent in this tropical wood help preserve it from the sun, salt and weathering. When left to season naturally, teak turns grey, gets dirty from airborne-pollutants, then mildews, but it doesn't rot.

Caring for teak demands a lot of effort and dedication. Some boat owners prefer to let it weather naturally. This is not a permanent solution, for eventually the teak dries out, checks and splits, especially around bung holes. When a more "yachty" finish is preferred, badly neglected teak handrails, hatch trim, railcaps and decks are easily and quickly restored to near-original condition. If you want your teak to last and look good, you have two choices of treatment: oil or varnish.

TO OIL OR VARNISH?

Teak oils and clear coatings or varnishes contain oils that replace the wood's natural oils lost during cleaning and bleaching (more on this later). Many products also contain mildewcides and ultraviolet (UV) inhibitors that withstand the damaging effects of the sun's rays for many months. What makes the two coatings distinctively different is application, ease of maintenance and finished appearance. Teak oils are absorbed into the wood, while successive coats of varnish are layered over the surface, providing a hard, thick, protective covering. Oil will not protect teak as well as a well-maintained clear coating, but it's a lot more user-friendly to apply and maintain. The greatest benefit of using oil is time. A season's worth of oil is easily applied in an afternoon. When the coating is in good condition, just scruff up the surface with a 3M Scotch-Brite pad and recoat. Some cleaning agents and oils require sanding prior to coating but, generally, this is only necessary when the surface has deteriorated and the teak begun to discolor. When teak begins to wear, all that's needed to restore the surface to like-new condition is a quick cleaning followed by sanding and overcoating.

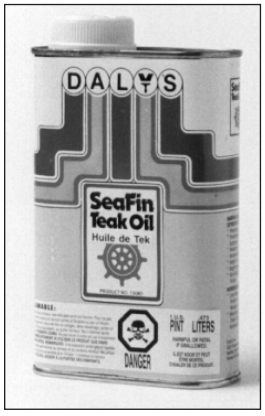
To obtain similar protection with varnish requires a buildup of a minimum of five coats with sanding and curing for at least one day between each coat. Once base coats are applied, however, varnished teak is actually far less labor intensive than oil — provided the coating is methodically maintained. Varnish requires a maintenance coat once or twice a season to maintain its gloss. But neglect varnish and it quickly sours. Nick or gouge a varnished surface and it must be repaired immediately, otherwise water leaches into the wood underneath and turns it black. Blistered or peeled varnish must be stripped off, sanded and multiple base coats reapplied. Varnished surfaces must also be cleaned regularly with a chamois or sponge to remove salt crystals, grime and pollutants that may pit the surface.

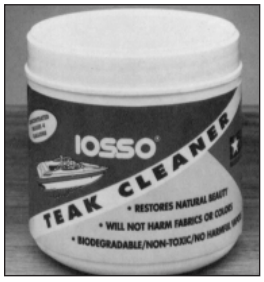
WOOD PREPARATION

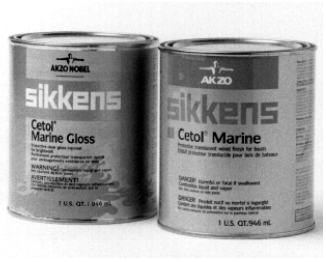
Blackened, previously oiled or mildewed teak must first be cleaned with a cleaner formulated for teak, then washed and sanded to remove the raised grain. The myriad teak cleaners on the market are divided into detergents, bleaches and alkaline caustics with acid neutralizers. Some are one-step cleaners. Others, such as Boat Armor's Unique Teak Cleaner, are a two-part system. Cleaners remove dirt, mildew stains, black algae and oils and restore teak to its original golden color. An optional brightener bleaches the wood and gives a brighter, more uniform color.

All cleaners are applied by first wetting the wood, spreading the cleaner and scrubbing. For stubborn stains, rub the surface with a stainless steel scrub pad, such as Boat Life Scrub-All or Star brite Magic Scrub. Similar to a pot scrubber, except made of continuous filament stainless steel, these pads are guaranteed never to corrode or wear out. Use these pads with care. Wet teak is extremely soft and if scrubbed vigorously wears away the soft top grain of the wood, leaving shallow ridges in the teak. Another alternative to stainless scrubs is to use a 3M Scotch-Brite pad. When using any abrasive, always scrub with the grain or you'll create severe cross-grain scratches. After scrubbing, let the wood dry, then sand uneven surfaces with 220-grit paper and rinse again. Always thoroughly rinse the wood after using cleaners and wear protective clothing and rubber gloves.

Some cleaners are extremely harsh; Iosso Teak Cleaner is an example of a newer user-friendly cleaner. A one-step, biodegradable, non-toxic powder, it does not contain chlorine, bleach or acids. It's powerful stuff for not only does it clean teak, it apparently also removes varnish and old stain, yet will not harm gelcoat and other finishes or fabrics. After mixing with water, brush the solution on the wood then leave to soak for about 10 minutes, reapplying as needed to keep the surface wet. Rinse the







Products for teak care include a broad selection of cleaners, brighteners and oils.

wood, then let dry for at least 24 hours before oiling or varnishing. A 473 ml (16 US oz) jar makes about 15 litres (4 US gallons) and costs $15.50.

In preparation for oiling or varnishing, let the teak dry after cleaning, then sand lightly (if necessary) with a medium-grit paper. Avoid using a fine-grit sandpaper as it fills the teak pores with sanding residue and the coating won't soak into the teak. After sanding, vacuum the dust residue, then carefully wipe the surface with clean, lint-free rags. A brush will pick up any sanding residue hiding in the nooks and crannies. Protect surrounding gelcoat from accidental spills with plastic held in place with a solvent-resistant tape such as 3M Masking Tape #226. Oil will permanently stain gelcoat; remove any spills immediately with a rag dampened with mineral spirits or Interlux Fiberglass Paintoff or other paint remover recommended for gelcoat. Some teak cleaners will also remove spilled oil. Remove previously varnished surfaces either by sanding or using a chemical stripper that's safe for use on gelcoat.

OILY SOLUTIONS

Chandlery shelves are crowded with a broad assortment of teak oils. More popular brands are Cetol Marine, Daly's, Perma-Teak, Teak-Brite and Star brite Teak Oil. A descrip-tion of each of these products follows. (Another top-rated oil is Armada, a fairly new teak finish manufactured in Concord, Ontario, that is readily available in the U.S. but not yet in Canada.) Because of the inherent nature of teak oils, some products discolor the wood and may be offen-sive. When applying a new coating, manufacturers recom-mend doing a test patch first, applying two or three coats on a scrap of teak.

Cetol Marine is one finish that gives a slightly orange hue to the wood. Based on Akzo Sikkens exterior house products, Cetol is an oil alkyd resin containing ultraviolet inhibitors. A favored oil for many boat owners, Cetol requires minimal prepping before oiling. Surface preparation for new wood requires wiping with an acetone-dipped rag to remove oils, followed by a sanding with 120-grit paper. For weathered or previously oiled teak, use teak cleaner to remove dirt and oil, then sand. Application instructions suggest using a long-hair bristle brush, but many users get good results with a foam brush or sponge. Apply three coats at 24 hour intervals without sanding between coats. For a smoother finish, you can sand after the third coat and apply another. Cetol is now offered in a gloss finish that goes directly over the second coat of the original finish; two coats are recommended. Maintaining

exterior TEAK

either of the Cetol finishes requires little effort. If the wood is in good condition, just clean the surface with a mild detergent, scrub with a Scotch-Brite-type pad, rinse and let dry. The gloss finish needs a light sanding with 220- to 320-grit paper prior to overcoating. Depending on use and environmental conditions, a once-a-year cleaning followed by a single touch-up coat is all that's needed to keep teak in near-original condition. A 946 ml (1 US quart) can sells for $23.95 and $6 more for the gloss; 3.78 litres (1 US gallon) is $74.95.

Star brite's teak system includes a cleaner, brightener and choice of oils. The acid-free cleaner does not raise the wood grain so no sanding is needed. Teak Brightener is the second step in restoring badly weathered teak. Rubbed into the wood, it brightens teak without scrubbing. Star brite's petroleum-based Teak Oil contains ultraviolet absorbers and dries quickly. The three-component package sells for less than $35. The more advanced Tropical line of teak oils and sealers comes in two colors and requires only one coat for year-round protection.

BoatLife's Teak Brite three-component teak care system includes a one-step cleaner, brightener and oil. The wood is first prepped with the powdered cleaner, then oiled. As the cleaner does not raise the grain, no sanding is needed after cleaning. Teak Brite oil is a mixture of oils, resins and paraffin oil. The first coat is applied after the teak has dried for 24 hours. Three coats are recommended, allowing a drying time of two hours between coats. Mid-season cleaning with the acid-based brightener followed by a new top coat is all that's needed to restore the finish.

Daly's SeaFin is a single-part system used by many boatbuilders for teak decks or interior floors. Produced in the U.S. Northwest, SeaFin is a petroleum-based product containing a UV inhibitor. Initial application is more laborious than most oils, but the long-term results are worth the effort. When correctly applied, you will never need to scrape or strip again. Unlike other oils, applying SeaFin involves sanding the oil into the wood. It sounds messy, but in reality is quite easy. First sand bare teak with no finer than100-grit paper. Using a roller or brush, coat a small section at one time. Leave for 15 minutes, wet sand with 400 grit, leave for 15 minutes then wipe up with cheesecloth. Continue coating then sanding until all teak is covered. Let dry for 24 hours. Reapply, using the same time frequency, wet sanding with 600-grit paper, until you have a buildup of four or five coats. Wet sanding heats the oil so it penetrates better and creates a very fine grit that when rubbed into the pores of the wood, forms a chemical bond. A modified oil, SeaFin dries to a hard, smooth finish that won't chip, peel or blister. Upkeep is minimal. To refinish, simply wipe on, leave for 15 minutes, wet sand, then wipe up without letting cure. The manufacturer recommends a maintenance coat spring and fall. At $14 for 473 ml (1 US pint) or $21 for 946 ml (1 US quart) it's also very economical. For large deck jobs, 3.78 litres (1 US gallon) sells for $60.

Developed for the harsh Florida climate, **Perma-Teak** is a water-based acrylic polymer with UV filters. Preparation of bare or previously oiled teak involves washing with a 3 to 1 solution of chlorine bleach and water and scrubbing with a stainless steel or Scotch-Brite-type pad. For previously oiled surfaces sand with 80-grit paper before washing. The manufacturer recommends applying One-Step-Prep, a chemical cleaner and brightener, after washing. A thin coating of Perma-Teak is then applied to moist teak, "wet on wet," using a foam brush. When the first coat is dry to touch, about 1/2 hour, apply a second thin coat. It goes on milky but dries to a clear finish in about one hour at 23 C (75 F). Water-soluble, any spills on gelcoat, painted surfaces or seam compounds are wiped clean with a wet cloth. Like many oils, Perma-Teak should not be applied in direct sunlight. If you cannot avoid the sun, cover the coated area with plastic wrap to prevent the oil from evaporating. Available in four tones — Gold, Classic Dark, Mahogany and Clear gloss — the Gold gives the teak a slight yellowish tint. Applied once a season, a quick cleaning with bleach and water and a light scrubbing is all that's required between coats. Perma-Teak comes in a 473 ml (1 US pint) container for $25.50 or a 946 ml (1 US quart) for $37.95. A 946 ml container of One-Step-Prep costs $17.75.

VARNISHING TEAK-NIQUES

To oil is human, to varnish divine, or so it would seem to many "purists" who would rather quit than switch. But because teak is an oily wood, varnishing becomes more of a challenge. The natural oils in teak that help preserve it can cause problems during and after varnishing if the surface is not prepared correctly. Problems such as slow drying, discoloring, blistering and peeling are not uncommon. (Not all varnishes are recommended for use on teak; check the label before buying.)

Sand bare wood smooth with 80- to 120-grit paper, then wipe with the recommended thinner to remove surface oil. To varnish teak that was previously oiled, apply a chemical cleaner to remove the oil. To increase penetration of the varnish into the wood, thin the first coat of varnish up to 40% by volume with the specified brushing liquid. This should seal the wood and provide a foundation for successive coats. Let dry overnight then lightly sand the surface with 220-grit paper. Remove sanding residue with cheesecloth or a lint-free rag, damp-ened with brushing liquid. Apply additional coats of full-strength varnish, letting dry overnight and sanding between coats. If time permits, plan to apply seven to nine coats of varnish on bare teak. The more coats, the more long-lasting the finish. A twice-annual recoating of varnish is all that's needed to keep teak looking shipshape.

Mounting DECK hardware

Nothing contributes more to cabin discomfort than leaking deck fittings. As a boat ages, vibration causes fittings to loosen, especially in areas of high stress: coamings, hull-to-deck joints, chain plates, portholes, handrails, stanchion bases, cleats, sheet stoppers, mast steps and other hardware that penetrate the deck or hull. Improperly bedded thru-bolted hardware often leaks through the fastener holes. If the deck is made of plywood or cored with balsa, the layers become spongy and eventually delaminate. To prevent deterioration of the deck material, leaky cleats, stanchions and other hardware should be rebedded as soon as possible.

If you suspect a leak, pinpointing the source may be difficult. Hose down the deck or wait for a heavy rain and from inside the cabin look for telltale water droplets. Sometimes leaks are not as obvious. If you can't find the source, go on deck and examine the sealant around deck fittings. With maturity, sealant dries or cracks causing water to migrate into the cabin. Once you've located the source of the leak, determine the best way to correct the problem. In some situations, all that's needed is to scrape away the old sealant and add new material. Sometimes repairing the leak requires complete removal of the fitting and rebedding with new sealant.

TIPS! When installing extra cleats, the general rule of thumb for determining size is 2.54 cm (1") of cleat length for every 3 mm (1/8") of line diameter.

THE RIGHT SEALANT FOR THE JOB

A sealant forms a watertight gasket between a fitting and mounting surface, preventing water from seeping under the fitting. Also known as caulking or bedding compounds, sealants formulated for marine use are divided into three general types: silicones, polysulfides and polyurethanes. Each kind is designed for a specific task, either sealing, bedding or bonding. The key to mounting hardware successfully is to select the right sealant for the task at hand. A sealant compound seals surfaces from water and moisture penetration and provides a foundation or "bed" for mounting hardware. Adhesive sealants are generally polyurethane-based and bond and seal hardware in one application. While silicone is generally only used as a sealant, many polysulfides and polyurethanes are used both as a sealant and an adhesive. Marine adhesive sealants are moisture-cure compounds that contain anti-mildew agents and ultraviolet filters to prevent yellowing. Sealants come in four colors: white is used for many topside applications; clear for concealment; mahogany for brightwork; brown and black for hulls; black for teak decks. Most sealants bond to fiberglass, wood, metal, glass and themselves. Check the label before using as some products are not compatible with certain materials.

Of the three sealant types, silicone is the most common. It adheres well to fiberglass, wood, metal and some plastics. Because of poor adhesion qualities, silicone compounds function as sealants rather than adhesives. Silicone is used in formed-in-place gasket applications where the compound is held in place with fasteners, such as bedding cleats and other deck hardware that may need periodic replacement. It's also used for mounting plastic fittings that would react with other sealants or for sealing portlights and hatches or caulking around the shower or sink in the head. The single greatest advantage of using silicone is its fast cure time. Silicones are tack-free in about 30 minutes and fully cured in 24 hours. The biggest drawback of silicone is it cannot be sanded or painted once cured. (The exception is BoatLife Sandable Silicone that is one of the few sandable silicones suitable for teak decks.) Where painting is necessary, paint all areas before using as any sealant residue will prevent painting of the surface later on. Because of silicone's fast cure time, all tooling and clean up of ragged edges must be done immediately after application.

TOOLS

Caulking and gun
Sharp knife
Putty knife, screwdriver
Scraper
Masking Tape
Clean dry rags
Filleting stick or plastic spoon
Solvent

Polysulfide-based sealants double as both sealing and bonding compound. They provide a flexible, watertight seal along with a strong adhesive bond for bedding hardware such as portholes, windshields, keel plates, cleats, mast plates, primed teak deck seams, instruments — any hardware that may require removal later. Polysulfides are used above and below the waterline and bond extremely well to wood, fiberglass, metal and some plastics, such as Delrin, nylon or Marelon, but never to PVC, Plexiglas, Lexan or ABS. Polysulfides are good compounds for bedding teak decks and fittings

around fuel systems and refrigeration equipment as they are resistant to teak cleaners, oil, gasoline and diesel fuels. Cure times vary. Most products are generally tack-free in 1 to 3 days depending on quantity applied, temperature and humidity. Fully cured polysulfides are sandable and paintable with no special priming required.

Polyurethane sealants contain a strong adhesive that cures to an extremely tough but flexible seal. They are used to permanently seal and bond joints above and below the waterline that are subject to structural movement, such as hull-to-deck joints, ballast keels, bulkheads, hatch frames to deck, radar arches, swim platforms and transoms. Once a polyurethane sealant fully cures, adhesion is virtually permanent and removal requires sliding an Exacto knife to separate the joined surfaces (heating the blade helps speed the process); in extremely stubborn cases, a chisel and hammer works well. For this reason, never use polyurethanes on seams or to bed hardware that will need periodic replacement, such as thru-hulls, transducers or winches. Polyurethanes should also never be used to bed plastic fittings, teak decks or fuel fittings as teak cleaners and fuel spills soften some compounds. Check the label and test a small area for both compatibility and resistance. Tack-free in 6 to 48 hours, curing times vary from 3 to 14 days, depending on temperature and humidity. For a faster cure, try Bostik 920 FS or Sikaflex-241 that cure in less than 36 hours at 22 C (72 F). Polyurethanes are sandable after curing and can be painted.

There are also some new hybrid compounds that combine the best qualities of the three above varieties. BoatLife's LifeSeal, for example, combines the adhesive benefits of polysulfide with the working properties of a marine silicone. It adheres well to all surfaces including Lexan and ABS and can be removed without damaging gelcoat. Another specialized product is Davis Slick Seam, a fast-curing compound intended for seams of wooden boats that adheres to wet, dry or oil-stained surfaces and is ready for painting in half an hour.

BEDDING HARDWARE

To stop leaks when time is limited, a temporary stopgap is to run a bead of sealant around the perimeter of the fitting. A more thorough job requires removal of the hardware and rebedding with new sealant.

To access deck hardware on fiberglass boats, you'll need to remove the overhead liner first and any wood backing plates. Removal of the old hardware may prove challenging, especially if the bolts are corroded. Try a penetrating oil to remove seized bolts and if that fails, cut the bolts with a hacksaw. If the screw head strips, drill and tap, screw another fastener in the hole and try again.

All surfaces must be clean, dry and free of dust, grease or any residual sealant. Use a sharp chisel, sandpaper, file, wire brush or solvent to remove any dirt, salt, corrosion, oxidation and paint from fitting, fasteners and mounting surface. Replace any corroded fasteners. When bedding hardware on a painted surface, either scrape the paint off the contact area or use a caulking specially formulated for painted surfaces. Cer-tain surfaces, such as Lexan, ABS and other plastics, may require additional preparation. No primer is usually necessary, except on oily woods such as teak.

Dry fit the hardware and fasteners in place without bedding compound and using a pencil, trace around the fitting. Drill new fastening holes if necessary. Remove and clean both mating surfaces and fasteners with a quick drying solvent (acetone, for example), keeping excess solvent away from paint and plastic surfaces. To facilitate clean-up, mask off the area using solvent-resistant tape. Allow an extra 3 mm (1/8") around the fitting when taping.

Cut the nozzle of the caulking tube or cartridge at a 30-degree angle and apply a generous bead of sealant approximately 6 mm (1/4") in from the penciled edge. Where possible, it's best to insert the fasteners in the fitting first, coating both surfaces, under each bolt head and threaded end with sealant, then install the fitting. Installing the fasteners after positioning the fitting is not only messier but can cause voids in the sealing compound and potential leakage through the fastener holes. Always install thru-deck fittings with oversize washers or backing plate to distribute the load. On thru-bolted installations, tighten fasteners with a socket or wrench on the nuts rather than turning the bolt or machine screw. The threading action pushes the sealant out of the hole; tightening the nut compresses the sealant. Tighten down each

bolt or screw equally in stages until there is only a slight gap, about 3 mm (1/8") between the mating surfaces. Remove any excess sealant that has squeezed out from the joint using a finger wrapped in cloth moistened with mineral spirits or other safe solvent. The bottom of a plastic spoon or a fillet stick, dampened with solvent and run over the seam, gives a smooth, uniform edge. The concave edge also encourages water runoff. Scrape up any excess material pushed to the sides with a 2.54 cm (1") putty knife, then clean with a solvent that will not damage the gelcoat or paint.

Since polysulfides and polyurethanes take anywhere from one hour to several days to fully cure, you have plenty of time to finish the job. Remove the tape (if used), before the sealant cures, pulling it slowly at a 90-degree angle to the seam. Wait for the sealant to fully cure then take up about 6 mm (1/4") to 12 mm (1/2") turn on the bolt or screw to hold the surfaces together. This will compress the sealant material and ensure a watertight seal. Use a knife to trim any cured silicone caulking, followed by a file to remove the residue. Remove polysulfide and polyurethane sealant material with sandpaper. Seal the tube or cartridge with a nail, screw or Marrette plug

Many thanks to Jeff Tiger of Star brite and 3M Canada for assistance in compiling the information on marine sealants.

COMPARISON CHART of MARINE SEALANTS

TASK	3M 101	3M 5200	BoatLife LifeCalk	BoatLife LifeSeal	BoatLife Silicone Rubber	BoatLife Sandable Silicone	BoatLife Polyurethane	Bostik 920	Bostik 920 FS	Davis Slick Seam	GE Silicones Marine	Rule Elastomeric Sealant	Rule Penetrating Sealant	Sikaflex-231	Sikaflex-240	Sikaflex-241	Sikaflex-290 DC	Sikaflex-292	Sikaflex SEA-L	Star brite Marine Silicone	Star brite Boat Caulk	Star brite 8200
Structural bonding		•		•			•	•	•						•			•				•
Repairing or bonding to fiberglass		•		•			•	•	•					•	•			•				•
Bonding keels, motor mounts		•					•	•	•						•							•
Bedding wood trim	•		•	•								•						•	•			
Bedding hardware above waterline	•		•	•	•				•			•		•	•	•			•	•	•	
Bedding hardware below waterline	•		•	•								•		•	•	•			•		•	
Permanent bedding of hardware		•					•	•	•						•			•				•
Bedding/sealing hatches, vents, portholes	•		•	•								•	•	•		•					•	
Bedding plastics	•		•	•								•		•		•				•	•	
Bedding ABS, Plexiglas, Lexan (check)	•			•								•		•		•				•	•	
Gasketing exhaust systems					•						•									•		
Sealing refrigeration systems	•		•									•	•								•	
Electrical insulation	•				•						•									•	•	
Sealing/bedding instruments	•		•	•	•						•		•						•	•	•	
Sealing sink, shower					•						•									•		
Sealing windshields	•		•	•								•	•	•	•	•			•		•	
Replacing rivets, mechanical fasteners		•		•			•	•	•									•				•
Sandable and paintable	•	•	•			•	•	•	•			•	•	•	•	•	•	•	•		•	•
Sealing teak decks	•					•															•	
Caulking wood seams										•							•					
Polyurethane		•		•			•							•	•	•	•	•	•			•
Polysulfide	•		•																		•	
Silicone				•	•	•					•									•		
Elastomeric								•	•			•										
Cure time (maximum days)	-	7	3	-	2	2	4	-	3	-	-	5	5	10	7	4	1	1	1	-	2	3

Note: This chart excludes products developed after July 1995