#2 2007

DIY BOAT OWNER

THE MARINE MAINTENANCE MAGAZINE

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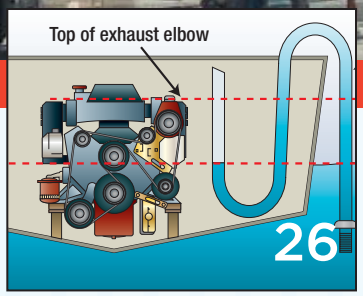

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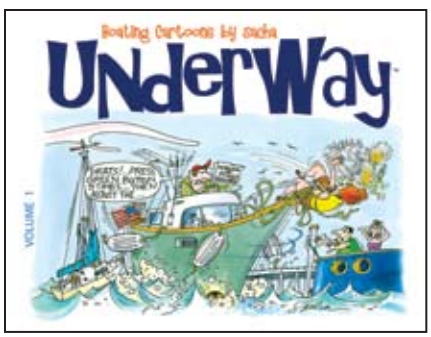
Edited by Jan Mundy

Laughter Exchange

Longdog Publishing's boatingcartoons.com is a new website catering to the boating enthusiast's appetite for nautical humor that features the sail, powerboat and recreational fishing cartoons of DIY's cartoonist, Sacha Warunkiw and also offers a platform for boaters to tell their funny stories.

In 300 words or less, would-be humorists can relate their stories about boating experiences and submit then, along with a photo or drawing that helps describe the experience to submissions@boatingcartoons.com. At present, the "Humor" button on the website takes visitors to five jokes but, knowing boaters, they will be scrambling to get their own funny experiences told. Longdog Publishing's editor will choose five stories a month for cyber publication. (As this is a family site, the editor will ensure all content is in keeping with family values and good taste.) Boatingcartoons.com will retain all stories submitted, hoping to use many of them in book form later. All successful submissions will be rewarded with a free, autographed copy of "Underway" Volume 1, Longdog Publishing's new release of Sacha's book of boating cartoons. "Underway" is also available to purchase online at essence-bookstore.com.



This hilarious look at the lighter side of boating is testament to the author's comic genius.

Tell us What you Want

Your opinion is of great value to us in our search for improved editorial content and design. We are asking for your help in providing us feedback. Please take a few minutes to fill out DIY's online reader survey at diy-boat.com. Your response will be anonymous and information kept confidential.

Quips and Quirks

A few of the latest ideas in new boat design.

Interior cabinetry and cabin soles in the newest offering from Hunter Marine are made of maintenance-free, scratch and scuff resistant veneer over plywood with an aluminum oxide finish. No need for oil or varnish in this interior.

Winner of this year's Innovation Awards in the Inboard and Outboard Cruisers cate-gory at the Miami International Boat Show, the Isle Runner from Glacier Bay features an offside port entry and a convertible, sunken cockpit galley.

Island Packet's new PY Cruiser uses a renewable alternative to oak, cherry and mahogany known as Lyptus, a hybrid hardwood made from Eucalyptus trees, grown on plantations in Brazil and that reach harvest size in just 15 years.

There's no mystery here as to which valve operates what pump and it's all nicely bundled in a compact, well-engineered manifold.

Deluxe anchor locker has switchable fresh and raw-water washdown and storage for a retractable, coil hose. Just be sure to replace the metal nozzle with a plastic one before you drop it and chip the deck.

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Boating Courses Expand

United States Power Squadrons (USPS) University has opened its doors with a series of courses, seminars and on-the-water training for boaters.

The university offers four levels of certification: Inshore, Coastal, Advanced Coastal and Offshore. Each certification's requirements involve the completion of courses, seminars and practical demonstrations of nautical skills. Within the various certificate levels, students will also be required to take prescribed updated courses from among the organization's traditional electives; namely, cruise planning, electronics, engine maintenance, instructor development, sail and weather. In addition, there will be new required course offerings in such topics as marine radio, navigational electronics, offshore weather and offshore seamanship.

The over-all concept under which these programs have been developed is the university's variety of "diplomas" in the form of diversified Boat Operator Certificates. The need for these certifications is clear. Insurance companies, charter companies and prospective passengers are increasingly concerned with the skills of the skipper. Certified boaters represent a far lower risk to all. Across Europe, International Certificates of Competency (ICC) are now being issued to address this concern. Eventually, such certification may be required in the U.S. but, in the meantime, USPS University is designed to bridge that gap.

For information on the USPS University state-approved online boating courses, seminars and on the water training log onto usps.org.

Streakless Waxing

Further to the article in the 2007-#1 issue titled "Detailing 101," written by DIY's editor, Jan Mundy, I have been cleaning my boat for years and always end up with a streaky wax job. Every spring I wash the boat to remove old wax, apply Boat and Aircraft wax with a cloth and buff it off with a wool pad and buffer then follow with Collinite's paste wax using the same application techniques.

Barry Freeman, Vancouver, British Columbia

DIY Replies: According to the techies at Interlux and 3M Marine, improper surface preparation and application gives wax a streaky or blotchy look. Any oxidation on the surface that is not removed by compounding causes uneven absorption of the wax, leaving a streaky appearance. Other causes are uneven application and/or putting the wax on too thick, applying it to a wet or damp surface or to a surface that has chilled to below 45F (7C). Another factor is the formulation itself. Different formulations suffer varying degrees of streaking. Always remove surface oxidation before waxing, apply a thin coat of wax to a dry surface and you should eliminate streaks.

What's Cooking?

For some unknown reason, standard equipment on the number one party boat did not include a barbeque, until this year. This clever pontoon boat builder tastefully mounted a barbeque on the stern deck in its 2007 models.

Refitting one on an existing boat is easy. Simply mount a barbecue to a pedestal base purchased from your local chandlery and fasten to the deck using Weaver Toggler SnapToggler anchors (weaverindustries.com).

EPIRB Ban

As of January 1, 2007 the operation of Class A, B and S Emergency Position Indicating Radio Beacons (EPIRBs) is prohibited. These regulations apply to EPIRBs that transmit a distress signal on the 121.5/243 MHz frequencies.

If you own an EPIRB, check the class or type of your beacon carefully since both the illegal 121.5 MHz and the authorized 406 MHz devices contain a 121.5 MHz homing signal used for direction finding purposes. Also, 121.5 MHz man-overboard devices are not affected by these regulations and are still legal for use. Replace the affected beacons with Category I or II 406 MHz beacons as soon as possible. When taking obsolete beacons out of service, be sure to remove and properly dispose of batteries to prevent future false alerts from occurring.

Be a Movie Critic

Discover Boating has posted a short movie dubbed "Good Run" on YouTube (discoverboating.com/viral/youtube.aspx). It's a nostalgic look at boating through the ages of one individual. If after watching this movie, you're deeply stirred and would like to comment, email your accolades or criticism to tech@diy-boat.com.

Morse Code Gets the Ax

I once considered getting a ham license but was stymied by the daunting Morse code test. For cruisers who have delayed getting an amateur radio license because of the Morse code requirement, your patience has paid off.

According to an article in the March issue of the Seven Seas Cruising Association "Commodores' Bulletin" (ssca.org), the Morse code requirement is history as of February 23, 2007.

If you don't already have a ham radio license and you're testing for a General Class or Extra Class license, you need only be prepared to answer 70 multiple choice high school level questions that, with a little preparation, it should be easy to get a passing score. If you currently have a valid Certificate of Successful Completion of Examination (CSCE) you can upgrade to a General or Extra Class License by paying a US$14 fee at an examining center. A list of examination schedules and locations are found on arrl.org/arrlvec/examsearch.phtml or w5yi.org/exam_locations_ama.php.

First Responders

If you live, work or are engage in recreational boating activities, the Coast Guard wants to hear from you. Modeled after a program that was setup during World War II, America's Waterway Watch (americaswaterwaywatch.org) encourages boaters to report suspicious behavior or activity to the Coast Guard and/or other law enforcement agencies.

Should you encounter anything suspicious, the Coast Guard asks that you do not call on a VHF radio but to use a cell phone and dial the National Response Center toll-free at 877-24WATCH or call 911 and ask for the Coast Guard or the FBI.

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WE FOLLOW IBWT'S ETHICS GUIDELINES

DIYer's Manifesto

DIY contributor Jim Discher (most recently, "Buying Right: Navigating the Electronics Maze," in the 2007-#1 issue) sent this to us, a fittingly summation of the average do-it-yourself project.

1. Just because you are hiring or paying someone to do a job, does not mean you are going to get a better installation than what you could do yourself. First, no one cares more about your boat than you. Secondly, you hire a company based on their reputation or experience. However, your installation depends on whether they send out the A Team or the B Team.
2. Every install you do yourself will teach you something about the boat that you are betting your life on every time you head out of the harbor. What are you going to do when that system fails and your technician is nowhere in sight?
3. You can break one out of three and still come out ahead. Early on as a boat owner, I figured out that you are paying $50 or $85 or $105 per hour whether your friendly mechanic is watching a pump run or turning wrenches. If you want to run a tight ship and minimize your cash outlay, do as much of the grunt work yourself and hire the pros for the most technical stuff. Chances are, if it's grunt work, they're going to have their assistant do it anyway.
4. Consider doing the install yourself and pay a professional to audit your work and make any necessary corrections and adjustments. Running cables properly can be time consuming but isn't difficult. Why pay someone to do the stuff you and your boat pal can knock out in a day and then be able to rock back with a couple of cold ones and admire your handy work along with the bragging rights and war stories that come with the effort.

If you wait to engage a pro to review your work, you miss the advantage of having their eagle eye at the start of the project. Consider meeting with the professional before you begin so that he/she can offer an assessment of the potential obstacles you may encounter along the way of DIYing it. A professional's experience tapped at the outset can save a great deal of angst after the fact.

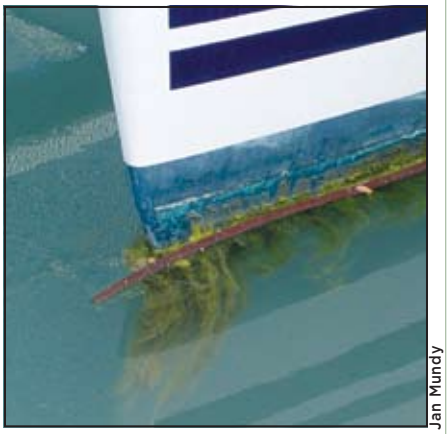
Source for Used Sails

Quantum Sails has launched an online store for slightly used and reconditioned sails from its lofts at quantumsails.com/products/refurbished. Sails are organized according to rig and each listing includes a description, rating (1 to 10), dimensions, photo, location and price. Visit the website often as inventory frequently changes.

Busting Barnacles

Q: We are in negotiations to purchase a catamaran and the hull bottom has not been painted for three years and is loaded with barnacles. Can this cause damage to the hull or is it just a performance issue.

George Marasco, Green Cove Springs, Florida

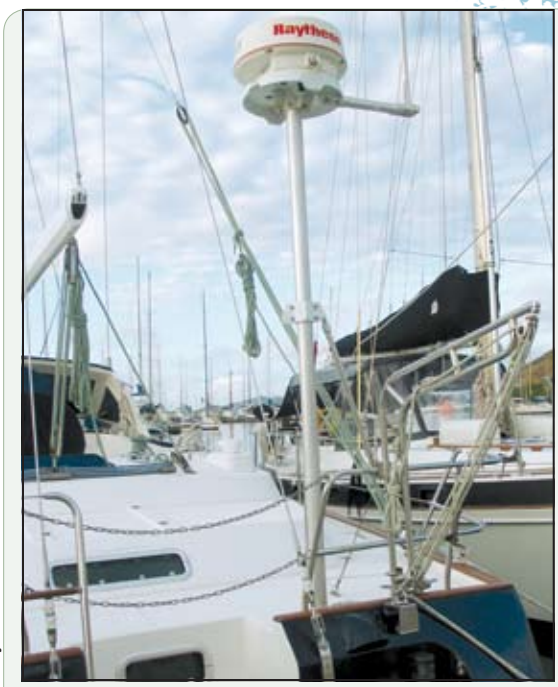


Jan Mundy

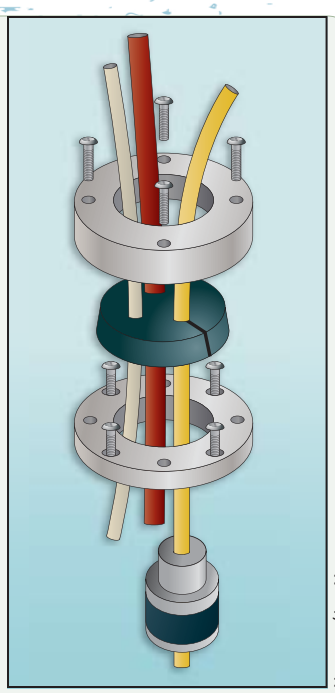
Time to paint? Though not a structural concern, a well cared for hull bottom does affect a boat's speed and fuel economy.

A: Barnacles don't cause structural damage to fiberglass but they can cause cosmetic damage to gelcoat. The natural adhesive they secrete can stain and etch the surface. There is also the danger of minor gelcoat damage from whatever mechanical process is used to remove the barnacles (scraping, sanding, etc). Be careful to avoid gouging the surface while scraping off the critters. When sanding to remove residual paint and flatten the barnacle root, use only a dual action (random orbit) sander held flat to the hull surface. If used properly, this style of sander won't scallop the surface. To preserve the gelcoat, I would not use sandpaper any coarser than 80 grit. By the end of this process, the bottom should be clear of old antifouling paint and barnacles. You'll probably notice a circular residual stain left by each barnacle but, as long as the bottom is smooth and 100% sanded, it's ready for new coatings. If the bottom is dry (according to a moisture meter), this is also an opportunity to apply an epoxy barrier coat (if one doesn't already exist) prior to painting with new antifouling.

Nick Bailey



Jan Mundy



Newmar/Joe Vanveenen

(left) DIY's electronics' specialist prefers a mast-mounted radar scanner rather than a transom post mount (shown above), that, with reduced height, diminishes range. The mast creates some shadowing and the microwave radiation from the unit may cause personal harm. (right) Newmar DX Series waterproof deck gland allows feeding of cable with connector attached.

Radar Set Up

Q: have a 1988 38' (11.5m) Legend. I want to install a 2kW radar to go with my Raymarine C80 and need to know the best place to mount it. On the split backstay or the mast? I am leaning toward the backstay as it's easier to route the radar cable and disconnect when the mast comes down for winter lay up. If the mast, how far up the mast should I mount it and how would I cut and reconnect the radar cable.

Lawrence Reiber, Toronto, Ontario

A: The best place to mount the radar scanner is around the spreaders and level on the mast. Here it's reasonably accessible, as any further up amplifies pitch and roll in sea conditions. You can also use radar leveler mounts to keep the scanner at the exact horizontal position, which improves performance. This added height also gives you greater radar range than just above deck level at the stern. While stern mounts on posts and backstays are popular, you also have some mast shadowing, which loses a lot in range, as well as having microwave radiation close to people and the damaging affects on eyes is well documented. Thinking about the mast coming down is a reasonable precaution. In reality, it's relatively low risk in a cruising boat and will probably be the least of your worries. Fortunately, you can overcome the cutting of the radar cable issue. Use one of the specially designed junction boxes, such as the Newmar Thru-dex or use the Newmar CCX or DX Series waterproof deck gland (newmar.com) that allows passing the cable plug completely through the gland as well.

John Payne

Fuel Filtering Limits

Q: The previous owner of my 1974 Grew 245 replaced the fuel gauge with a fuel flow meter. An inline fuel filter was also installed on the fuel line leading from the fuel tank to reduce the chance that any particles would damage the operation of the flow meter. I have experienced several instances where the filter has caused fuel starvation even though the filter appears to be relatively

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clean. When this occurs, I replace the filter and the engine runs fine again. Can you suggest a different type of filter that will prevent this problem from occurring so frequently?
Cam Burns, Kingston, Ontario

A: You could put a prefilter in front of the existing filter to try and filter out the bigger debris leaving the finite filter for the small particles. I would suggest something like the Mercury spin on filter kit (35-802893Q4, US$75) that is easily replaceable with a new spin on cartridge (35-802893Q, US$14). This filter separates water from the fuel and keeps any particles over 35 microns out of the fuel system. When adding more filters to the fuel supply system, it's imperative to keep the vacuum level in the fuel supply system below 2" (50mm) hg or vapor lock could result. The vacuum value can be checked with a digital vacuum gauge teed into the supply hose and the engine run at wide open throttle.
Steve Auger

Outboard Breathalyzer Test

Q: I've been advised that the oxygen sensor on my 2001 200-hp Yamaha OX outboard needs replacing at a cost of more than US$500. Is there a diagnostic test for the oxygen sensor to determine if it really needs replacing or is this simply routine maintenance?
Doug Wade, Langley, British Columbia

A: An oxygen sensor mounts in the exhaust system of an electronic fuel injection (EFI) engine and is used to determine if the engine air fuel ratio is correct. This keeps engine operation and performance at optimum yet within EPA guidelines. The EFI computer uses information from the oxygen sensor to adjust how much fuel the injectors supply to the engine. Most EFI outboards have a self-diagnostic capability. This means that, if the oxygen sensor fails, the EFI system computer logs a fault and either activates a check engine light or warning horn. This usually is accompanied by poor outboard performance. Check with your dealer to see if the EFI system on your engine can be checked for faults with a scan tool or laptop EFI diagnostic program to determine if any system has failed. It's more common for a wiring harness or terminal failure to cause a fault than a failed sensor. Oxygen sensors are usually removed, cleaned and reinstalled with no ill effects; however, you would need a service manual to perform any service procedure safely.
Steve Auger

Failed Frost Plug

Q: My 5.7L Mercruiser has a corroded, leaking frost plug that's in an awkward place beneath the oil cooler. I've done a bit of Internet research on removing and replacing the frost plug but, before I purchase the special tool and perhaps rent an air hammer, I thought I would hear what you have to say about the removal and replacement of a frost plug.
Mike Holden, Ajax, Ontario

A: I cannot remember the last time I saw a frost plug fail from corrosion in an engine run in fresh water. The plugs used by Mercruiser are made of brass, which does not corrode in freshwater. This means your engine is either an automotive block with steel frost plugs or the leaking frost plug has been pushed out partially by a freeze or the boat has been used in saltwater without flushing the cooling system after usage. Regardless, frost plugs are not easy to replace with the engine in the boat. Most dealers would partially remove and hang the engine on a hoist to gain proper access to the plug. Use a punch to turn the plug sideways in its bore so the edge is facing out and then grab with Vise-Grip pliers and yank the plug out. If the plug won't turn in its bore, drill a 3/8" hole in the center of the frost plug to allow installing a pry bar into the hole and pry out the plug. If the plug is stubborn, you can use a die grinder or rotary tool to cut the plug from the hole to the outer edge, which allows the plug to come out quite easily. Be sure to use a sealer, such as Quicksilver Perfect Seal, when installing the new plug to prevent any leaks.
Steve Auger

Durable DIY Holding Tank

Q: I plan to build a 40-gallon (151L) plywood and epoxy holding tank per your instructions on the "Better Boats" DIY's MRT Series CD-ROM. How does this type of construction compare to a polyethylene or stainless steel tank?
Donald Lavoie, Ste-Foy, Quebec

A: According to J.R. Watson of Gougeon Brothers in Bay City, Michigan, this builder has used plywood/epoxy construction for holding tanks with good, long term success. The photo across shows the interior of such a tank installed in Watson's Howard I. Chapelle-based design sharpie. The tank has baffles to reduce surge and support the walls. The joint is a 1" (254mm) radius epoxy fillet covered with glass tape. Three coats of pigmented epoxy were applied with a narrow roller and brushed as thick as possible, spaced about an hour apart, using West System 105 Resin and 205 Fast Hardener to get a good build up. The pigment serves as an aid to see where each coat goes (and makes the dirt more visible when tank cleaning). The interior

Courtesy of Gougeon Brothers

Example of a custom holding tank made of plywood and epoxy built by J.R. Watson of Gougeon Brothers. Inspection ports between each baffle allows thorough inspection and cleaning.

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is then lightly sanded smooth with 220 grit paper. For this holding tank the fill, vent and empty ports are PVC plastic glued into the lid.

Jan Mundy

Why not Gelcoat?

Q: I would like to refinish my boat's topsides and my first preference is to use gelcoat for future maintenance considerations instead of paint. I would practice on an old dinghy before actually commencing work on my boat. My current plan is to fair the hull, prime with one or more coats of Interlux Epoxy Primekote or Pre-Kote, sand primer to a 220- or 320-grit finish and then roll on two or three coats of gelcoat. Once cured, I'll machine sand to a 320-to 400-grit finish to remove the orange peel, wet sand up to a 1,200-grit finish and then compound. If it doesn't go well, I'll then experiment with Interlux Perfection paint.

Robert Mayerhofer, "Willow,"
Chicago, Illinois

Nick Bailey

For best results, paint topsides, don't gelcoat.

A: There are some problems with your approach to this repair from the standpoint of both tactics and strategy.

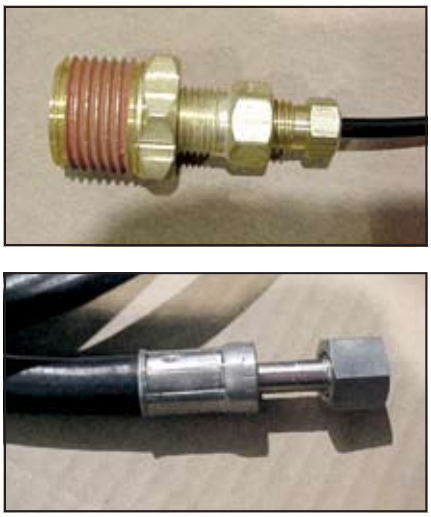
In my experience, polyester gelcoat does not stick very well to epoxy filler or primer and it will definitely not adhere well to an epoxy primer surface that has been sanded to a very smooth finish (220 or 320). Gelcoat sticks best to a polyester (or vinylester) substrate sanded no finer than 80 grit. Primers are unnecessary for gelcoat over older gelcoat or a compatible substrate as they are part of a paint system. Gelcoat is designed primarily as an in-mold finish but can also be used as a coating for repairs if it has an air-dry formulation. It's almost never used anymore as an overall coating system.

Gelcoat does not apply smoothly and so requires enormous amounts of labor to wet sand and buff to a decent finish and to do the hull sides and transom of your boat would be measured in man-weeks. At the end of all this work you have an inferior finish that dulls, demanding routine buffing and waxing until you wear through it. For the best topsides refinishing job chose a quality exterior polyurethane paint system designed and marketed for amateur use (Interlux Perfection, Brightside or Toplac) and follow the instructions regarding prep, sanding and priming to the letter. This will look better and prove more durable than gelcoat. Go ahead and practice gelcoat work on the dinghy. By the time it's done, you will know first hand how to do gelcoat repairs but I think you will also agree with me when I say gelcoat is not the way to go on a major refinishing job.

Nick Bailey

About Compression Fittings

Q: I am preparing to install hydraulic steering on my 25' (7.6m) Bayliner Trophy Convertible. In all literature, the fittings are described as compression yet, in pictures of the fittings, I don't see compression rings. I'm a professional auto mechanic (retired) and am familiar with such fittings. Supposedly these fittings are interchangeable from copper to plastic. Is the compression ring now built into the nut?
Bill Reese, Reno, Nevada



Examples of compression fittings: (top) Assembled bronze compression fitting with plastic hose. (bottom) Swaged steering hose fitting.

A: There are two styles of hoses for hydraulic steering systems. In the past, a 3/8" (10mm) copper tube was used to route the oil from the helm pump to the steering cylinder. Later systems used plastic tubing in place of copper but both of these style systems consist of a nut and compression fitting. Modern high-quality hydraulic steering systems typically use a swaged fitting attached to a precut length of high-pressure rubber hose similar to the hydraulic hose used on heavy equipment to connect hydraulic rams to the pump. Compression style fittings work for a low-pressure steering system but with bigger motors comes the need for more hydraulic pressure to control steering feedback, hence the move to swaged hydraulic fittings.
Steve Auger

Resins for Deck Repairs

Q: When repairing wet decks why not use epoxy? It seems that epoxy would bond better to the existing glass and be stronger overall. I redid my decks with new balsa and epoxy three years ago and everything seems okay so far. I'm helping a friend with a similar repair and want to make sure we are doing it right.
Dave MacMillan, St. Catherines, Ontario

Nick Bailey

When repairing decks, select a resin compatible with your choice of finish coating.

A: Who said you can't use epoxy to repair wet decks? Not me. Use whatever resin, epoxy, polyester or vinylester that is familiar to you. Keep in mind that, if you want to finish the new outer skin with polyester gelcoat, the gelcoat layer may not bond as well to an epoxy substrate as it would to polyester. An epoxy repair substrate is best finished off with a high-quality polyurethane paint system.

When you say, "repair wet decks" I assume you are cutting away either the inner or outer skin and replacing any rotten or wet core to ensure a dry deck with new core and new glass skin. I mention this because I have seen people try to just inject resin into a soggy deck. This is pretty futile because the moisture destroys the chemical reaction that enables the resin to cure. Any of the resins mentioned above will fail if used this way but epoxy is particularly sensitive to excess moisture and you end up with expensive goo. This is a more extreme form of the same reaction that causes amine blush when epoxy cures in damp, low temperature conditions.
Nick Bailey

Power Slippage

Q: I just put my boat back in the water after a stay ashore that involved replacing the shift cable, rebuilding and reinstalling the prop and changing the gear case oil (no metal or water in the old oil). During the test run, there was a definite lack of power being transferred from the engine through the sterndrive. With the throttle wide open, the tachometer only reached 3,800 rpm (WOT is 3,800 to 4,200). Oil pressure was fine; temperature read 160F (71C). The engine wasn't working hard but we weren't really moving very fast, either. There was no noise or heat from the sterndrive. The boat was then hauled out and the spare propeller installed. No change. This time though, the exhaust had a definite gasoline smell to it. It seems like, if this were a truck, the clutch was slipping.
Patrick Murray, "Emi Too,"
Port Alice, British Columbia

A: Look at the very back of your engine and you'll see a splined shaft that runs from the transom assembly to the rear of the engine. The shaft is the input to the drive unit and is driven by a rubber-hub engine coupler. It sounds like the rubber hub is slipping inside the engine coupler. To verify this, paint a line along the shaft and up the rubber hub with white out (Liquid Paper). Take the boat for a ride and make it slip as before and then inspect your white line. If the white line on the shaft is still lined up with the hub the coupler is okay. If not, remove the engine and replace the coupler.
Steve Auger

Defect, Schmefect!

When is a Defect Not a Defect?

It pays to know your options when a boat or boating equipment fails.

(left) Sample complaint form from the BoatU.S. Consumer Protection Bureau. (right) U.S. Coast Guard online form to search for manufacturer recalls.

By Pat Kearns

There are many definitions of defect to consider when applied to a boat. They are the same ones that we use in describing most "stuff" that disappoints us in performance, fit, finish and overall satisfaction with a purchase or use of a product. "It's broken … doesn't fit … doesn't work … it's defective!" Yes? No? Maybe? All three answers can be right and the right answer depends on whose definition is in play when you are exclaiming that a boat or boating equipment is defective. Take the word "defect" out of the context of a defect under the Federal Boat Safety Act (FBSA) of 1971 and the problem you have may not be a defect at all.

When it comes to a boat defect, in the eyes of the defect decider, there is only one meaning and it's often subject to further qualification. Unhappy boat owners can cry "defect" until the oceans turn into fresh water but unless the problem meets the strict definition of a defect under the FBSA, the crying will continue without recompense.

Caroline Ajootian is the official advocate for Consumer Affairs at the BoatU.S. Consumer Protection Bureau (703/461-2856; consumerprotection@boatus.com), a repository of consumer complaints about boat problems. "Most of the complaints relate to poor quality control in the manufacture of boats and related products," says Caroline. "Few of the 500 or so complaints my department gets annually fall into the category of defects as defined in the Federal Boat Safety Act of 1971." While the typical complaint may not be safety related, it can be difficult and frustrating to get builders to correct their mistakes.

Recalls are another matter. "After the Coast Guard issues a recall and together with the manufacturer develops a repair protocol, the manufacturer is required to contact all known owners in writing, warning them of the defect and offering recall repairs at no charge," explained Caroline.

The cries for help in resolving these problems cannot be addressed by the law covering defects as the conditions are more accurately described in the generic definitions of defect, e.g., the problems relate to flaws, some minor, some serious, and faults, some grave enough to render the boat or equipment unusable. Sadly, for consumers who have invested in these products, their only recourse is limited to what they can do to persuade the manufacturer or dealer to satisfy their demands. Here's where the Protection Bureau advocacy can help.

The BoatU.S. Consumer Complaint Database, available to BoatU.S. members, is the nation's only privately maintained database that tracks problems involving boats, marine engines, boating products and related services. But what do you do when a complaint rises to the level of a true defect? When does U.S. federal law step in to protect the boater's safety?

The U.S. Coast Guard (USCG) investigates a discovered or reported problem if it meets the following three criteria. First, the complaint must relate to a boat or associated equipment that is less than 10 years old.

Secondly, the condition described is a violation of federal regulations or is safety related, that is a defect that creates a substantial risk of personal injury. The defects must arise from a failure to comply with one of the following manufacturer requirements contained in the Code of Federal Regulations (CFR): display of capacity information; safe loading; safe flotation (inboard boats,inboard/outdrive boats, and airboats); flotation requirements for outboard boats; electrical systems; fuel systems; and start-in-gear protection. Lastly, the defect causes a failure or dangerous condition that occurs suddenly, without warning.

The limited scope of the definition of a "defect" under the law leaves a great deal of open space for the boating consumer to ponder. That's compounded by the fact that the coverage of the law is further strictly limited in its application to boats less than 20' (6m) in length, to require compliance with the CFR mandates. It means that hull cracks in a new 34' (10.3m) cruiser with diesel engines probably will not constitute a "defect" that is entitled to a statutory resolution. The law steps in only where personal injury or death is a possible outcome of a defect. The law does not recognize inconvenience, property damage or performance issues as a basis for establishing a defect.

Random failures and poor quality control are certainly a cause for complaint but are not necessarily the basis for Federal defect definition. That does not mean that a complaint or a series of complaints go unanswered. The

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USCG responds with investigations if the complaints of any alleged defect are sufficient in number and meet the criteria of tracking a defect. The only other alternatives for owners of boats that are not covered under the statutory classifications are those pursued in litigation or handled by a public minded entity like the BoatU.S. consumer advocacy.

Under the law, there are two types of defects. There is the manufacturer's failure to meet one of the minimum safety standards contained in federal law. Subsets of defects are those that arise as a physical flaw that occurs as a production error and others that are the result of a design error. The former class is relatively easy to identify. The latter can be a nightmare of determination since it often arises even when the product has been well designed for its intended service. Design defects occur when a manufacturer hasn't anticipated the foreseeable misuse or abuse of his product. A design defect can also exist when a designer fails to consider accepted safety standards.

The other defect is much more difficult to define. When a manufacturer discovers or acquires information that its product, some part of it or its use, poses a substantial risk of personal injury to the public, this problem becomes a defect. Add to that ambiguity the fact that the USCG has never issued any guidelines for helping make such a determination. When the task of defining a defect falls to the USCG because of either the failure of a manufacturer to recognize or acknowledge the problem, the determination is made on a case-by-case basis. In general, the call comes down to whether the alleged defect is the primary cause of an injury or probable injury and it must also occur generally without warning, which precludes a condition that creates a defect due to normal wear and use of the product.

About the author: DIY's technical editor, Patricia Kearns, is a NAMS certified marine surveyor and operates Recreational Marine Experts Group, a marine surveying firm based in Naples, Florida.

FURTHER REFERENCE

BoatU.S. National Recall Alert Registry online posting of the newest recalls
boatamerica.org/recall/new.htm

BoatU.S. National Recall Alert Registry online form for registering your boat
boatamerica.org/recal

U.S. Coast Guard online form to report a possible safety defect
uscgboating.org/recalls/owners_report.aspx

U.S. Coast Guard database of all manufacturer recalls
uscgboating.org/recalls/recalls_database.htm

U.S. Coast Guard list of Code of Federal Regulations relating to safety standards for recreational boats *uscgboating.org/regulations/fedreg.htm*

Patience, Solvent and a Jig

To remove stainless-steel screws that are corrosion bonded to an aluminum mast without drilling out the screws, soak the culprits in a mixture of aluminum tapping liquid and Silicroil, a rust penetrant. Wait a few days, then alternately tap lightly and tighten and loosen the fasteners with a custom "extractor" made from a socket bit of the proper size that fits the screws (slotted heads in this case) and a clamp big enough to span the mast, socket handle and an oversize socket placed between the handle and the clamp, which keeps the bit on the screw head. When reassembling, I now always use an anti-seize lubricant, such as Tef-Gel or zinc chromate paste.
David Shulman, White Plains, New York

No More Scratches

The ScrapeRite plastic scraper, unlike a metal one, removes cured sealant and paint and adhesive residue from gelcoat, varnished wood and other delicate surfaces without risk of scratches. For best results, always apply solvent or water and scrape using mild pressure. A pack of five blades plus a holder retails for less than US$4.

Bilge Glaze

For a hard, waterproof, easy-to-clean bilge, apply Interlux Interprotect, a two-part epoxy coating, available in gray or white, and commonly used below the waterline for protection against water absorption and gelcoat blisters. Roll it on and tip off with a brush for a smoother finish. Be sure to ventilate the area and wear a respirator when applying.

Fits like a Glove

To conceal the sharp end of a hose clamp band, cut a small piece of 1/2" (12mm) heat-shrink rubber tubing, open the clamp and slip the tubing over the band and then, once tightened, tuck the end under the tubing and apply heat.

Mix it Up

When a spray can of paint instructs the user to "shake," what the manufacturer actually means is to vigorously agitate the can for upwards of 2 minutes, not just to a count of 30, and continue to shake the can periodically during application.

Restoring Aluminum

To remove pitting on aluminum rails or hardware, knock down the pits with a razor blade then aggressively rub with bronze wool and rubbing compound. Apply a metal wax and then finish with Interlux Teflon Sealer for a long lasting, durable, corrosion-resistant finish.

Simplify Redtape

When cruising to foreign lands, carry a rubber stamp with your boat's name and registration number on it for official duties.
Rob and Dee Dubin, "Ventana," presently cruising the Pacific Ocean

Pure-Odor Rinse

To eliminate bacteria build up and resultant odors in potable water hoses, flush tanks and hoses, using a solution of 30% vinegar and freshwater, after the last use before leaving the boat for a week or longer.

Pucker Power

When dome fasteners on canvas enclosures become stiff and need lubrication, try a lip balm (e.g., Chap Stick), which is non-greasy and offers the added benefit of UV protection.

TECH TIPS WANTED

Get your copy of "Underway" Volume 1, a humorous compilation from DIY's cartoonist Sacha Warunkiw. ($14.95 value.) From live-aboard to cruising underway, you'll laugh and relate to the folly boaters encounter.

Just send us a description of your boat-tested tip or technique, along with a photo (if available), your name, boat name and homeport to:

DIY TECH TIPS
P.O. Box 22473, Alexandria, VA 22304
or E-mail to: tech@diy-boat.com.

Head Fix

The Raritan toilets in my past three boats have had a marble-sized rubber ball that works like a check valve. This ball often sticks making it difficult to remove and impossible to flush. Remove it and replace with a real marble of the same size and it will never stick again.
Peter Knorr, Spring Lake, Michigan

Paint Later, Boat Now

This spring has been unseasonably cold, certainly too cold to apply antifouling. Next fall, after hauling out, paint the hull bottom so you'll be ready to launch in the spring, despite the weather. Note that this works only if applying a multi-season antifouling or an ablative.

Barely Stripping

To prevent a chemical paint stripper from "curing" before removing and having to reapply, work in small sections, applying it in a 3' by 3' (91cm by 91cm) area, let it activate then remove and apply the stripper to the next section.

Tie Up a Storm

For everything you've ever wanted to know about knot tying, log onto Animated Knots by Grog (animatedknots.com) where you'll find fully animated step-by-step learning or teaching knots of all kinds and with fast and slow replay buttons.
Priscilla Travis, "Nomad," currently berthed in Scotland

HOW TO REPAIR Deck Non-Skid

It's easy to do professional looking repairs of the molded, slip-resistant surfaces on a boat deck using Flex-Mold patterns.

Story and photos by Nick Bailey (exceptions noted)

In a previous article ("Getting a Good Grip," DIY 2002-#4), I reviewed repair techniques for the two basic styles of deck non-skid: the repeating pattern style and the random or stucco (stipple) type. Since then, technology has changed. The slip resistant, repeating pattern style technique of deck molding offers so many advantages to the production boat builder (e.g., pattern consistency, ease of tooling, repair etc.) that few glass boats built today have the stucco/stipple style finish. Repair techniques, especially on new boats under warranty, must adjust accordingly.

In that same article I wrote "…recreating a repeating pattern ranges from difficult to completely impractical…." Even then, word was spreading of a remarkable product, Gibco patented Flex-Mold that allows (almost) seamless repairs of patterned non-skid. If Gibco has the matching pattern you need (most are available), then you can now repair damaged non-skid deck patterns or add to or repattern an entire deck area with near perfect results. [Ed: No deck surface is "non-skid" under all conditions, wet or dry, and the term is used to describe the type of deck coating rather than the physical properties of that coating.]

Without Gibco Flex-Mold, the cracks traversing this swim platform would be difficult to repair while preserving the original non-skid pattern.

Before attempting any deck repairs, you should be aware of the potential safety and health risks involved. Read all manufacturers' safety precautions outlined on the labels and found in the manufacturers' safety data sheet (MSDS) for each product. (These are also found online on msds.com, msdsearch.com or msdsonline.com.) Many of the chemicals are highly toxic, so the work area should be well-ventilated. Always wear gloves when handling gelcoat or resin, safety glasses or goggles when grinding and a dust mask when grinding, sanding and buffing. This is toxic stuff so, when spraying gelcoat or mold release, always don a respirator with the proper filter. Carefully follow the manufacturers' instructions and the directions for mixing and application of gelcoat, resins and other repair materials. (Typing 3m.com/occsafety in your web browser redirects you to 3M's safety website and information on products, regulations and technical literature).

Repairs Simplified

Flex-Mold consists of a rubberized sheet of material with the non-skid pattern embossed on one side. It's flexible enough to be rolled into a mailing tube for shipping and durable enough to withstand routine handling and repeated use as long as it is properly cleaned and prepped. Precoating the non-skid side with the mold release agent polyvinyl alcohol (PVA) means nothing sticks to it. It's available both as a negative (female) pattern for repairing existing decks and as a positive (male) pattern for tooling use on the plug from which a set of production molds is made.

As the name suggests, it's a flexible contact mold that is rolled or squeegeed

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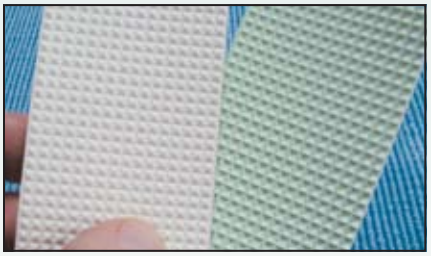
Flex-Mold is exactly as its name implies: a flexible mold for a non-skid pattern.



Flex-Mold is available as positive (male) or negative (female) patterns for original tooling and repairs respectively.

down over wet catalyzed gelcoat to create a duplicate of the original non-skid pattern. After the gelcoat has cured the Flex-Mold sheet is peeled back cleanly from the new surface.

Pattern Recognition

The first requirement is to determine the pattern you need. Gibco provides a sample kit that includes business card sized swatches of their stock patterns in both negative and positive versions. With the sample in hand, it's fairly easy to identify a match. Just place a negative swatch over top of the existing non-skid and, when you have the correct one, it locks in to mesh perfectly. The kit also includes a listing of the various styles used by many popular domestic and foreign boat builders.

Full Panel Repairs

On most boats with patterned slip-resistant decks (including cabin tops, cockpits and swim platforms), the non-skid is laid out in panels separated by a border or shallow gutter of smooth gelcoat.

One of the keys to success with large non-skid repairs, such as those required after a core replacement or major accident repair, is to make sure the new section of non-skid is always surrounded by one of these borders as opposed to butting directly up against or trying to blend into the original non-skid.

Repairs in the middle of an existing non-skid panel like this are best done by "reprinting" the whole panel or a convincing part thereof. A new border at the aft edge of the anchor locker hatch would be appropriate when repairing this starboard section of foredeck.

Although this is less of an issue on small spot repairs, the longer the interface seam, the more difficult it is to make it invisible for the following reasons: any variance in color and sheen is exaggerated; it's hard to avoid a slight ridge at the edge of the new gelcoat and, most significant, the pattern gradually shifts out of correct registration. Many Flex-Mold patterns are not recommended for spot repairs because, to quote the Gibco catalog, they "do not run true or, by nature of design, will not align properly."

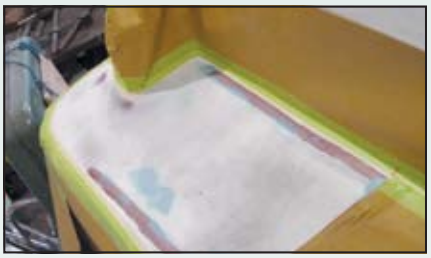
If the subsurface glass repair extends part way into a large non-skid panel, it usually makes sense to sand out a new gutter to divide the original panel into a more manageable size. The pattern symmetry of the deck can be preserved by sanding in a new matching gutter on the other side of the deck as necessary.

Step 1 Prep

The existing non-skid in the repair area is removed by sanding with 40 to 80 grit dry paper.

The surface of the underlying structural repair must be smooth and non-porous. Sand the adjacent original non-skid flat with 40 to 80 grit discs on a dual action sander, extending out to the edge of the nearest smooth border.

Step 2 Masking



Careful masking defines the edge of the new non-skid pattern.

Define the edge of the new non-skid by a high quality masking tape, (3M Fine-line is recommended), bordered by conventional masking tape and the usual brown masking paper to avoid overspray issues during the gelcoat primer stage. The masking setup must be wide enough to allow the Flex-Mold sheet to overlap onto the masking about 1/2" to 3/4" (12mm to 19mm) and also have a low profile so that the outer edge of the Flex-Mold sheet lies flat.

Step 3 Cutting the Pattern

The Flex-Mold is easily cut to a pattern.

Heavy masking paper works well for making an accurate pattern of the new non-skid panel. Place this pattern on the backside of the Flex-Mold sheet and use it as a guide when cutting the Flex-Mold to size (use big scissors). As noted above, the pattern and the Flex-Mold should be 1/2" to 3/4" (12mm to 19mm) larger than the new non-skid area.

Step 4 Gelcoat Primer Coat

Any surface discolouration shows through the low spots in the Flex-Mold pattern so it's important to apply a base coat of color-matched gelcoat. This is best done by spraying gelcoat, thinned with acetone or styrene, thick enough to yield a consistent color.

A common additive with any repair gelcoat is a wax-based surfacing agent

The subsurface must be a consistent matching gelcoat so a sprayed prime coat is mandatory on large repairs.

(e.g., Air-dry) designed to seal the curing gelcoat from the air and allow it to fully cure. The additive is optional in this application as the primer gelcoat is covered eventually by the non-skid gelcoat and sealed by the Flex-Mold. An unwaxed prime coat surface is ready for "green" coating with the non-skid gelcoat without prep sanding.

When doing the initial placement and alignment of the Flex-Mold, take care to avoid inadvertently sticking and prematurely peeling off the PVA release coat. To avoid this, temporarily place waxed paper between the deck and the Flex-Mold. Be careful to avoid applying too much pressure on the Flex-Mold piece when it's initially positioned on deck.

If using waxed resin for the gelcoat prime coat, sanding to remove the surfacing agent (and cleaning afterwards with acetone or styrene) is mandatory to ensure good adhesion of the non-skid.

Step 5 Dry Fit

Courtesy of Gibco

To minimize squeegee friction a dusting of talcum is recommended.

Taking as the cautionary steps outlined above to handle the Flex-Mold carefully, you can now position it on deck, making sure the 1/2" (12mm) overlap over the masking tape remains flat. Secure one corner or edge with masking tape and dust the back side of the Flex-Mold with talcum powder to reduce squeegee friction. Remove any excess talcum.

Step 6 Gelcoat Prep

Courtesy of Gibco

Thin the gelcoat. It should take 45 to 50 seconds to run through a #2 Zahn cup.

To avoid lumps, ridges and air bubbles, the liquid gelcoat used for the non-skid must have a low enough viscosity to flow easily under squeegee pressure. Gibco recommends the gelcoat be thinned until it takes about 45 to 50 seconds to run out of a #2 Zahn cup. The exact quantity of gelcoat varies depending on the depth of the selected non-skid pattern. About 1 quart (946ml) per 2' by 2' (61cm by 61cm) section should be plenty. The exact percentage of gelcoat catalyst to mix in depends on ambient temperature and the particular gelcoat/catalyst formulation used. In all cases, to provide maximum working time, use a "cool" mix (as close to the recommended minimum catalyst).

Step 7 Gelcoat and Flex-Mold

Courtesy of Gibco

Doing the wave: push the gelcoat ahead when laying down the Flex-Mold.

Lift the Flex-Mold and roll it back towards the edge secured with tape. Starting at the secured edge, pour gelcoat onto the deck in enough quantity to start a wave as the Flex-Mold is rolled back down on top of it. Use a large squeegee (or flexible board, paint roller, 12" drywall spreader) to push along the top surface of the Flex-Mold right behind the wave of gelcoat, spreading the gel across the repair as the mold is rolled down on top of it.

Step 8 Flatten the Mold

Squeegee out excess gelcoat in all directions until the Flex-Mold lays flat and even.

With the mold in place, starting in the middle, use the squeegee in all directions to work any excess gelcoat out from under the mold to get the Flex-Mold as flat as possible. Detect any lumps or ridges by running a hand back and forth over the upper surface of the Flex-Mold. To preserve the Flex-Mold for future use, clean excess gelcoat off the back surface of the mold using a rag dampened sparingly with acetone.

Step 9 Finishing

After the gelcoat has cured peel back the Flex-Mold to reveal the new non-skid. Note the rough edge overlapping onto the masking. This is trimmed off and sanded.

After the gelcoat has cured (a few hours to overnight), peel back the Flex-Mold and remove the masking. The edges are slightly rough but are tidied up by the usual gelcoat finishing technique of sanding with gradually increasing grits, starting with 100, 220, 320, 500 then 600 wet paper, followed by compounding and polish. Use water to remove any portions of the green PVA that remain behind in the deck. If the PVA coating on the Flex-Mold is damaged, do not reuse before scrubbing off the remaining PVA and renewing the coating. Gibco

TIP

Spray in a Bottle

Jan Mundy

An inexpensive and handy tool for spraying thin, even layers of gelcoat or PVA is a disposable Preval sprayer, available for US$20 or less at autobody and marine supply shops and some hardware stores.
– Jan Mundy

recommends using a spray gun to mist on six light coats of fresh PVA.

Spot Repairs

Spot repairs at chips, cracks and voids are in some ways trickier than repairing a full panel as it's difficult to avoid a faint seam between the new and old gelcoat.

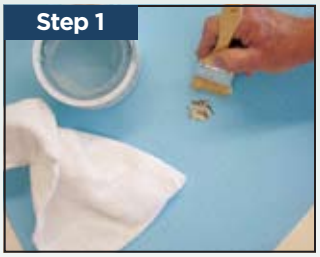
Step 1 Prep and Cut Out

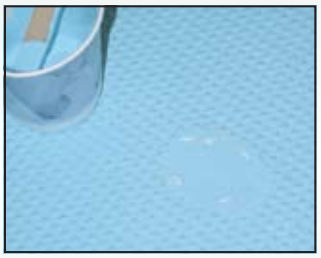
To begin, wax the damaged spot and the immediate surrounding area. Buff with a brush and polish with a rag. This helps prevent the excess gel that squeezes out during the molding process from sticking to the deck outside the repair perimeter.

Remove the spot of damaged gelcoat (and underlying glass if necessary) by sanding or using a router or rotary tool to create a clearly defined cutout in the existing non-skid. For routing, use a 1/2" (12mm) straight, single-fluke carbide cutting bit. (Don't use spiral or double fluke bits, which tend to break away.) Step the depth of the cuts so you cut into the laminate just below the gelcoat, making the first cut no more than 1/16" (1.5mm). Keep lowering the router bit until the cutting depth matches the thickness of your replacement piece. Cut carefully. Too deep and you'll go through the deck. Don't do this with an expensive router as fiberglass dust will destroy it. Any subsurface glass repairs are completed and sanded or machined by router to level. The finished repair cutout must sit deep enough to allow room for the gel primer coat and the new anti-skid to lie on top without any bulging.

Step 2 Fill, Prime and Edge Prep

Fill the repair area with filler and glass and let cure. Rout or sand the filler so the repair is just below the existing base of the deck pattern. Fill with color-matched gelcoat (as outlined in Full Panel Repairs, Step 4 on page





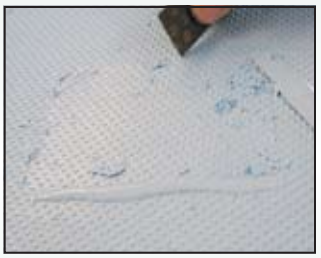
Jan Mundy

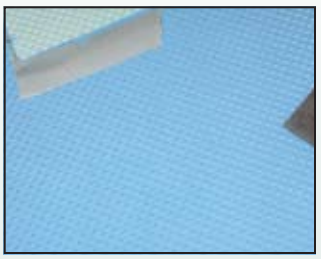
(top) Apply wax over and around the repair area and buff with a brush and rag. (middle) Using a router with a 1/2" (12mm) straight, single-fluke carbide cutting bit or a rotary tool (bottom) and grinding bit carefully remove the deck surface.

(top) Fill the spot. (middle) Apply an underlay of even colored gelcoat. (bottom) Taper back the outside edge.

Overlap the repair with the Flex-Mold piece by at least 1" (25mm) and once it's correctly registered, tape down one side and roll it back onto a tube.

(top) Apply the gelcoat and roll it across the repair with the Flex-Mold. (bottom) Using firm pressure squeegee the patch two or three times.





(top) Let the gelcoat cure and remove the Flex-Mold. (middle) Remove excess gelcoat. (bottom) Voila, a nearly invisible repair.

Remaining photos courtesy of Gibco

15). This may not be necessary if the original damage was superficial and an even layer of gel remains at the base of the repair.

Using a rotary tool and grinding bit, cut the raised portion of the deck pattern down to the base around the outside perimeter. Rout and sand, using a small block and 80 to 100 grit paper, the center of the fill areas to the same depth as the outside edge. Sand to taper any straight-cut non-skid edges at the border of the repair. This creates a scarf joint for a better new/old gelcoat bond.

Step 3 Position the Patch

Cut a Flex-Mold patch large enough to overlap the repair by at least 1" (25mm) on all sides and place it over the repair. To ensure correct pattern alignment, wiggle the patch until it meshes with the surrounding non-skid. Run your hand over the patch to feel for any high or low spots and refill, if needed. If the patch is flat and level and while it remains locked into alignment, apply duct tape firmly to secure one end in place and then roll back the Flex-Mold onto a small tube.

Step 4 Mold the Non-skid

Apply slightly thinned (15% to 20%), catalyzed gelcoat in a generous blob at the edge of the repair adjacent to the Flex-Mold roll. Slowly unroll the mold forward and using moderate pressure push an even wave of gelcoat ahead of it to prevent air entrapment. Once the Flex-Mold is down, drag the squeegee two or three times over the patch with firm pressure. Let cure.

Step 5 Finishing

After cure, peel off the mold patch and carefully chip the excess gelcoat off the waxed original non-skid with a non-scratching plastic or wood tool. (Ed: A plastic ScapeRite razor blade does this job best.) If the color match is good and all goes well, you'll see only a faint seam. Not perfect, but as close as the current technology allows.

About the author: Nick Bailey is DIY Magazine's repair specialist and has spent 30 years in the boat repair business.

Where to Buy Flex-Mold is available from the following suppliers:

Spectrum Colors, Auburn, Washington	800/754-5516	spectrumcolor.com
Fiberglass Services, Sarasota, Florida	800/226-8112	fiberglassservices.com
Mini-Craft of Florida, Wildwood, Florida	800/282-8244	minicraft.com

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Here's the Best Protection for Your Wallet On the Water

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Keep Your Cool About Engine Cooling

Regular maintenance and routine replacement of wear items helps to avoid breakdowns and extend the life of your engine's cooling system.

By Randy Renn

Like our home refrigerators, we tend to take our engine cooling systems for granted. After millions of use cycles, a refrigerator stops being cold. You know the experience, there's no recall of any strange noises, the milk was never warm and the light was still on but there is no ice. The refrigerator was 12 years old, the coils on the back had never been vacuumed, the seals and drains had not been changed. This is analogous to the boat owner who states, "my engine just overheated," or "every time the boat gets on plane, the engine temperature creeps up." Some things have sudden endings but, more likely with a cooling system, it's an ongoing condition of small, sequential failures and wear characteristics that leads to an unfortunate conclusion.

A marine engine cooling system and its major parts are best presented in zones, each with different pressures and then further separated into raw-water and freshwater cooling. It's a typical "leg bone is connected to the knee bone" story that first requires an awareness of the basic components, which you'll find in the sidebar "Cooling System Components" on the opposite page). Each of these parts and sub-assemblies or systems suffers wear and tear without obvious indications of system performance loss. Luckily, all bolt-on parts of the cooling system are considered wear items and many are replaceable before confronting an engine repower or replacement.

Vetus exhaust temperature alert (US$150 with one sensor) sounds an audible alarm when it senses a loss of cooling water to the exhaust system.

Zone One

Zone one is the negative pressure region where seawater is drawn from the under the boat, taken in via the thru-hull fitting and then flowing towards the seawater strainer and onward to the seawater pump. With seawater also comes plastic, sand, silt, shellfish, tentacles and all manner of abrasives. Next time you back into your slip and see your props kicking up the sea bottom mud, think of the seawater pump as acting like a vacuum cleaner powered by the engine. If you do not have an inline seawater strainer, be sure to install one before you begin this season's boating.

Every few years, inspect the thru-hull and its seavalve (seacock or ball type valve). Thru-hulls are given to corrosion and that fuzzy green stuff is a symptom of corrosion activity. After painting the boat bottom, clean the thru-hull opening to ensure that there is no paint or other foreign material blocking its opening and reducing the fitting's internal dimension. Exercise all the seavalves monthly. All below waterline plumbing parts must be well supported and not in any way side loaded by an anchor or the like that is stowed in the same space as the valve.

Hoses in this zone are internally supported, usually by wire, and a kink visible outside the hose definitely means a greater kink inside the hose, which causes a restriction. In no case should any garden, automotive heater, fuel or non-flexible hose be used anywhere in the cooling system.

At the end of the negative pressure system is the seawater pump. Whether belt driven or gear driven, the seawater pump is subject to terrific loads and abuse. Impellers fail and pumps have wear plates and seals that wear and leak. Most impeller service or pump removals are within DIY skill levels. Seawater pump seals and bearings could be outside the realm of the average DIYer but gasket and wear plate replacements are normal and expected service items worth mastering.

When you are facing a failed or worn impeller or are changing the impeller for maintenance, try these hints. When removing the cover plate screws, expect to lose a few so have extras onboard. The cover plate gasket sticks and tears unless it was lubricated when last changed so

Jan Mundy

(left) The seawater strainer filters debris, sand, weeds, etc. before they get into the engine. (right) All strainers have a removable filter or screen that should be inspected and cleaned before every engine startup.

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Seawater impellers with missing blades that are now likely resting in the heat exchanger tube bundle.

have a spare as well. With care, you can make a gasket from a heavy paper bag in an emergency. Be sure to replace the cam plate inside the pump. This part is in the repair kit and requires only one screw. Don't pry out the impeller with two screwdrivers or you risk denting the pump housing and the cover plate won't seal. Use the proper impeller removal tool for your engine or pad the screwdriver ends. Cranking the engine briefly with the cover plate removed often dislodges the impeller. (Be sure all is clear of the engine before doing this.)

If the pump is not easily accessible in its installed position on the engine, remove it from the engine for service and repairs. A failed bearing or seals may need the attention of a repair shop with a press to seal the installation bushings. If, when you remove the impeller, you see that impeller blades are missing, their detached parts are somewhere in the cooling system (the heat exchanger, coolers or hoses) and must be found or they will block the system. Replace any internally scarred housing or a gouged or badly worn wear plate or, in a pinch, flip it over. Placing a hose clamp or two around the new impeller compresses the blades and helps with the installation of the new one. Make sure that the blades are set for the proper rotation before you insert the impeller.

Replace seawater pump drive belts at pump service or whenever you see black soot on the belt or surrounding area. Soot being thrown from a belt is an indication of a loose or worn belt. Adjust the belt according to the service manual and adjust again after 15 minutes running. Never use large pry bars as over tightening damages the pump, idler pulleys and perhaps the alternator, if fitted. A tight belt has about 3/4" (19mm) deflection when pressed firmly with your thumb if the belt run is 12" (30cm) or longer. A belt that easily twists more than half a turn may be too loose. Be sure to turn off the ball valve before beginning work on the pump and open it after completing the service. Do remember to close all seavalves when leaving the boat unattended.

Cooling System Components

Ball valve: A fitting/valve with a stainless-steel ball in a plastic bearing. A pivoting handle shuts off or allows water flow. Ball valves are mounted to a thru-hull fitting.

Bonding: An optional practice of electrically connecting metal hull fittings in contact with seawater (inside and outside of the boat) in an effort to minimize corrosion.

Circulation pump: A belt-driven pump used to circulate cooling water within an engine.

Coolers: These are pipe-like fittings through which water flows to jacket and cool a fluid such as oil, fuel, transmission fluid, etc.

Drive belt: A "V" type fan belt or flat serpentine type belt used to rotate circulation and/or seawater pumps as well as engine alternators.

Exhaust elbow: A pipe fitting through which seawater exits the engine and mixes with the engine exhaust.

Exhaust manifold: Engine exhaust leaves the engine and is collected from each cylinder in this chamber where it is cooled by freshwater or seawater that jackets the exterior of the chamber. Here it is combined into a single stream for discharge at the exhaust terminus via a muffler, waterlift and other piping.

Expansion cap: A radiator-type cap mounted in the freshwater side (expansion tank) of a freshwater cooled engine. This tank is under pressure as the water heats and expands within the expansion tank.

Heat exchanger: On freshwater cooled engines, this is a tank with pipe tube bundles inside that are filled with antifreeze (coolant). The heat exchanger performs a task similar to that of a vehicle's radiator. The heat generated by the engine is cooled (exchanged/transferred) via the effect of the coolant flow around it.

Negative pressure area: The area between the seawater intake thru-hull to the inlet side of the seawater pump.

Positive pressure area: The area between the outlet side of the seawater pump and the point where seawater mixes with engine exhaust.

Scaling: Flaking rust from cast iron parts of the exhaust system. These flakes swell and clog seawater passageways.

Seawater pump: The heart of the cooling system flow, it's a belt- or gear-driven pump with an impeller inside.

Seawater strainer: A glass or plastic canister with a removable stainless-steel filter inside. The filter element traps contaminants and sediment, preventing it from passing into the cooling system. The element is removable for cleaning.

Thermostat: A self-regulating valve that controls coolant flow through the engine.

Tube bundle: A group of small tubes inside a cooler or heat exchanger.

TIP

Temp Gauge Fix

If the temperature gauge indicator simply does not move, you can check the gauge by taking a ground wire and ground the temperature sender brown wire to the engine block. A working gauge should peg the needle.
— RR

(top) Seawater pump with a corroded plate and fasteners that need replacing. (bottom) Impeller positioned in a seawater pump.

(left) Typical tube bundles. (right) End view of a tube bundle shows the small 1/4" (6mm) diameter tubes.

Zone Two

From the seawater pump, the cooling system becomes positive pressure in both raw (sea) water or freshwater cooled systems. From the pump, seawater usually passes through one or more coolers or tube bundles of some description. An inboard engine with a hydraulic transmission has a transmission cooler and, if larger than, for example, 40 hp, also an engine oil cooler. Sailing auxiliary engines with plate or cone transmissions have a cooler inside the transmissions and some diesels have fuel coolers.

Coolers reduce the operating temperatures of lubricant or operating fluids. Cooler and tube bundle construction consists of many small tubes bundled or soldered together that can become clogged by very small deposits. If swelling or corrosion is noted at cooler solder joints remove and replace the unit. When performing oil sampling, it's not infrequent to find trace amounts of seawater sneaking into engines and transmissions though pinholes in coolers. Keep coolers clean and inspect all zincs monthly, if installed, and replace, if depleted. Coolers play a big part in overall seawater system restriction. Any sand, silt or debris, even bits of impeller

Replace expendable oil or transmission cooler when corrosion is noted at soldered joints.

blades, that make it past the seawater pump clog the system upstream but this all begins at the coolers.

On a raw-water cooled engine, the seawater flow now travels to the engine circulation pump, a belt-driven pump on the front of the engine. If water weeps from a hole on the pump, replace it before this causes the engine to become a heap of rust. Replacement of the pump means removing four pulley bolts, five mounting bolts and two gaskets. Reassembly requires some adjustment of the drive belt, which should be replaced at the same time. Replacement of the raw-water circulation pump is within an average mechanic's skill level using regular hand tools.

Seawater joins the exhaust at the exhaust elbow causing agressive corrosion and clogging.

With a raw-water cooled engine, the seawater makes its way past the thermostat and exits via the exhaust manifold/riser. Leaks at the exhaust manifold to riser unions are frequent and expected as normal wear. If riser gaskets are leaking seawater outside the engine, then some seawater is leaking into the engine at the same gasket union. Don't ignore leaks. Manifold failure and scaling are major concerns with raw-water cooled engines and, for engines operated in saltwater, maximum life expectancy is seven years. Manifold and riser

Heat exchanger with a bent outlet due to overtightening a hose clamp.

replacement, while heavy work, can be accomplished by the amateur mechanic. Expect to crack a few knuckles and leave some rust piles behind. Plan to inspect thermostat housings and replace thermostats annually. Housings scale up rapidly in raw-water cooled engines and add to gradual overheating conditions.

In the case of freshwater-cooled engines, seawater pushes through the cooler lines to the heat exchanger. The heat exchanger is really a glorified, water-cooled radiator and seawater acts like the air passing over an automobile radiator.

Heat exchanger end shows tubes, cover and gasket. Covers crack if overtightened.

Replace worn impeller wear plates when servicing a seawater pump.

A heat exchanger consists of a large bundle of very small tubes with a larger chamber surrounding it. This group of tubes is wrapped in a thin copper jacket with copper tubes leading into and away from it. I mention these tubes because an aggressive mechanic can over tighten hose clamps at hose connections and crush the tubes, ruining the exchanger. Most heat exchangers have end caps with simple rubber gaskets that simplify exchanger cleaning. Also, heat exchangers have expansion caps, which are really radiator caps. I recommend expansion cap replacement annually as some tend to weep coolant. Don't over tightened this cap as it may crack. Unlike raw water cooled engines, it's not necessary to replace the thermostat annually. Change engine coolant at least semi-annually and inspect any zincs monthly. (Generator zinc inspection is often a more difficult task.) When inspecting zincs, do not try to just unscrew the zinc fitting. Always use two wrenches, one for the zinc fitting and one for the fitting on the exchanger. Using just one wrench may damage the exchanger. Use proper six point wrenches or line wrenches rather than open end or adjustable wrenches to avoid rounding the fitting.

Weep port of a seawater circlation pump has been leaking for some time. Replace this type of pump as rebuilding is not practical.

In a freshwater cooled engine, seawater exits the heat exchanger and travels toward the exhaust elbow where it mixes with the exhaust. The freshwater in the engine, in all cases, cools the engine body and, in most cases, the exhaust manifold and frequently the turbo scrolls or turbo charger. As the exit water is seawater, the terminus of most non stainless-steel exhaust elbows rusts and builds scale in the same manner as raw-water cooled units. Be suspect of cast iron risers and tolerate no seawater leaks on engines so equipped. Routine freshwater flushing of all seawater circuits helps to extend exhaust system maintenance intervals.

Fault Overview

If there is a gradual overheat while running or a steady rise in temperature, look for restrictions and or a weak impeller. A very rapid overheat might indicate a failed impeller, broken drive belt or a complete flow blockage. Begin your fault finding at the raw-water intake thru-hull and work toward the exhaust thru-hull. Any small restriction adds to the troubleshooting mix.

If there are sporadic high and low temperature readings and perhaps a very slow or too rapid warm up without overheat but with good water flow exiting the exhaust thru-hull, suspect the thermostat or thermostat housing. Steam exiting at the exhaust riser points to weeping gaskets.

Maintenance costs are not high and should be considered normal and ongoing and are largely within the scope of the average boat owner. Keeping coolers and strainers clean goes a long way to deferring major repair costs. Annual impeller changes, gasket renewals, new expansion caps and belts help and these routine renewals are good practice for when your engine has an urgent problem.

Carry an assortment of fasteners, especially pivot and tightening bolts, purchased from hardware stores for pennies a piece. Costs of spares are significant. A spare impeller kit ranges from US$45 to US$155 plus extra screws for up to US$5 per set; a spare pump is US$150 to US$450; extra belt is US$12.50 to US$41.75; coolant is US$4 to US$9 per gallon; thermostat and gaskets range from US$14 to US$44. Budget a few extra dollars for replacement hose clamps.

When a blockage in the water intake or a damaged pump impeller reduces the volume of cooling water in the exhaust, the exhaust temperature rises much faster than the engine temperature. To monitor exhaust temperatures, consider adding a seawater restriction alarm. This device is easy to install and it provides a visual and audible alarm when the temperature inside the exhaust hose or the muffler due to loss of cooling water, depending on where the sensors are mounted, exceeds an acceptable level.

About the author: James R. (Randy) Renn is one of a few marine surveyors to also be accredited as an engine surveyor and operates Marine Forensic Technicians in Stevensville, Maryland.

TIP

Anodes Do Dissolve

"If my engine zincs are good all the time then I have nothing to worry about." This is incorrect. Particularly in saltwater, the sacrificial anode system is designed to dissolve (waste) sacrificially so, if your engine's zincs are not dissolving, then some other metal is. Have an ABYC certified technician test your boat's electrical "potential" to ensure that potential readings are within acceptable ranges. — *RR*

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Sunscreen In Fashion

Photo courtesy of Columbia Sportswear

Sun protective clothing can block up to 98% of UV rays and works all day, offering boaters an alternative to sunscreen that does not need to be reapplied.

For the busy boater, a day on the water often starts with a liberal application of sunscreen. But many of us ignore skin covered by clothing. Just how much protection does a simple cotton shirt provide? Not as much as you might think.

An average cotton t-shirt might offer the equivalent of a Sun Protection Factor (SPF) of five, slightly more if it is a dark color, less if it gets wet. And clothes made of thin fabrics with open weaves, such as those designed for athletes to train in, can offer little or no protection.

In recognition of this fact, more clothing manufacturers are offering an ever widening variety of sun-protective clothing suited to fishing, swimming, or just relaxing aboard. When shopping, look for clothing with an Ultraviolet Protection Factor (UPF) rating on the tag, which indicates the apparel has been designed and tested for UV protection.

Due to different testing standards, sun-protective clothing receives a UPF rating unlike the SPF ratings given to sunscreens. The UPF indicates the amount of UV light that the fabric allows to penetrate the clothing. A shirt with a UPF of 15 blocks 93% of UV rays; one with a UPF of 50 blocks 98% of all UV light. And that protection lasts as long as you wear the shirt.

On the other hand, sunscreens, even the ones labeled "ultra-water-resistant" or "ultra-sweat-proof" are only tested and rated to protect your skin at their advertised SPF for 80 minutes. Sunscreens labeled merely "water-resistant" are only tested to 40 minutes. After that amount of time on a person in the water or perspiring, sunscreen needs to be reapplied. Judging from the number of lobster-red faces and necks at the boat ramps at the end of the day, many boaters forget to do just that. But a sun-protective shirt can keep you from looking like a cooked crustacean at the end of the day.

Columbia Sportswear, one of the leading brands of sun-protective clothing, offers a full range of UPF-rated clothing for men and women, particularly in their fishing clothing lines. Their Tamiami, Bahamas II and UPF 50 fishing shirts are designed to keep the sun off while keeping the wearer comfortable on the water. Featuring a breathable, wicking fabric that keeps moisture away from skin and vents to help keep you cool, these shirts can be worn all day on the exposed deck of an open fishing boat without worrying about sunburn.

"Our UV protection is done through the tightness and knit of the weave of our fabrics," says Columbia representative Anna Kern. "It's not a topical layer or chemical treatment. Our UV protection does not wash out."

Washing clothing in UV-absorbing chemicals specially designed for application during laundering can boost the UV protection of ordinary clothes as well. Rit's SunGuard, when added to a load of clothes laundered in warm or hot water, can increase the UPF of those clothes to around 30. The additive sells for around $2 per treatment and lasts through 20 washings.

For keeping the sun at bay when in the pool or ocean, Coolibar Sun Gear produces swim shirts, also known as rash guards, for men, women and children, out of chlorine-resistant fabrics.

Originally developed for swimmers and surfers in Australia, where they take sun protection very seriously due to high rates of skin cancer, Coolibar offers a wide range of swimwear as well as casual clothing. Many items offer a UPF rating of 50 and have been certified by the Skin Cancer Foundation.

Other companies, such as Solumbra, specialize in sun-protective clothing for sun-sensitive people. And even catalog retailer Lands' End offers sun protection in their active casual wear lines.

While sun-protective clothing might cost more than similar clothing not designed with UV protection in mind, it offers a much greater degree of protection. And for ease of use and all-day UV protection even in an open boat, a UPF-rated shirt or swimwear is hard to beat.

— By Michael Vatalaro

Sun-protective products can be found at the following online stores:

- Columbia Sportswear is sold at Westmarine.com. Find additional retailers at www.columbia.com.
- Coolibar products are sold direct at Coolibar.com.
- Landsend.com has their complete catalog.
- Rit Sunguard is available direct from Sunguardsunprotection.com.

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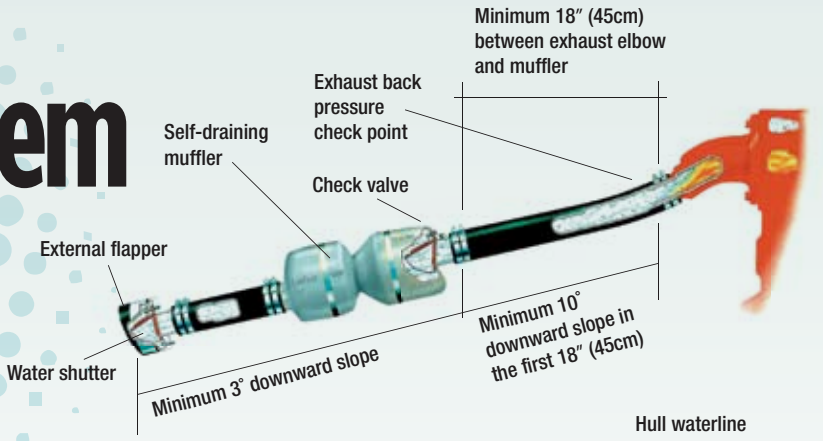
Exhaust System Checks

When it comes to sterndrive exhaust systems, a little knowledge of a proper installation and routine inspection and maintenance requirements goes a long way in making your boating experience an uneventful one.

Story and photos by Steve Auger (exceptions noted)



This exhaust system configuration is typical when the engine, exhaust elbow, cooling water injection point and exhaust outlet are well above the waterline. The exhaust and cooling water travel down the piping, through the muffler (Vetus MV) and exit through the transom exhaust outlet. When the engine is shut down, water simply drains out of the system by gravity because of the constant slope of the piping. One or more water shutters or flappers help keep water from backing up the exhaust and flooding the engine when the engine is not running and the boat encounters following seas.

The variety of different marine exhaust systems is as numerous as the different sizes and types of boats on the water. On the other hand, the rules that govern the safety factors for all systems have basic similarities in their application for most boats up to 50' (15m) in length.

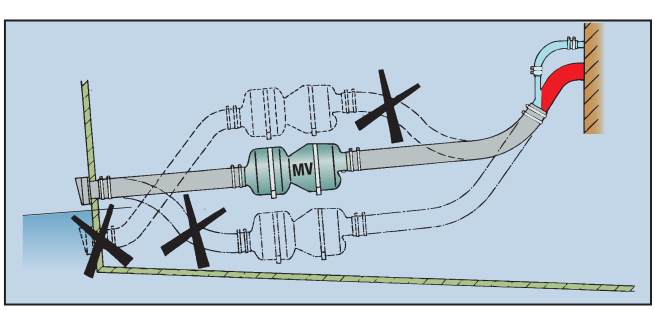
All marine inboard and sterndrive engines emit high temperature engine exhaust byproducts that contain toxic gases and vapors that need to be routed to the outside of the hull, safely diverted from spaces normally occupied by passengers and away from engine air intakes and propellers for performance reasons. Large displacement gasoline and diesel engines can route as much as 1,000 cubic feet (28 cubic meters) per minute of air through the engine and ultimately through the exhaust system.

A loose fitting or cracked hose in the exhaust system can result in water leaking into the engine compartment, causing damage to the running gear and even possible submersion if left unchecked. Toxic gases could migrate into the passenger compartment causing illness, injury and even death.

ABYC standard P-1, Installation of Exhaust Systems for Propulsion and Auxiliary Engines, is the go to reference for the safety and engineering requirements for marine wet and dry exhaust systems. P-1 requires that all materials, including metal and non-metal pipe, hoses, mufflers and waterlifts be in compliance with Table I of the standard and/or "shall comply with the performance requirements of SAE J2006, Marine Exhaust Hose, or UL1129, Standard for Wet Exhaust Components for Marine Engines. All other exhaust system components shall meet the performance requirements of UL 1129."

As for the efforts to keep your onboard family and friends from over-exposure to toxic vapors, there are so many variables that affect this condition that pages have been written on the how and there is no perfect prescription for achieving this protection. P-1 provides considerable guidance about the placement of openings in the hull. ABYC also publishes an information report, TH-22, Educational Information About Carbon Monoxide (CO), which is available for download from the ABYC website at abycinc.org. It's a must read for anyone involved with boats. [Ed: Also refer to DIY's "DIY Mechanic" MRT Series CD-ROM for information on CO-proofing your boat.]

Exhaust gases exit the engine at a temperature of around 1,500F (815C), which is too hot for anything other than metal exhaust components and is too much of a fire hazard to be plumbed in a pleasure craft. In order to reduce the temperature of exhaust gases, marine inboard and sterndrive engines employ the use of a wet exhaust system. The wet exhaust system utilizes the engine cooling system water that is exiting the engine block via the exhaust manifold and elbow by mixing the cool (relatively speaking) 150F (65.5C) water with the hot exhaust gases in the exhaust elbow. The cooled exhaust gases and water are then routed through a pipe (or hose) to an exhaust outlet, usually near or just below the waterline. This



If exhaust systems that depend on grade to drain out have low spots in the piping where water can collect, back pressure could prevent the engine from starting. When the exhaust outlet is under the waterline, it only takes the failure of the clamps or hose to sink a boat. Use an inclinometer to be sure the system has the correct slope aft to prevent water getting into the engine. Note that the hose is angled so that the exhaust elbow is positioned in the center of the hose and discharge water flows around the entire inside of the hose to avoid causing hot spots that could burn through the hose.

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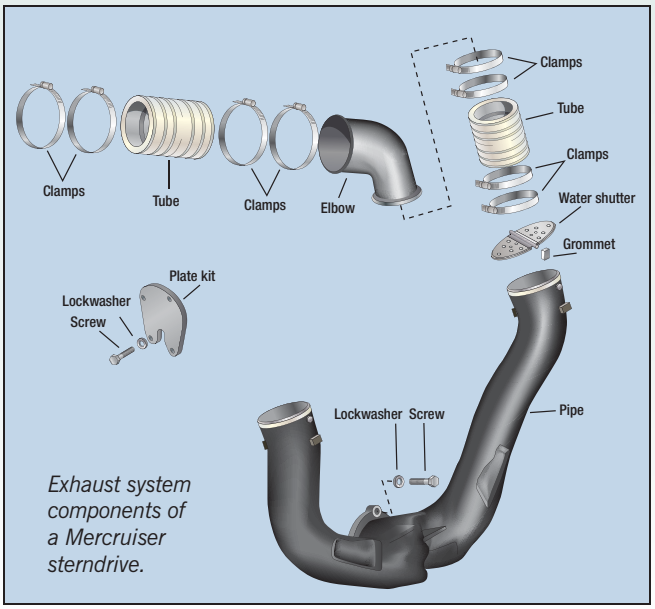
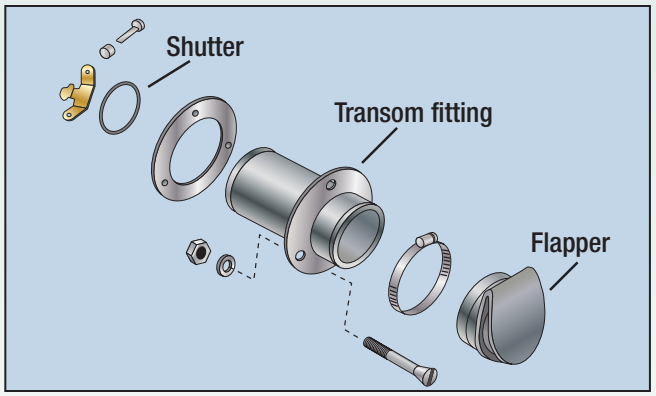


Mercury Marine/Joe Van Veenan

Exhaust system components of a Mercruiser sterndrive.



Mercury Marine/Joe Van Veenan

Through-the-transom exhaust requires an internal shutter and external flapper to prevent water intrusion problems. Though not required on systems with waterlift mufflers, both are recommended.

reduced temperature allows the use of alternative materials such as rubber, aluminum alloys or fiberglass to make up many of the different components of the wet exhaust system.

Professional marine engine technicians always rely on quality service manuals and bulletins to ensure the highest quality repair is performed with a scrupulous eye on safety. Before attempting any engine repair or inspection procedures, I highly recommend obtaining and reviewing the appropriate manual for your engine. Always refer to your service manual before removing any exhaust system component as an enormous water influx could result if a component is removed that is below the waterline.

Systems Set-up

Many sterndrive-powered boats use a series of short aluminum alloy tubes with rubber bellows to connect the exhaust elbows to a through-the-propeller or through-the-transom exhaust system (e.g., Silent Choice or below the swim platform through transom outlets). The through-the-prop style of exhaust system does not require mufflers to meet noise mitigation guidelines because the sound exits the boat well below the waterline. This dramatically cuts down on noise; however, maintenance schedules must be adhered to strictly or the possibility of severe and expensive engine problems due to water shutter or bellows failure increases.

Most inboard engines use a combination of rubber compound hoses and metal or fiberglass pipes that connect the exhaust elbows to a through-the-transom exhaust system that employs a waterlock type muffler to reduce the noise. This system usually exits the hull at or below the waterline. ABYC P-1 requires that hose used in these exhaust systems be double clamped where it connects to any metal or composite pipes.

Waterline Positioning

Water-cooled engines have a water level or waterline and this waterline is located at the top of the exhaust elbow outlet. Most new boats are equipped with an approximated exhaust riser to waterline distance of 13" to 16" (33cm to 41cm).

Most engine manufacturers like to see this distance set at 16" (41cm) or greater. If the hull waterline becomes higher than the engine waterline, gravity forces the water level in the engine to rise and equalize its level with the water outside the boat. The engine fills with water because the water levels inside the boat and outside the boat seek to equalize. This process, known as water reversion can destroy an engine. Ensuring that the hull waterline cannot ever become higher than the engine waterline prevents seawater siphoning from outside the hull and backing into the engine through the exhaust pipes. Such reversion causes any cylinder with an open exhaust valve to fill with water and leads to the probable death of the engine.

To assist in reducing water reversion boat builders install water shutters and flaps that are open when under exhaust pressure and close when the seawater pressure gets higher than the exhaust pressure. If your engine is not so equipped, install both interior water shutters and an external flap on the exhaust outlet to reduce the possibility of the engine ingesting water.

Historically, as boats get older, some get heavier and sit lower in the water, reducing the waterline value below specification, which increases the possibility of water ingestion into the engine. Other factors that effect this critical waterline specification are the aftermarket additions and placement of batteries, air conditioning, generator, water heater, additional tankage, etc. It's imperative to maintain a vertical height of 16" (41cm) from the exhaust elbow outlet (engine waterline) to the boat's waterline when the boat is fully loaded to prevent water from traveling backwards through the exhaust system and into the engine.

You can check the waterline to exhaust elbow height by a number of different methods that are typically outlined in any quality service manual.

It's possible to check the waterline value using the clear hose method (**Figure 1**) or by placing a straight edge that spans the gunwales, overhangs each side by a few inches and positioned directly over the exhaust elbow (I usually use a 12'/3.6m long 2x4 as a high-tech straight edge) as shown

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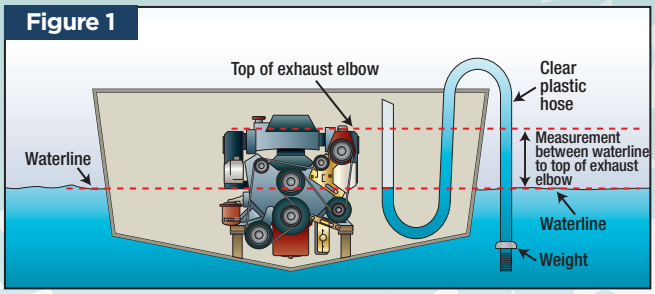
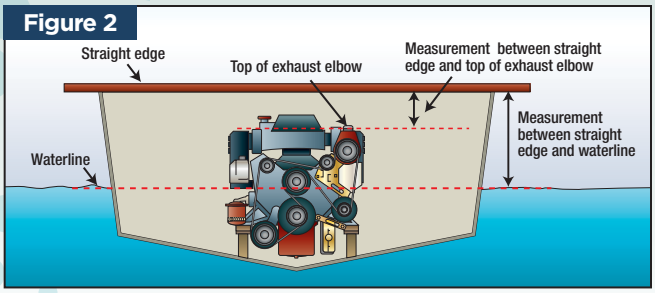
Figure 1



Checking waterline height using the clear hose method. Do this only after the boat is fully loaded.

Figure 2



Mercury Marine/Joe Van Veenan

With the boat fully loaded, open the engine hatch then place a straight edge across the boat, parallel to the water, and measure the distances between the straight edge and the exhaust elbow and the straight edge and the boat's waterline. The difference between these two measurements should equal 16" (40cm) or greater.

in **Figure 2**. Measuring the distance from the straight edge to the waterline and then measuring the distance from the straight edge to the top of the exhaust elbow, then subtracting the exhaust elbow measurement from the waterline measurement gives an approximate of the critical waterline to exhaust elbow value. This checking method is only possible on smaller runabouts or traditional sedan or express cruisers with removable cockpit hatches.

Consider this example: a straight edge to waterline measurement of 38" (96cm) and a straight edge to top of exhaust elbow measurement of 27" 68cm) for a difference of 11" (28cm). This means the critical distance of 11" (28cm) is too small and this system requires raising the height of the exhaust loop by installing a 6" (15cm) exhaust riser to meet the correct distance of 16" (41cm) or longer.

Exhaust risers are purchased in kit form and typically come in 3" (76mm) increments. These risers are installed between the engine's exhaust manifold and the exhaust elbow. Many modern engines come with 3" (76mm) risers installed from the factory as part of the engine package.

Overheat Conditions

Any inboard or sterndrive engine that has suffered a major engine overheat condition requires immediate service.

Remove and inspect all rubber components and gaskets for overheat damage. It's not uncommon to have an exhaust system blocked by the material shed by old or heat dam-

aged hoses, mufflers or water shutters. A blocked exhaust system results in reduced power. A standard vacuum gauge connected to a vacuum fitting in the intake manifold quickly identifies a blocked exhaust. A vacuum gauge indicator that drops to zero as engine rpm is increased indicates a restricted exhaust system.

Routine Maintenance

Most service manuals advise owners to have the exhaust system inspected annually, including water shutters, bellows and hoses.

- Check that hose clamps are tight and rust free and examine all connections for leaks. Any rust trails or corrosion at system joints or on engine components below these connections are symptomatic of leaks that are not easily visually identified.
- Be sure all solid pipes are corrosion free and are not cracked. Vibration is a factor in stressing solid metal pipe and fiberglass sections so these should be carefully inspected for damage.
- Check all exhaust pipe supports for condition and strength. Straps can sag and crutches and bulkhead openings can rot.
- Long runs of exhaust piping, both rigid and flexible, between the engine and the transom exhaust outlet, require adequate support due to the weight of the water, inline mufflers and vibration while retaining a continuously downward slope towards the exhaust exit.

Larry Blais

In boats where the waterline is higher, the exhaust elbow is raised to gain a safe height above the waterline. This photo shows a 6" (15cm) exhaust riser mounted between the engine's exhaust manifold and the exhaust elbow to compensate for waterline height problems. The waterline can change drastically due to loading and sea conditions and exhaust system installation must account for these conditions.

Jan Mundy

Vetus transom exhaust flapper with thru-hull connects directly to the exhaust hose.

Pat Kearns

Exposed fibers found on the exterior of a FRP section of pipe dictate that the pipe be removed and examined carefully for symptoms of degrading laminate.

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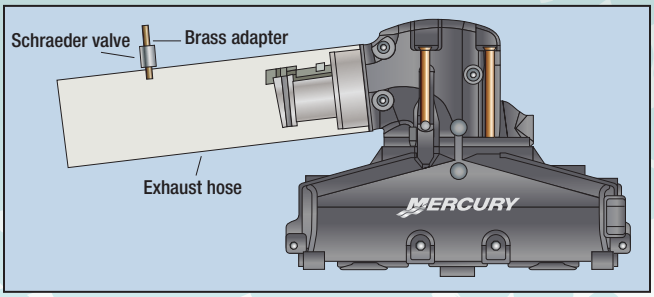

Mercury Marine/Joe Van Veenan

Schraeder valve installed in exhaust hose to ensure exhaust back pressure does not exceed 2 psi. Before connecting, set pressure gauge to zero. While underway, operate the engine at 1,000 rpm, 2,000 rpm, 3,000 rpm, 4,000 rpm and WOT. Record back pressure at each setting.

- Inspect mufflers for loose or broken parts and leaks.
- Inspect bellows and water shutters for damage every 50 hours. Under good conditions and maintenance, they typically require replacement on average every five years or 500 hours. In-water inspections are possible but the boat usually needs to be hauled out to perform any major system repairs. Modern sterndrive powered boats usually have water shutters installed inside the boat, which allows servicing without hauling the boat, reducing maintenance and repair related costs.
- Inspect all rubber components (hoses, exhaust flappers, etc.) annually for deterioration.

Steve Auger

Make sure that all hose used in your boat's exhaust system indicates compliance by the marking "marine wet exhaust."

- The exhaust system needs to have no more than 2 psi of back pressure (or resistance.) Excessive back pressure causes a lack of performance and possible water ingestion into the engine. Check back pressure by installing a short pipe in the exhaust hose (6"/152mm long by the diameter of your exhaust pipe) with a test port connected to a 0 to 10 psi pressure gauge. Run the engine at different rpms under load and monitor the pressure gauge. The pressure should never rise above 2 psi. If it does, there is enough of a restriction to cause engine problems.

By conducting annual exhaust system inspection and regular maintenance, you'll reduce the possibility of an operational problem on the water as well as safety related problems.

About the author: Mercury Mercruiser master technician and DIY's engine technical advisor, Steve Auger, has more than 35 years experience in marine retail, manufacturing and training, mostly with Mercury Marine.

Cracking the Code

Correct identification of wiring brings confidence to the diagnosis and troubleshooting process. Follow these steps to develop a wiring labeling system for your boat.

By John Payne

I have performed marine electrical and electronics work on many boats of all types and sizes. One item that complicates the job and, ultimately, makes it more expensive for the boat owner, is the lack of any wiring coding, either by numbers or colors on the various wiring circuits. Since many boats don't have a basic wiring diagram this makes the task of troubleshooting even harder.

Being greeted by a spaghetti mix of wires when you open the electrical panel to sort out the why of a darkened navigation light is more than frustrating. It can be dangerous. Labeling and coding your boat wiring simplifies troubleshooting so you can quickly identify the circuit and then test and locate the fault.

Code Specs

Color-coding in many boats utilizes a natural extension of the various coding systems used within the automotive industry. Motor vehicle wiring is all color coded and relatively standardized. The American Boat and Yacht Council (ABYC) standard E-11 contains the accepted color-coding for wiring on boats. (This is available online; turn to page 33 for instructions.) Also, many engine and trailer manufacturers have developed color-coding systems and you should consult your owner's manual for the correct information. Most of these are consistent with ABYC standards and are also found in SAE (Society of Automotive Engineering) standards.

The ABYC standard uses yellow for a boat's DC negative, due to the fact that, in AC power systems in the U.S., black is also used in AC system wiring. In boats built outside the U.S., AC systems use the IEC standard colors of brown for hot or active conductor, light blue for the neutral conductor and green/yellow stripe for the ground or earth conductor. Use caution when working on an unfamiliar or foreign-built boat as many other countries still use black and red for DC wiring and not the ABYC colors of yellow and

Photos 1 to 4by Jan Mundy

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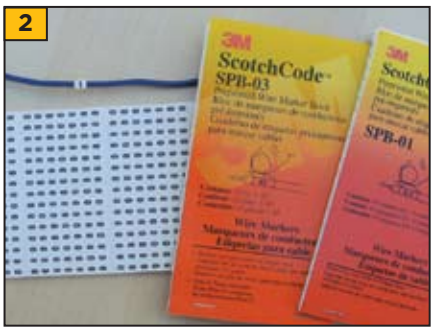

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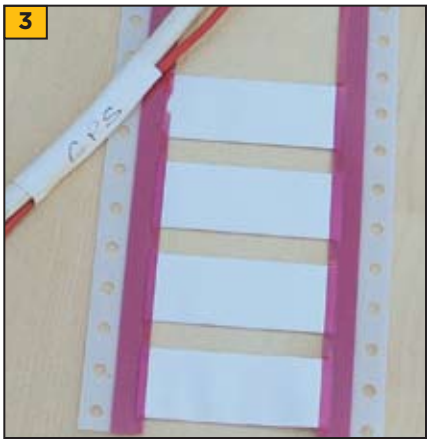

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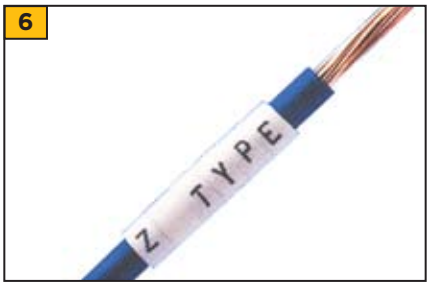

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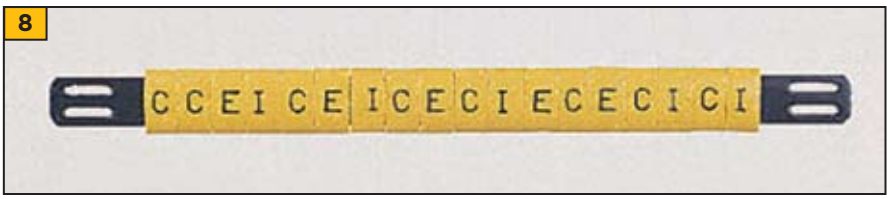


CONTENTS PREVIOUS NEXT

*Cable marking options (shown on previous page): **1.** To use the 3M ScotchCode Write-On Dispenser, write on the white area with the SMP marker pen, pull out marker (70 markers per roll) then place the white area on the cable and wrap the clear self-laminating tail around to protect marking (also useful for identifying pipes or hoses). **2** Marker books of preprinted vinyl-coated cloth markers each contain 450 numbers and/or letters. **3** Ancor Write On ID Tubing contains 10, 3" (76mm) flattened, white heat-shrink sleeves that attach to a polyester strip designed to feed through some printers or labels are written with a pen, and whichever type used becomes permanent when shrunk. **4** 3M ScotchCode STD Tape Dispenser has 10 refillable compartments containing 8' (2.4m) of preprinted polyester wrap-around tape (numbered 0 to 9) with a high tack, acrylic adhesive that resists oil, solvents and water. **5** Preprinted clip-on sleeve markers with interlocking sections for 8AWG up to 20 AWG. **6** Push-on wire markers have an expanding profile that accommodates various wire sizes. **7** Markers slide on to a PVC carrier strip that holds up to 18 markers, which then attaches to the cable using cable ties. **8** Markers slip over a cable tie and lock together.*

red. To avoid any chance of confusion always be sure that AC and DC systems are physically separated as far as practicable.

Wiring Tags

The wiring labeling exercise on new boat wiring projects often goes wrong right from the start. When you have a morass of wires that are unmarked and awaiting termination, the best practice is to apply labels, even temporary ones, as you go along. It saves a lot of time and frustration later when verifying the purpose of each cable.

Labeling with tape and a pen works but, in many cases, I have seen these temporary labels come off or the writing has rubbed off. When you finally terminate into the various equipment or distribution boards, then apply permanent labels. Make sure that all wire numbers match those numbers that you are using on your wiring diagram.

Part of commissioning your wiring system is to also verify that the label is correct by testing the circuit. You know the story, switch on breaker for cabin lights and the water pump runs. This happens more times than you might believe possible. This is also the best time to develop a wiring schedule and numbering system and create a wiring schematic, if none exists.

What label type to use? Personally I prefer using the simple, slide-on number systems. These tend to stay on and you can always hold them in place with a dab of superglue or other adhesive. (A worldwide source is rs-components.com; search for “cable markers.”)

On commercial boats, printed or even metal punched number tags are used and these are fastened onto the cable using plastic cable ties or stainless steel ties so they cannot move.

Base Number System

Considering the discrepancy in color

coding of wiring conductors, the use of numbered cores is an acceptable alternative and is reasonably common in marine grade cables. These are generally coded with the numeral 1 (I always use this as the positive conductor) and the numeral 2 (as the negative conductor). These identify electrical polarity; however, the circuit labeling is a different function. Evolving a system from a large harness of red and yellow or black wires requires a methodical and logical approach.

There is no general standard to circuit numbering and color codes do not address large boat wiring systems. A system I developed myself over the years is one largely derived from similar systems used with commercial shipping and it works fine.

The numbering system defined herein can be expanded as a circuit gets more complex. For example, 201-1 or 201-2, and this often becomes necessary in lighting circuits where several lights radiate from a common supply point. Adapt the system to suit your own specific requirements. Of course, you apply the same number to each end of the positive and the negative cable.

100 (101, 102 etc): Use for the various pump circuits, such as bilge pumps, holding tank pumps, shower pumps, water pumps, etc. I also include fans and ventilation systems within this category.

200 (201, 202 etc): Use for all general cabin lighting, bunk lighting, engine room lighting and also for DC power circuits, such as DC outlets, cabin fans and windscreen wipers, etc.

300 (301, 302 etc): Use for external deck and mast lighting circuits and includes courtesy lights, handheld spotlight outlets, mast spotlights, navigation lights and any other installed exterior lights.

400 (401, 402 etc): Use for the various communications equipment onboard, such as VHF radio, SSB radio, satellite communications, satellite TV systems, satellite radio and phones, etc. I also use this for the Navtex receiver and any broadband radio receivers.

500 (501, 502 etc): Use for other marine electronics, including autopilot, boat instrumentation system, chart plotters, echosounders, fishfinders, GPS, radar, radar detectors and any other navigational systems. I also include entertainment systems, such the stereo system and speaker cables in this group.

A chart of the ABYC DC Wiring Color Codes is on this CD. Click here to view.

600 (601, 602 etc): Use for any safety systems, including gas and fire monitoring systems and associated sensors, security systems and the various attached sensors as well as any water, fuel and other tank monitoring systems.

700 (701, 702 etc): Use for heavy current equipment, such as the anchor windlass and associated control systems, DC air conditioning, any electric thrusters and controls, electric toilets and controls, MSD systems, refrigeration system, sail handling winches and associated control systems, watermakers, etc.

800 (801, 802 etc): Use for the various battery charging systems and this includes any installed solar panels, water generators, wind generators and also circuits from the engine alternator, including diode isolators, main output, relays, etc. I also use this for any power monitoring or metering that includes ammeters, voltmeters and other devices.

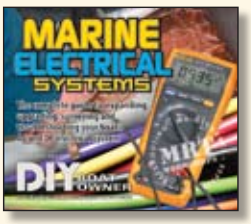
900 (901, 902 etc): Use where various bonding and grounding conductors are installed in the boat. This includes cathodic protection bonding, lightning protection system bonding, tank bonding, etc., and for any basic equipment grounding used for interference and RFI suppression.

X1000 (X1001, X1002 etc): This is reserved for all AC power systems, including AC generators, inverters and associated control systems, shorepower systems and all general AC distribution and wiring systems. The use of an X prefix and a 4 numeral coding arrangement is to clearly distinguish it from the DC wiring system.

There are variations on both wiring color coding and wiring label systems. Devise a marking system that works for you and then apply it consistently. It will make your and your service technician's lives easier and it saves you time and money. It may even save your life.

About the author: John Payne is the author of the newly released third edition of "The Marine Electrical and Electronics Bible" and the website, fishingandboats.com.

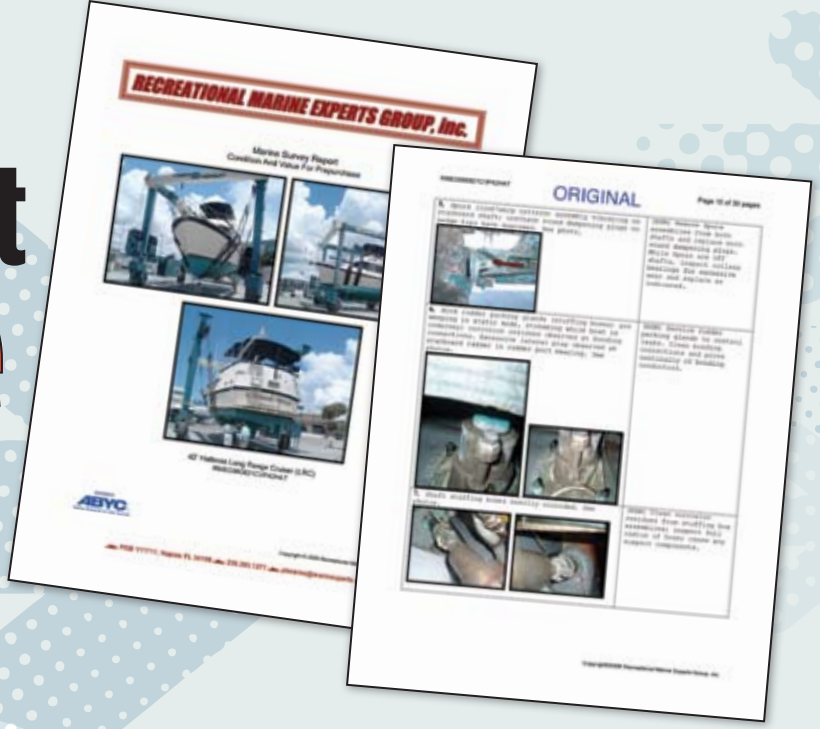
ADDITIONAL READING



Marine Electrical Systems CD

A guide to expanding, upgrading, surveying and troublshooting your boat's AC and DC electrical system. All articles follow ABYC Standards. Includes information relevant to this article including: steps to prepare a wiring schematic, ABYC DC engine wiring color codes and wire identification

Choosing a Boat to Renovate



Follow this recipe for success to find a special older boat that is worthy of the investment to keep it serviceable or to refit and refurbish.

By Pat Kearns

It's not just all about nuts and bolts, blisters and budgets when purchasing a used fiberglass boat. The magic formula for determining which older boats are worthy of refurbishing or upgrading and have the potential for giving continued pleasure begins with good genes and an intrinsic value worth preserving and/or improving. Prospective buyers may be ready, willing and able to buy a boat but plotting the waypoints to that acquisition is much more than searching the ads and meeting with yacht brokers. An honest pairing of the surveyor's objectivity and the buyer's subjectivity can be the recipe for success.

When a succession of surveys in the quest for the boat "that can" leads to boats that consistently produce disappointment, it's time to begin the "analysis" of both the boats and the clients. It's time to isolate the passion factor and to intellectualize the buyer's goals, time for the surveyor to step back and facilitate the talk "therapy."

It's not the surveyor's job to tell someone what kind of boat to buy or even whether the one chosen is a right buy. The surveyor's examination and report must produce the information to enable his/her client to make an informed decision. But surveyors sometimes also have to don the psychologist's hat as they approach a boat for survey that an elated would-be buyer has selected. When these expectations turn into nightmares of disappointment, talk therapy is often integrated into the survey process.

Separate the Wheat from the Chaff

If you're searching for that special preowned boat, begin the process by making a list of the boats that generally meet your needs. In business goal setting, the principal players in a project face a triangle of parameters that defines their approach to a task. Using the same method, a triangle for the boat "that can" might have these three sides: price; the look, size and condition; and the desired pedigree. If money is no object and you have the pick of the market, you can have all three. More often, you can have two of the three and you have to prioritize the parameters of your choice.

Working with your surveyor, pare down the list to include only the boats that meet the gene pool criteria (worthy pedigree) and then identify the qualities or characteristics that your dreamboat has to have.

Don't be enthralled by an exhaustive equipment inventory on the boats you see as possibilities. Strip off all the electronics, soft goods (biminis, covers, upholstery, linens, etc.) tools, dinghy and outboard and total their current (new) value. Binoculars, galley ware, linens, 10-year-old electronics, an aging inflatable, assorted tools, old charts and cruising guides, etc., are often touted in a listing inventory as making the boat "ready for sea" when, in fact, while maybe still serviceable, this stuff is obsolete and could fail at any time. Furthermore, their value today is almost incalculable, mere pennies on a replacement dollar so the value isn't a significant percentage of the boat's current market value.

Next, visit the boat's "perishable" systems: engines, fuel and water tanks, electrical systems, generator and air-conditioning. What if some or all needed upgrading? Identify exactly what work you can do and what you're not equipped to do, the kind that would require a steep learning curve or professional services. The goal here is to develop insights that will help you in your price negotiations before and, sometimes, after the survey.

Proof Positive

Let's follow this process with Jane and Michael, an ambitious couple with a cruising plan. Their vision includes cruising and living aboard for extended periods. They had looked at lots of boats, mostly trawler types but a few

The author at work venturing into spaces previously unexplored on the boat du jour. Despite all the tools available for a surveyor's use, the five senses and a healthy dose of integrity are still the most important tools of the trade.

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Pat Kearns

It's easy to appreciate the handsome is as handsome does of the 1981 Hatteras 42' LRC. For 20% of the cost of a modern yacht, this one is still an eye catcher.

Nick Bailey

Evidence of blisters looks scary but boats don't die from blisters. The condition should be evaluted by a fiberglass repair expert before deciding on the repair process.

Pat Kearns

All that is rusted is not necessarily terminal to an elderly engine. Though concerning to a potential buyer the engine surveyor put the situation into perspective.

motor yachts as well and they were discouraged. They had a budget, a fairly generous one, and they liked traditional boat designs. They'd been listening to friends, brokers and doing lots of reading and shopping both with yacht brokers and online. They were targeting what appealed to them visually and the darts they shot at a few targets turned out to be disappointing in terms of boat condition. They wanted the economy of diesel engines and liveaboard amenities in an affordable package and, in their triangle, they knew they would be looking at mature boats.

At this point in the story, Jane and Michael had already been through one deal that resulted in a walk-away after the survey. Coming down the runway, so to speak, this boat was a stunner. Dark green gelcoat on a faux planked topside molding and the handsome, respectable look of a seagoing trawler yacht. It called to everything Jane and Michael liked and wanted but, up close, it had been around and it didn't take long under the surveyor's scrutiny for it to lose its allure.

Working with the surveyor, Jane and Michael narrowed their wish list of boats. To spice up the mix, the surveyor tested their parameters for size, adding a few boats that they had not yet considered. They then identified the qualities or characteristics that their dreamboat had to have, the ones that were the nice to haves and those that were not factors at

all. They had previously succumbed to a pattern of being captivated by the equipment inventory of the boats they saw as possibilities. Now, they applied the formula for assessing the value of obsolete equipment in each list. This was a startling revelation to Jane and Michael. Buying all these things new was just not a big deal in the macro view of their plan. This was an exercise in getting them to focus on the wheat, not the chaff and was a huge step toward making a realistic assessment of a boat's value.

As for perishables, replacing machinery was not feasible at any price, as they had a cruising timeline and they could not tolerate weeks in the yard for installations and proving trials. Another list suggested they could handle everything but major engine work, rewiring, significant fiberglass repairs, etc. The boat had to have good engines, thru-hull fittings and plumbing, no structural faults, an electrical system that had originally been well engineered and installed and a decent appearance. Everything else could be fixed. If the remaining stuff onboard is serviceable, all to the good but it doesn't add much to the real value of a boat.

The boats the surveyor added to Jane and Michael's list of boats "that can" had the livability needed, the economy of diesel engines and were worthy of bringing them to the new life they deserved included a Hatteras 42 LRC (long range cruiser), the 40 and 43 Hatteras motoryachts, the Hatteras 38 double cabin, a Gulfstar 44 motoryacht, Grand Banks, Island Gypsy, Cape Dory Explorer and others. The Hatteras LRC quickly surfaced as their first choice. It was offered at the limit of their budget.

A survey and test run were scheduled along with an independent marine engine survey. The survey report enumerated 41 items to be addressed, along with the rebuilding of the engine transmissions from the engine surveyor's list. The boat had a full bloom of blisters and that was factored into the budget for future repairs.

Since taking possession of the boat, Jane and Michael have put their souls and shoulders to the task of putting it in order and making ready to weigh anchor for America's Great Loop, the continuous waterway that circumnavigates the eastern portion of North America from the Atlantic Seaboard, across the Great Lakes, down the inland rivers and along the shores of the Gulf of Mexico.

This boat had all the earmarks of a successful investment in boating pleasure. As in most other decisions, good looks (subjective), good genes, operating capability and an ability to meet an intended purpose made for a good buying decision. Much of the success Jane and Michael had in their quest for the boat "that can" came in the intellectual analysis of their goals. The surveyor took care of the nuts and bolts.

About the author: DIY's technical editor, Patricia Kearns, is a NAMS certified marine surveyor and operates Recreational Marine Experts Group, a marine surveying and consulting firm based in Naples, Florida.

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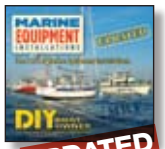

Here's how to choose, install and operate equipment for your boat including: air conditioning and heating systems, audio systems, bow thrusters, davits, lightning protection, propane systems, refrigeration, windlasses and more.

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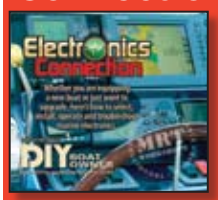

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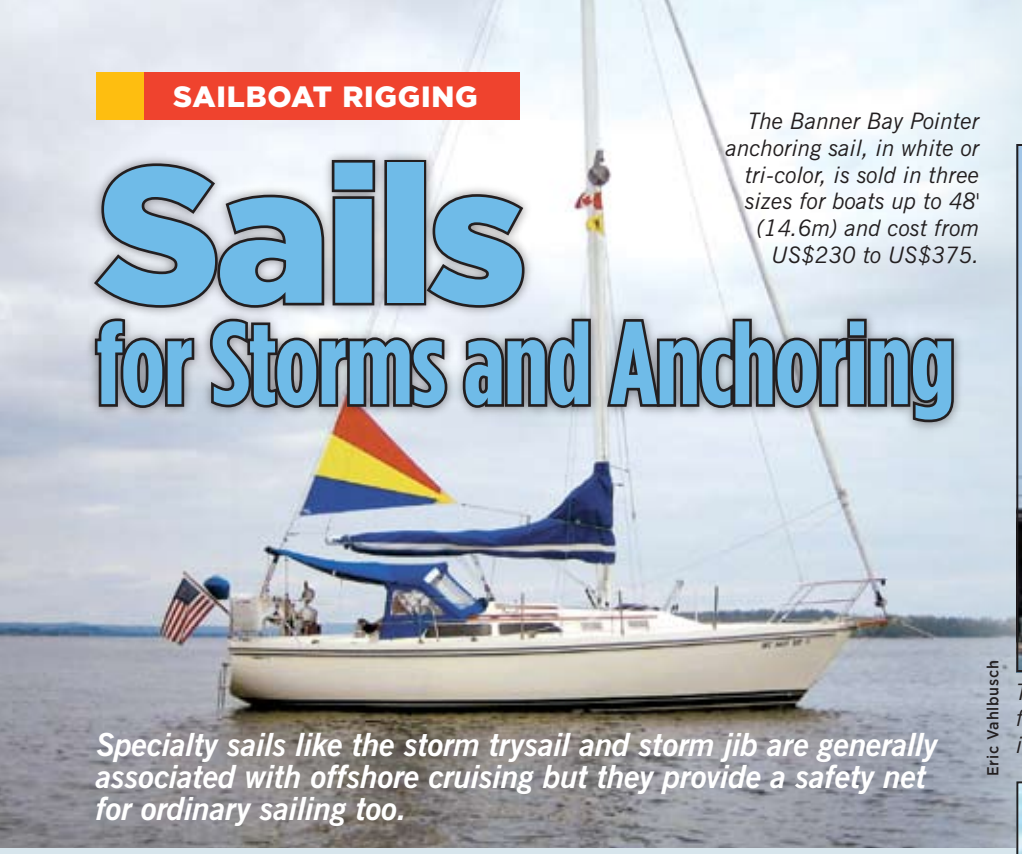
Sails for Storms and Anchoring



Specialty sails like the storm trysail and storm jib are generally associated with offshore cruising but they provide a safety net for ordinary sailing too.

The Banner Bay Pointer anchoring sail, in white or tri-color, is sold in three sizes for boats up to 48' (14.6m) and cost from US$230 to US$375.

Eric Vahlbusch

Courtesy of North Sails

Trysails are made in five sizes to fit boats from 30' to 50' (9m to 15m) and range in price from US$400 to US$800.

Courtesy of ATN Inc.

The Gale Sail from ATN is available in five standard sizes to fit 27' to 60' (8.2m to 18.2m) boats. Prices range from $495 to $1770.

Courtesy of North Sails

Storm jibs are made in five sizes to fit boats from 26' to 50' (8m to 15m) and cost US$415 to US$825.

By David and Zora Aiken

Sturdy storm sails have helped as many weekend sailors caught by a fast-moving front as they have served long-distance cruisers caught in the storm system for days. Production storm sails are sized to accommodate boats within specified size ranges and are best suited for inshore cruisers. Offshore cruisers may prefer to have storm sails designed specifically for their boat. A custom sail assures the best possible fit and that can translate to better handling and control when it's really needed.

Heavy (8 to 10-ounce) Dacron is one measure of a good storm sail but its real strength has more to do with construction details than material. Storm sails have extra rows of stitching on seams and oversized reinforcements at all stress points. Safety issues are covered by high visibility, fluorescent green Dacron patches (green rather than caution orange, which is an international distress symbol), sewn on both sides near the head of the sail, and built-in radar reflectors. Check with your sailmaker and rigger for recommendations on the appropriate sails as well as suitable rigging.

Head to Wind

When the final mainsail reef still leaves too much sail area and/or conditions are such that a smaller, heavier sail would help reduce speed and ease the crew's effort, it's time to hoist the storm trysail on the main mast. Normally, a separate track is installed on the mast starting below the gooseneck and this sail is often bagged and stored on deck, ready to hoist when needed. To use, drop the mainsail, transfer the main halyard to the trysail and haul away.

The storm trysail does not have a horizontal foot, because that would make it impossible to have a proper lead for the sheets. Instead, the sail's foot is cut on a downward angle slanting aft. Hoist the sail until the tack is above the furled mainsail stack and then run the sheets aft. The sail must be hoisted high enough so the boom is not in the way of the sheet lead. On some boats, the spinnaker padeyes are the likely location for sheet blocks; other sailors put the sheet blocks on the genoa tracks. Find the best lead so the sheets pull back and down to keep the sail flat.

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Storm Jib

On boats that use only hanked-on sails, the storm jib is set like any other headsail but cruising boats nowadays are largely equipped with a roller-furled genoa. Nobody wants to drop and stow the genoa, especially when the weather is turning foul. Fortunately, there are a few alternatives for setting a storm jib.

If the boat has a permanent inner forestay, no special adaptation is needed to attach the storm jib. Simply hank the sail onto the inner stay and hoist it with the staysail halyard. To compensate for the mast stress from the forces of the storm jib, use running backstays to add support for the mast.

If the boat has no permanent inner forestay, with planning, it's still possible to set the jib in that mid-foredeck location. Rig a temporary stay equipped with a quick-release mechanism (a.k.a. a Hyfield lever) and a chainplate (or heavy- duty padeye) set into the foredeck. [Ed: Instructions on mounting and rigging an inner forestay appeared in DIY 1995-#3 issue and this article is available on DIY's MRT "Sailboat Rigging" CD-ROM or the "1995-2006 Hands-On Boater" CD-ROM.] To use the storm jib, connect the stay to the chainplate, hank on the sail and hoist it with the staysail halyard, which you will have to add to a boat not usually set up with a staysail. Most storm jibs require a tack pendant, usually a wire one. Use running backstays here, too.

A third alternative utilizes a small furling drum installed behind the headstay. Because the sail is already furled with the drum furler, it can be rigged well before the threat of bad weather. The sail is made with a heavy rope luff and hoisted with a very low-stretch line. If the halyard is led back to the cockpit, the sail is hoisted and set when needed without sending crew on a hazardous trip forward. The rigger may recommend a 2:1 halyard to ensure the tightest possible set. The sail should set relatively flat but some luff sag is unavoidable and that may provide as much shape as the sail needs.

Another choice exists in the patented Gale Sail (atninc.com), a storm jib that fits over the furled genoa. After furling the headsail, coil the sheets around the furled sail and lead them down to secure at deck level. Attach a halyard (spinnaker or spare jib halyard) to the head of the Gale Sail, attach the sheets and hoist the sail's luff "pouch" over the furled genoa. The smooth Dacron of the luff "pouch" slides easily over the furled Dacron sail and makes this unique set possible. Because it fits over the genoa, the Gale Sail provides the coincidental side benefit of preventing the headsail from unfurling unintentionally. Like other storm jibs, it can be used alone or with a reefed main or trysail.

Anchoring Sail

Many boats sail at anchor, tacking back and forth on the leash of the anchor rode, even in a light breeze. Under ordinary conditions, the tendency might be overlooked but, when the wind kicks up, such sailing becomes worrisome, especially if the anchorage does not have room for this tacking motion. Equally troublesome, the abrupt halt that occurs with each tack stresses the ground tackle and may dislodge the anchor.

To stop this tacking, sailors have long used a riding or anchoring sail. Set at the stern, this sail forces the boat to ride quietly bow to wind. While riding sails were traditionally set on the mizzenmast of a ketch or yawl, today's sloops use the backstay or, occasionally, the mainsail topping lift to hoist this sail. To set the anchoring sail, hank it onto the backstay. Attach the main halyard to the head of the sail, another line to the tack (for a downhaul), and a third line to the clew, leading that line forward to a suitable fitting on the boom or mast. Adjust the three lines as necessary to keep the sail at the desired height and as flat as possible. If the boat has a split backstay, it's still possible to use an anchoring sail. Banner Bay Marine, manufacturer of the Pointer, provides suggestions for different configurations on its website (bannerbaymarine.com).

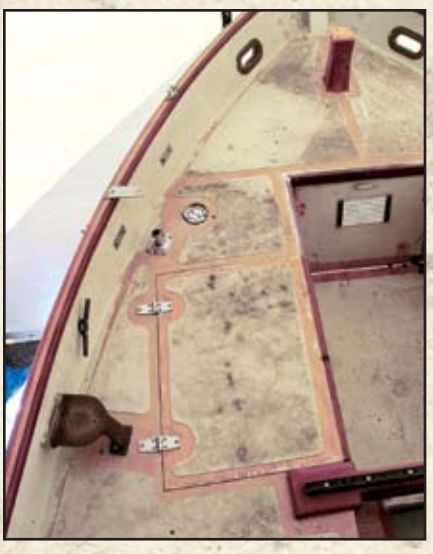
Not all boats react the same way to the same setup. Some sailors intentionally tie the clew line slightly off center. Similarly, while the rudder is usually centered, there's room to experiment here, too. Whatever the individual setup, boat owners seem universally pleased with a much improved anchoring situation.

— David and Zora Aiken have been meandering by boat for more than 20 years and are authors of numerous books on boating, camping and travel.

Winning the Mildew Battle

It takes more than boat soap to effectively remove and eradicate mildew. Here's the secret.

Story and photos by Jan Mundy



Before: Mildew stained deck, the result of condensation build up in a poorly ventilated, canvas-covered shed.

Mildew combat kit: hydrogen peroxide, boat soap, spray bottle, medium bristle scrub brush, rubber gloves and a PVA Absorber.

For many years my wood-epoxy sailboat has been cradled under a canvas-covered, pipe-framed structure, sorely neglected and in various stages of reconstruction. Visiting the boat last winter after a season's absence, I discovered the one drawback of this shed type; they sweat buckets, year round. As long as there's sun, condensation builds up on the roof inside and it drips on deck, even in freezing temps where water turns to ice only to thaw on a warmer day. So it was with sorrowful eyes that I looked at the deck blackened with mildew from bow to stern. I hastily retreated, anxiously wondering how best to deal with this severe mildew attack and concerned about permanent surface damage.

My first response was to call Abe Kelly, a brilliant chemist and former owner of Captain Phab who has, in the past, rescued many DIY readers from their unusual maintenance challenges. (Readers might remember the fiberglass-eating bilge fungus.) Mildew is a vegetative fungus that thrives in warm, damp, poorly ventilated environments. To eliminate it, you must kill the mildew fungi or the spores regenerate and it grows back. Abe was certain that a marine boat soap would have no effect and I didn't want to use a toxic solvent. He recommended an aggressive approach using a mild solution of household chlorine bleach and if ineffective, then to use hydrogen peroxide, beginning with the drug store variety and then using commercial grade strength, if needed. Adding a little soap to the mix would suspend the gunk until the deck was thoroughly rinsed.

What more harm could I do? I approached the task with a trial and error attitude and arrived at the boat with a tub of cleaning products.

It didn't take long to determine what products didn't work. Assorted brands of boat soaps in various concentrations and heavy-duty stain removers containing mild acid formulations were left to soak for a few minutes. Other than removing surface dirt none touched the mildew. The deck surface is a slip-resistant synthetic material that I had epoxy glued to fiberglass and was just awaiting the finishing paint. The mildew had a powerful grip on this porous "fabric." What was needed now was to concoct a high-powered cleaner that would eradicate the mildew and hopefully, clean the deck and remove the severe staining.

Considering that chlorine bleach can damage some plastics and or painted surfaces and is harmful to the environment, I decided to first try Abe's second option. Hydrogen peroxide (H202) is an odorless solution of water and oxygen. It cleans and disinfects without toxic chemicals. Like ozone, it kills mildew by oxidation and the residue from cleaning is nothing more than environmentally safe water, oxygen and hopefully, lots of dead microorganisms (mildew).

Armed with three bottles of a 3% solution of H202 and a bottle of boat soap (not concentrated), I proceeded to mix small batches diluted with water of varying strengths, beginning with Abe's recipe, in a spray bottle. Each batch was sprayed over a very small area, allowed to sit on the surface for a time, agitated by hand with a medium bristle scrub brush and rinsed off with water.

The successful potion was: one part H202, one part water and 1/4 part boat soap. I sprayed this solution

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After: The H202 blend removed all but the most stubborn stains. The bleaching power of H202 took care of the rest, which disappeared over time.

on the surface, let it "cure" for 10 minutes and then scrubbed aggressively, rinsed and dried the surface with a PVA Absorber cloth. Dividing the deck into quarters, working the bow area first, then each of the side decks and finishing with the cockpit, allowed me to focus my labors on a smaller area.

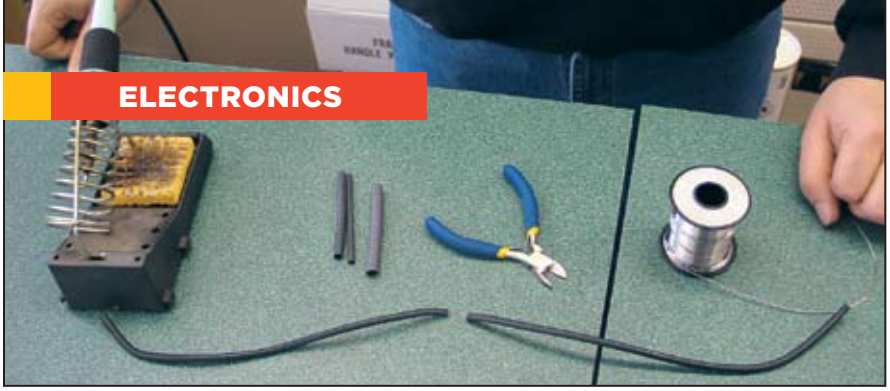
Two hours later all painted surfaces were clean after a single application and only the cockpit area required a second application. Mildew stains that remained on the material were then sprayed with a stain remover but without success. The fungus had been active too long enough and had damaged the material, or so it appeared.

The deck now looked worn, rather than new, but not bad for a 23-year-old boat. Once completely dry, I covered the deck in 6mil plastic. Water dripping from the roof would now pool on the plastic and either run onto the shed floor or evaporate. Painted interior cabin surfaces were also coated with mildew but that was a cleaning task for another day.

If ever you're confronted with a mildew infestation, use a commercial grade of H202, if available. Its 30% solution cleans faster and better removes stains than the drug store variety.

Interestingly, since doing this job four months ago, all stains have completely disappeared and the deck looks new again. Victory was mine. I had battled mildew and won.

About the author: Jan Mundy is editor of DIY.



How to Splice Coaxial Cable

Follow these steps to splice a damaged coaxial cable.

Though manufacturers do not recommend splicing coaxial cable, in the event of a damaged cable, it is possible to repair rather than purchase a replacement one. It's an easy, 10-minute job that requires a soldering gun, solder, wet sponge, wire cutters, wire stripper, heat-shrink tubing, butane lighter and a small piece of aluminum foil.

If you're unsure of soldering basics, practice on some scrap wire. The key to a strong soldered joint is the proper amount of heat. Too much heat can damage the wire; too little heat results in a weak joint. Use hobby-type, rosin-core (flux) solder, which is sold at electronics supply stores. It contains the correct tin-lead ratio.

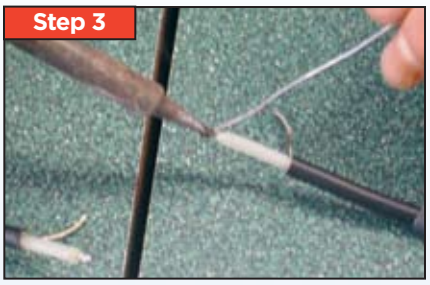
Step 1

Make a straight cut on both joining ends of the coax cable. Over one end, slip two pieces of heat-shrink tubing that are three times the length of the splice and of a diameter slightly larger than the cable. Strip 1" (254mm) of insulation from the end of each cable. Tightly twist the exposed shielding wires together.

Step 2

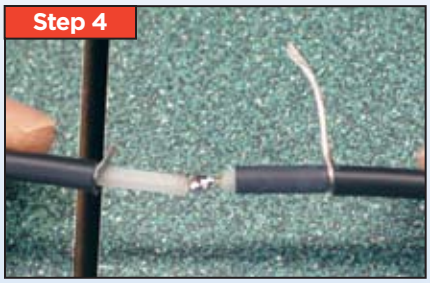
Strip 1/8" (3mm) of the plastic insulation that surrounds the center core wire. Be careful not to cut the wire. Do this on each cable end.

Step 3



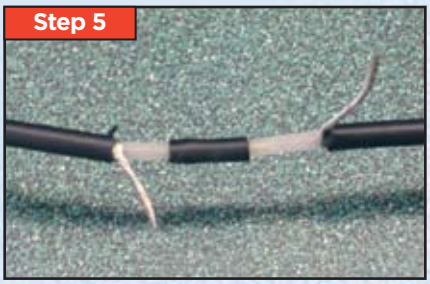
Tin the end of the center core wire. To do this, wipe the soldering gun tip on a wet sponge, and then apply a small amount of solder to the tip. Place the soldering gun against the exposed core wire and then apply solder to the wire (not to the tip).

Step 4



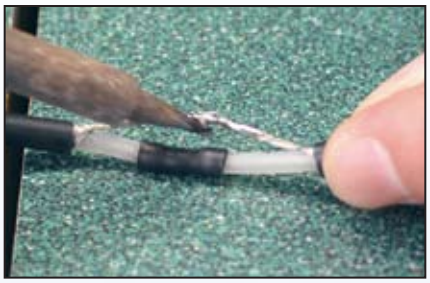
Join the two center core wires together with solder using the method outlined above to tin the wire.

Step 5



Slide one piece of heat-shrink tubing over the joint and using a butane lighter carefully apply heat to shrink the tubing (don't burn it). This insulates the connection to prevent shorting.

Step 6



Tin the ends of both twisted shielding wires and then join the ends by twisting them together and soldering.

Step 7

Wrap aluminum foil around the splice.

Finish by sliding the remaining piece of heat-shrink tubing over the joint and shrink to form a weathertight seal.

Story and photos by Jan Mundy

Much thanks to Bill Glowsky of Shortwave Marine (905-278-6541) for sharing this trade secret with DIY readers.

Steering Upgrade

The steering tube is the Achilles' heel of a cable steering system but it's easy to protect.

Story and photos by Jerry Jones

It started as a normal day. Two game wardens were patrolling a waterway in separate 22' (6.7m) patrol boats. These boats proceeded to overtake a slower-moving trawler, passing on each side. As one of the wardens steered across the trawler's wake, which was less than a foot high, his boat suddenly veered violently to the left and he was thrown overboard. When he hit the water, his lifejacket deployed. When he surfaced, he saw his boat running in circles.

He began swimming toward the shoreline, glancing back at his boat as he swam. To his horror, the circling boat was coming directly toward him. As it approached, he attempted to kick it away but the propeller struck his leg, slicing it badly. Bleeding heavily, he removed his dress belt, wrapped it around his injured leg and continued to try to get to the shoreline.

Meanwhile, the other warden cleared the bow of the slower vessel but he didn't see his partner on the other side as he expected. Looking back, he saw his partner's boat circling out of control. As he quickly turned his boat around, he saw his partner in the water. He sped over and pulled him from the water, adjusted the tourniquet and phoned EMS. A medical helicopter met them at the nearest harbor and transported the injured warden to a metropolitan hospital about 100 miles (161km) away.

Even with the excellent emergency medical care he received, it took months of physical therapy before he could walk again. Five years later, he still walks with a slight limp. Still, he is thankful that his fellow warden was there to pull him from the water and get help.

A snapped steering cable initiated the chain of events that led to this accident. When the cable failed, the outboard slammed to one side, turning the boat suddenly, throwing the operator out of the boat. Unseen corrosion had weakened the cable internally even though the boat was well maintained and its steering system had passed visual inspections. Basic preventive maintenance could have saved the day and the anguish of its consequences.

Insurance company claim reports contain accounts of boats running into trees, stumps, docks, bridges and other boats because of a steering failure. Thankfully, most of these accidents don't result in serious injury or death. When a steering cable assembly is sealed and lubricated, it can provide satisfactory service for the life of the craft. The trick is to keep the contaminants out and the lubrication in.

Cable Design

A typical cable steering configuration has a shielded cable that connects the wheel at the helm to the tiller rod on the outboard. The aft end of the cable, called the steering rod,

Typical factory configuration on a 90-hp Mercury.

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moves back and forth through the outboard tilt tube as you steer. When you turn to the right, the steering rod extends from the port side of the tilt tube. While it's extended, it's exposed to splashing water and all kinds of contamination. Turn left and the steering rod pulls back inside the tilt tube, along with the moisture and contaminants it picked up while working outside the tilt tube. When drawn back into the tube, these elements go to work to corrode and the internal carbon steel parts. In extreme cases, moisture is drawn up the cable sheath by capillary action and the cable begins to rust. This may cause steering performance to become sluggish or fail completely.

The Steersman Steering Guard replaces the factory nut on the port side of the outboard tilt tube. The steering rod, which is part of the cable assembly, passes through this nut as the boat is steered.

Nut Replacement

The Steersman Steering Guard, formerly known as the Widget, replaces the factory nut on the port side of the tilt tube. It includes a grease fitting and the all-important O-ring that wipes off the moisture and contaminants before they can get inside the tilt tube. Unlike the various "wipers" available, the O-ring causes the least amount of resistance to movement. The grease fitting allows for lubrication of steering parts. Very little grease is required but a bit of lubrication is very helpful any time you have the friction of a rod moving inside a pipe. Many boaters assume that the grease fitting found at the center of most tilt tube assemblies lubricates the steering; however, none of the grease from that fitting reaches steering parts. It only lubricates the tilt motion of the outboard.

Made in the U.S., there are two versions: a 300 series all stainless-steel model for freshwater or saltwater (US$30); and an anodized aluminum model for freshwater only (US$20). The standard 7/8" size fits all Honda, some Mercury, Nissan, OMC, Suzuki, Tohatsu and Yamaha motors. The larger 1" device fits Mariner and some Mercury motors. Check steersman.com for more information. Many boat dealers, boatyards or marinas sell the Steersman, as well as authorized American Honda and Yamaha dealers who offer it under their own brands.

The best time to install a Steersman is when the inside of the tilt tube is smooth and dry. If your steering is getting "sticky" and rust has already begun to take hold inside the tilt tube, clean it out using plumbers' pipe wire brushes or brake cylinder hones or gun-cleaning brushes or similar tools. T&R Marine (trmarine.com) sells a wire steering tube cleaning brush (part number TB-10) that fits into a power drill.

Installation

Depending on your boat and your skill level, installation could take anywhere from 5 minutes to an hour. The installation detailed below was done on a Mercury 90-hp outboard.

Step 1 Remove the locknut holding the tiller rod to the steering rod. Typically this 3/8-24 UNF nylon lock nut is removed with a 9/16" wrench.

Step 2 Lift the tiller rod and pivot it out of the way. If your steering has been stiff, this is a good time to diagnose the problem. If the steering is still stiff with the cable disconnected, the cable may need replacing. If it's smoother when disconnected, get

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out your engine manual and lubricate your engine pivot. A stiff pivot puts more pressure on the cable and hastens its demise.

Step 3 Remove the factory nut. This nut can be as large as 1-1/2" so have a large crescent or open-end wrench available. It's not necessary to remove the factory nut if at least three threads are already exposed. The Steersman can be threaded onto the tilt tube alongside the factory nut.

If when turning the factory nut the threaded tilt tube rotates, secure the tilt tube from the starboard side of the engine, where the cable is attached, to keep the cable from twisting. One good way is to tighten the two nuts on the cable side against each other and hold them with another wrench while the factory nut is removed. If your factory nut is welded on with rust, apply penetrating oil to release the grip of corrosion.

Visible thread length differs depending on the make. If more than 1/2" of the threads are exposed on the threaded tilt tube and the Steersman is tightened all the way to its shoulder, it will interfere with the flow of grease into the tilt tube. In many cases, you can adjust the length of exposed thread on the steering rod end of the tilt tube by turning the nuts on the cable side. This technique just slides the threaded tilt tube toward the starboard slightly. If this is not possible, washers may be used under the Steersman to keep the grease fitting clear.

Step 4 Wipe the steering rod clean. You may see a bushing or wiper in the end of the threaded tilt tube. Remove it if possible. If there is any "wiggle room" between the inside of this tube and the steering rod, you do not have to remove this bushing. If it is truly a wiper or O-ring, it will be necessary to remove it for the proper flow of grease.

Step 5 Apply a small amount of grease to the O-ring and slide on the Steersman.

Step 6 Tighten the Steersman securely. It may be necessary to tighten both steering/tilt tube nuts prior to tightening. Make sure the grease fitting is accessible.

Step 7 Replace the tiller rod linkage nut and washer(s). Do not over tighten. Since this is a locknut, just tighten it gently until snug. It needs to be free to pivot. If you have a torque wrench, tighten to a torque of 7 to 8 ft lb and then loosen the locknut 1/8 turn.

Step 8 Grease using a hand pumped grease gun only containing a marine Moly EP or lithium-based grease. Do not over lubricate, as this can cause hydraulic lockup. One full shot, two maximum.

Maintenance

As a general rule, a steering cable requires very little maintenance. If possible, when storing your boat, keep the cable out of direct sunlight as UV rays deteriorate the plastic outer jacket. Cables also benefit from a freshwater bath after being used in saltwater. Whether your boat's steering cable is older or brand new, periodically, look at the outer jacket, which is typically black or red plastic. Early signs that a cable is deteriorating include a faded outer jacket, cracks and/or swelling. These indicate the cable needs replacing.

Maintaining your steering with the Steersman is very simple. Every four or five outings, just give it a shot or two of grease. You may never need to replace the O-ring, but if you begin to see streaking on your steering rod, it's time to replace the O-ring. Replacements are free for the life of your Steersman.

These Hallowed Hauls

Story and photos by Tedd Campbell

18 tips for dealing with boat haulers

After years of searching, you've finally found the Holy Grail of boats. Yes, you've purchased the ideal yacht at a reasonable price. There's only one catch: the boat is a 2,500-mile (4,023 km) road trip away.

Assuming that your midwest gem doesn't come with a trailer and you're not prepared to shell out several thousand dollars to have one built and then even more money to upgrade your wheels from commuter car to the SUV or large pickup needed to pull the trailer, you'll have to find someone to move the boat for you.

If you (and the seller of the boat) have all the time and money in the world, then this delivery stuff is a snap. Simply call the first professional boat hauler listed in the phone book, tell him to pick up the boat whenever he finds the time and bill you when he arrives. But what if your boat is damaged or destroyed in a traffic accident and the hauler's insurance doesn't cover your loss?

Equally important is timing. The same pressure on the seller that helped you land this great deal may now be working against you as the seller needs the boat moved quickly.

While the cost of having your boat hauled across the country may represent just a fraction of the purchase price, even a local delivery can add unanticipated cost to the purchase of a small, older project boat that you plan to restore on a shoestring budget. If it has to be transported across country, it's now up to you to find the right boat hauler for the job.

Here are some tips to help prevent the delivery of your dreamboat from becoming a nightmare.

1 Timing: Don't wait until the very last minute to find a boat hauler. All haulers that I contacted in early summer were booking at least a week in advance. Often, it's difficult for them to immediately nail down a specific date since some jobs may take longer than anticipated or they want to control their schedule to achieve efficiencies of scheduled deliveries, unavoidable delay or to avoid deadheading (a return trip with no load). Our boat haul was tentatively scheduled for a Friday but was actually picked up and delivered on Sunday because of delays with the previous delivery. You, and possibly the seller, need to be flexible with your schedule.

When we arrived, the cradle was resting on 4" steel pipes that the seller had used to roll it out of the garage. Here boat hauler Dave Kopriva positions cement blocks under the cradle.

Grey hairs, anyone? The truck slowly drags the cradle forward onto blocks to allow 8" (20cm) minimum clearance for the hydraulic lift. Since the truck was too long to back straight into the driveway, the cradle was also dragged to one side to allow access.

2 Distance: What is the minimum distance that the boat needs to be hauled? In other words, can you save on haulage fees by having it transported to the closest marine facility where it can be launched and then motored or sailed home? Our boat was in too many pieces to make this practical but it may save you money and get you out on the water much sooner.

3 Ask around: As with any service for which you hire help, it's always best to seek referrals from your local marina or yacht club, boatyard and boat dealerships, along with family, friends and reliable acquaintances who might have shipped a boat. Also check with the BoatU.S. Consumer Protection Bureau for a list of qualified boat haulers (703/461-2856).

4 Measure: Note the basic specifications of your boat, such as overall length, beam, height from keel to cabin top and weight. You may be asked for some or all of this information during the quotation process. These specs are especially important if it's a rare or custom yacht that may be unfamiliar to the hauler. On U.S. highways, 8'6" (2.6m) is the maximum load width without applying for special permits, state by state.

5 Paperwork: Get a written quote for delivery. Many hauling companies provide online quotation services, where you fill out a form on its website to have a quote emailed to you. If you call for a quote, request a written copy via e-mail, fax or mail. As with any other quote, be sure that you understand what is included and what is extra. Does the total amount include all applicable taxes? Several different haulers quoted me CDN$3 per kilometer (about US$5 per mile,) plus taxes for a regional delivery to my home in Ontario. Others made reference to a separate fuel surcharge. Review the quote with the hauler before engaging his services so there will be no surprises when it comes time to pay. Also negotiable, you may get a cheaper rate if the hauler can deliver your boat on a return trip when he would otherwise be running with no load.

On the preparation for transport, find out what services the hauler does and does not provide for the quoted price and what extra charges you might encounter. For instance, what equipment must be removed, such as masts, rigging, radar arch, flying bridge, etc.

6 Finalize title transfer: Finalize the purchase of the boat and all financial transactions as well as ownership transfers before arranging transport. Obviously, the seller won't let anyone lay a finger on the boat until he gets paid in full. The hauler may want to deal only with the owner.

7 Check insurance: Once ownership is transferred, make sure your boat is covered by insurance. Find out what damage your yacht policy covers during transport.

For the hauler, ask to see proof of the boat hauler's insurance coverage and call the insurance company to confirm that the policy is still in effect. If the boat is damaged en route, you need to be certain that you will be compensated for repairs or replacement. If your boat is extremely valuable, be absolutely sure the hauler has enough coverage for a total loss.

8 Search the MC number: The Federal Motor Carrier Safety Administration, which regulates interstate hauling in the U.S., approves companies by issuing a "Motor Carrier" (MC) number. If a U.S. hauler cannot provide a MC number, keep looking. You can search the web site at www.safersys.org and go to "Company Snapshot" under "FMCSA Searches." They should be checked for "authorization for hire" status under Operator Classification.

9 Prefit: If you are picking the boat up or dropping it off at a location other than a large lot, be sure to take measurements of the area (e.g., entrance width, clearance from ditch, street width) and ask boat haulers if

With the cradle turned and on blocks, the boat was finally ready for loading onto the trailer.

That won't fit in my driveway! The boat is only 25' (7.6m) but the truck and trailer are more than twice as long.

their truck/trailer will be able to maneuver in the space available. Neither you nor the hauler wants to cancel the job at the last minute because his truck can't get to the boat. If you can't travel to the pick-up location, ask the seller to measure the area for you and, better yet, get digital photographs to enable you to actually see the lay of the land. Most boats are delivered to marinas, yacht clubs or storage lots but if not, be aware that a tractor-trailer likely doesn't have enough room to back into a residential driveway.

10 Lift clearance: Ask each hauler about his trailer(s). Is it equipped with a hydraulic lift or does the boat need to be lifted from the trailer (or cradle) with a forklift, crane or straddle lift (an additional expense)? If hydraulically equipped, does the trailer lift the cradle (and boat) or just the boat? If the trailer is designed to lift the cradle, do you need a certain type of cradle? How much ground clearance (under the cradle) is required by the lift? During the quotation process, several haulers mentioned to me that they needed a minimum clearance of 8" (20cm) while others were more vague, saying that the cradle just needed to be on blocks. If the trailer lifts only the boat, is there also room for the cradle? For sailboats, find out if the mast should be tied to the boat or kept separate.

If the boat is stored indoors does it need to be pulled out of the shed or can the trailer fit through doors and pull directly into the shed? If the boat is in the water arrange with the marina for it to be hauled and placed on a cradle ahead of time or see if the boat can be lifted and loaded directly on the truck. There may be extra charges for this. Check the same for the drop-off location so you're prepared when the truck arrives.

11 Border crossings: If your boat is transported across international borders, contact customs officials well in advance to learn about procedures and expenses involved. Our boat was transported within Canada so we did not have to deal with cross-border issues. Other international boundaries may require the services of a freight forwarder experienced with these matters.

12 Good directions: Provide the hauler with clear, detailed directions to the pick-up and drop-off locations. This may seem like a no-brainer but in the flurry of arrangements surrounding a boat purchase (e.g., financial matters, insurance, finding a slip, etc.), it can be easily overlooked.

13. Stay in touch: Provide the hauler with a contact number where you can be reached on the scheduled pick-up date and stay close to the phone to sort out any last minute glitches. Also, if the seller is still involved at this point and, if he agrees, provide the hauler with his phone number. The seller is probably more familiar with the area around the pick-up location than you are, so he will likely be able to provide alternate driving directions to the hauler if he makes a wrong turn. Also, if necessary, the hauler can call the seller to confirm when he is nearing the pick-up location.

Arrived safely and it's time to remove strips of tape covering holes drilled to dry out the deck core. We were lucky that the truck did not encounter rain en route.

14 Arrange an alternate site: Pick out an alternate spot where you're certain the boat can be deposited. After all, it has to go somewhere if you arrive at your storage lot only to find that the gate has been locked for the weekend (despite the arrangement you made to have it remain open) or, equally bad, the hauler shows up with his large trailer that won't fit into your driveway instead of the small one that you were promised.

15 Expose yourself: Be present when the boat is picked up and dropped off. Being there allows you to solve problems and make executive decisions on the spot. Chalk it up to human nature but people tend to be a bit more careful with things when the owner is looking on. Besides, an extra pair of hands may facilitate certain jobs (e.g., carrying the mast to the truck) but take care not to get in the way.

16 Boat prep: Take photographs of the boat inside and out prior to the hauling job. It could be very helpful later on if damages occur or are suspected during transport.

Make sure that the boat is prepped for transport, as agreed upon with the boat hauler. If you plan to be present when the boat is loaded, arrive early at the pickup location with at least one hydraulic jack and plenty of extra blocks, in case the cradle clearance is insufficient. Remember that you are the one who will have to pay if the hauler chooses to charge for additional time to raise the cradle sufficiently to engage the lift. If the hauler is unable or unwilling to fiddle around with your cradle to get it on the truck, then the pick-up may not happen at all.

Take care to cover any vulnerable openings (e.g., in the deck) with waterproof tape. If you're not present, ask the seller to do this for you and get the hauler to check it before setting out. A driving rain is not good news for your exposed deck core. A tarp won't survive for long at highway speeds and the boat hauler is certain to pull it off prior to departing anyway.

Remove any and all loose items from the boat. The hauler will probably check this as well since he doesn't want anything flying off his truck into traffic. Double secure all interior doors, cupboards and fixtures that could shake loose on the road. Remove any expensive items such as electronics.

17 Blocking: If you have future plans to move your boat again by truck from its drop-off location (as I do, when the refit is complete), ensure that you have plenty of blocks handy to maintain the required cradle-ground clearance. Also, the extra blocks are useful for supporting and leveling the cradle on unpaved and/or uneven ground. When we bought our boat, the cradle was resting on a level, concrete floor and we didn't even think of blocks until the hauler showed up with the boat at our gently-sloping, gravel storage lot, hopped out of his truck and said, "Okay, let's get this done. Where are your blocks?"

18. Patience: Finally, haste makes waste so don't rush things. I know that's asking a lot but do the best you can.

Organize yourself, gather the information you need to make a good decision and shop around for the best price from a reputable, fully insured boat hauler who has the right equipment to move your boat from its current location to your desired destination. Above all, be sure that your precious yacht will be treated like a lady because if you don't look out for her, who will?

About the author: Tedd Campbell and his wife are now immersed in a complete refit of their 1964 Whitby Continental Folkboat 25.

Sewing in Circles

It's easy to sew chart cases, duffle bags, winch covers, wheel covers and other circular items with these tips.

Story and photos by Jim Grant

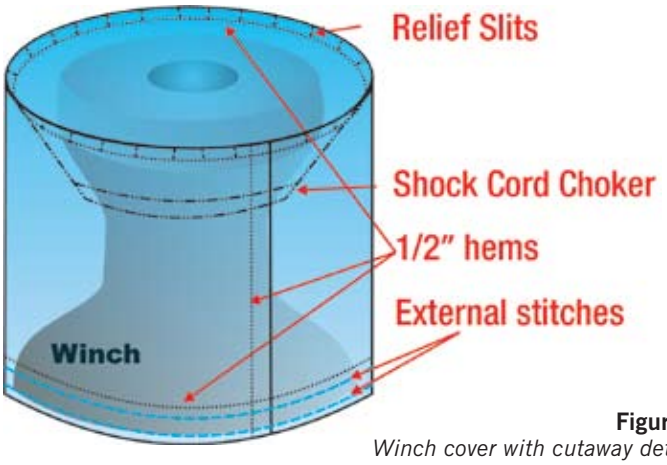


Figure 1
Winch cover with cutaway detail.

A Finished Winch Cover

There are few tasks in sewing that can lead to more frustration than circles and smaller circles are especially problematic. In this regard, an article on winch covers is appropriate. Even though you may not need to cover a winch, use the procedures described here to make chart cases, duffle bags, sail bags, tote bags, compass or wheel covers and other fabric items that are useful onboard.

Because working from a kit is often easiest for first-time sewers, purchase Sailrite's Winch Cover Kit (part number 102173, US$14.95). It includes .5 yard (45cm) of 60" (152cm) wide Captain Navy Sunbrella. Other fabrics, Surlast is an obvious choice, make suitable winch covers but Sunbrella is the best bet to match your boat's existing covers (bimini, dodger, hatch, sail, etc.). The kit also includes sewing machine thread (Dacron size V-69) and 8' (2.43m) of 3/16" (4.7mm) shock cord. There's enough material to build two winch covers, 7" (177mm) in diameter by 9" (228mm) high or four winch covers 5" (127mm) in diameter by 6" (15cm) high or seven covers 4.25" (107mm) x 4" (101mm) like the one we'll build here.

Our winch cover consists of an outer skirt and an inner "choker," which secures the cover neatly in place (**Figure 1**). Two rectangles of cloth are cut, one for the skirt and one for the choker, and one circle for the top. Both rectangles are hemmed along the bottom edge. A short length of shock cord inserts into the hem at the bottom of the choker rectangle. The rectangles are sewn shut across their narrow ends to form the skirt and choker "barrels" and then all three pieces, the skirt, choker, and top are sewn together, inside out.

Step 1 Measuring and Cutting

Be sure the skirt rectangle is wide enough to completely encircle the winch plus 1" (25mm) for seam allowance. This length is the diameter of the winch multiplied by pi (3.1417) plus 1 rounded up to the nearest 1/4". The depth of the rectangle equals the height of the winch plus another 1" (25mm) for seam allowance and again, rounding up to the nearest 1/4". The primary winches on my Lindenburg 22 are 4.25" (107mm) in diameter and 4" (101mm) in height. So the skirt rectangle is 14.35" (4.25" by pi + 1") by 5" (364mm by 127mm).

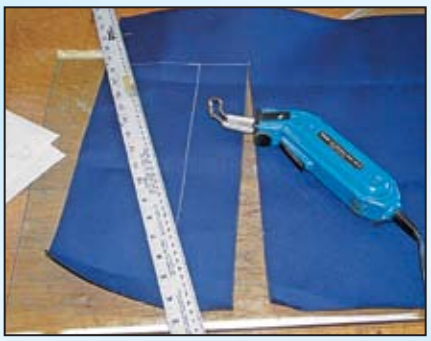
Step 2 Cutting

Cut the skirt rectangle to size. The choker rectangle is cut the same width as the skirt rectangle but make it just half as deep as the skirt. Mine is 14.35" by 2.5" (364mm by 63mm). After cutting, seal the edges with a hotknife to prevent fabric raveling. Sailrite has specially designed hotknives that cut these synthetic fabrics and seal the edge at the same time but a soldering gun works well in this capacity, albeit more slowly.

Step 3 Create the Cover Barrel

Make the barrel by sewing hems along the lower edges of the two rectangles.

1 Measure the winch.



2 Cut the skirt and choker rectangles.

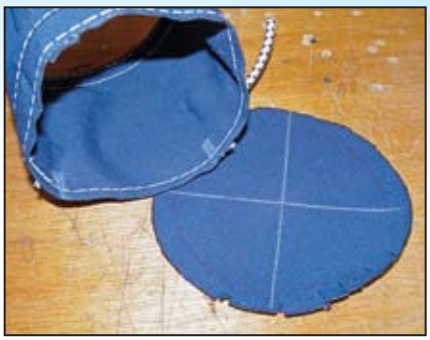
3 Score the fold line along the hem.


4 The skirt and choker after hemming.


6 Use a wooden compass to form a circle.


8 Top stapled into the barrel.


5 Note that one leg of cord is tucked into the hem on the choker.


7 Quarter points aid circle and barrel match up.


9 Shock cord crossover sewing detail.

Then, insert shock cord in the hem of the narrow rectangle. Finally, fold over the rectangles along their length and sew closed.

The hem along the bottom of the large rectangle should be 1/2" (12mm) wide. On the small rectangle, make the hem 3/4" (19mm) wide to better accommodate the shock cord. Before folding the flap of cloth over to form the hem, run a screwdriver blade along a straight edge to score the fabric, giving it an accurate fold line.

Run two rows of straight stitches over the hem on the large rectangle. It's a good idea to sew the first stitch row near the fold (roughly 1/8"/3mm from the edge) and to sew with the flap of cloth down. This sewing technique reduces the tendency for the flap edge to creep, creating bubbles, as it's sewn. Finish the hem along the small rectangle with a single stitch. Sew that stitch about 1/8" (3mm) from the flap edge. This allows for cord insertion. Again, sew with the flap down to reduce fabric creep (the sewing machine's bottom feed dog engages both layers of cloth here, which makes the technique especially effective).

Insert the shock cord into the hem on the small rectangle and push it all the way through. Cut the cord so that 2" (50mm) or so extends beyond each end.

Step 4 Skirt and Choker Assembly

Fold the two rectangles in half along their length keeping the hem folds outside. Sew the matched ends of one and then the other together with a row of straight stitches. Place this row of stitches 1/2" (12mm) inside the rectangle ends. For the choker rectangle sew up to the shock cord in the hem but not over it so that it remains unfastened in the hem.

Step 5 Skirt and Choker Finishing

Fold the 1/2" (12mm) seam allowance over to one side and sew it flat.

Step 6 Make the Top

The diameter of the winch top equals the diameter of the winch plus 1" (25mm). Use a compass to mark the cloth with two circles. Both should have the same center point; one being the exact diameter of the winch and the second circle 1/2" (12mm) larger all the way round. I like to make a wooden compass by drilling a 1/8" (3mm) hole at one end of a length of wood slightly longer than the diameter of the circle needed and then two more holes at appropriate points for the circle diameters. Use a nail or awl to hold the stick on the center point and insert a pen or pencil through the holes then move the stick around the center to draw accurate circles. Cut the circle top on the outside line with a hotknife, if possible. Shears work as well but cause raveling over time even if sealed, unless the raw edge is over sewn.

Step 7 Barrel Assembly

Slide the choker barrel down over the skirt barrel until top (not hemmed) edges are flush. Note that the hem folds are still on the outside. We'll turn the cover right side out only when it's completed. Also note that the choker barrel is on the outside of the skirt barrel at this point. The seams do not have to line up. Actually, it's a good idea to offset them somewhat to avoid a bump

in the finished cover. Staple this assembly together and place a row of stitches 1/8" (3mm) or so inside the edges. When sewing is complete, remove the staples.

Stretch the barrel and place marks at quarter points around its opening. Locate quarter points on the circle that forms the cover top as well. Make “let” (as opposed to “ease”) cuts all round the circle that are roughly half the depth of the seam allowance.

Step 8 Prefit

Fit the circle into the opening formed by the barrel assembly so that the inner circle line designating the actual diameter of the winch is visible. Staple the assembly together using a standard office stapler. Pins can also be used here but they are difficult to push through the canvas. Secure each of the four quarter points first, carefully lining up the circle marks against the barrel marks and then finish with more staples until an accurate fit is achieved.

Step 9 Finishing

Sew all round the cover top following the inner line on the circle very carefully. It’s important to realize that deviation of as little as 1/16" (1.5mm) from the line reduces or increases (deviation times pi) the diameter of the circle by 3/16" (4.7mm), resulting in either too much or too little fabric in the barrel assembly. Be aware that any inaccuracy in sewing circles multiplies the resulting circumference by a factor of 3.1417. Using staples and the guiding stitch line resolves this problem and makes absolute accuracy possible.

Now, shorten the shock cord so the diameter of the choker is reduced to about half of its original diameter. Overlap the ends of the chord in the hem by a 1/2" (12mm) or so. Sew over the hem opening where the cord overlaps to lock everything in place and close the hem opening. If your machine balks at this task, hand sew with a needle and thread. Turn the cover right side out and try it on for size.

A 20-minute video on making winch covers streams from Sailrite’s website (sailrite.com). Search on the words “winch video” to find it quickly. The charge for the video is US$5. A preview clip can be run without charge.

About the author: Jim Grant is the founder of Sailrite (sailrite.com), a supplier of specialty marine fabrics, component hardware and tools, sewing kits and sewing machines for boaters to build or repair canvas and sails.

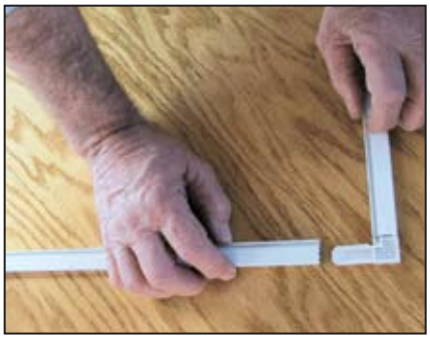
Bug Free

Here are two ways to make boat screens, one for hatches with square corners, the other to accommodate special shapes or circumstances.

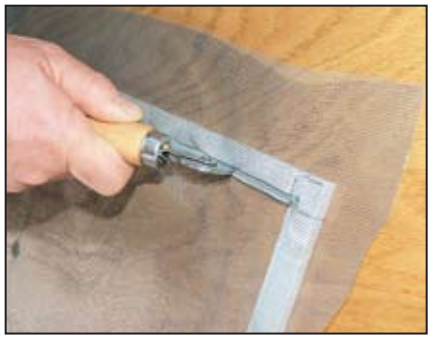
BLISTER FACTOR
INDICATES THE DEGREE OF DIFFICULTY WITH 10 BEING THE HARDEST AND 1 BEING THE EASIEST.

5

Story and photos by David and Zora Aiken



Push side strips onto corner pieces.



Use the spline tool to press spline in place.

Cut the spline to fit flush; press in the cut end.

Finished screen, in place.

Every boat needs insect screens for hatches and vents that let fresh air in and keep winged undesirables out of the boat, especially if you do a lot of cruising.

To make screens for square or rectangular overhead or companionway hatches, borrow from house door screen technology. You'll need these components purchased from a hardware store: strips of side framing metal; corner pieces; screening; spline (the hollow tube that holds screening in the grooves on side strips); and a spline tool.

1 Measure the opening.
2 Cut the side strips to size, using a hacksaw. (Remember to subtract the appropriate measure from each side to allow for corner pieces.
3 Push the side strips onto the corner pieces to assemble the frame. Measure again.
4 Cut the screening material 1" to 2" (254mm to 508mm) larger than the frame on all sides.
5 Place the screen over the frame, aligning the screen grid with the frame. Take a piece of spline that's long enough to fit around the entire screen. Starting at a corner, use the spline tool to press the spline into the groove on the side strips.
6 Where the spline meets the starting corner, cut the spline and press in the cut end.
7 Trim the excess screen with a sharp knife.

Making a screen for our opening windshield presented a challenge. The screen was to fit on the inside, so we could open the windshield and still have the screen's protection. As well, the windshield adjuster must remain accessible to open or close the windshield. This meant that the screen edge must be flexible enough to fit around the bracket holding the adjuster but still be stiff enough to hold its shape.

Our solution was to fold a fabric strip over the edge of the screening material. We already had some vinyl fabric but other materials could be used, perhaps to match a color or fabric already onboard. Two-sided carpet tape allows easy assembly. The top frame of our screen also holds a piece of 3/16" (4.7mm) line, so the screen slides easily into a bolt-rope track.

Assemble these materials: screening, cut to size; two-sided, 2" (508mm) wide carpet tape; 2" (508mm) wide fabric strips; 3/16" (4.7mm) line for use with bolt-rope track (optional); sail repair needle and thread. Now follow the assembly steps below.

1 Make a paper pattern.
2 Cut the screen to size. Cut lengths of carpet tape and fabric strips to fit all sides.
3 Press the fabric strips onto the exposed sticky-side of the carpet tape. Before removing the protective paper from the other side of the tape, fold each strip in half lengthwise, creasing it just enough to create a visible centerline. Unfold and lay the pieces flat.
4 Attaching fabric to screen is best done by two people. Remove the protective paper from the carpet tape as one person holds the tape as flat as possible, sticky-side up, and the other person places the screen over the tape at the crease line. The "holding" person then folds the tape/fabric strip over the screen's edge. Press firmly and rub a metal straightedge along the fold to form a neat crease. If your application uses a bolt-rope attachment for the top frame, first place the 3/16" (4.7mm) line on the fold mark, then position the screening just under the line.
5 When all edges are taped, add one or two rows of stitching for permanent reinforcement. Machine sewing is naturally neatest, but hand-sewing works, at least temporarily, with help from a sail repair kit's needle, thread and palm.
6 To install the screen, slide the top into the bolt-rope track on the windshield frame. Cut a small hole through the

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Place 3/16" (4.7mm) line and screening onto tape at the fold line.

Fold fabric strip over screen edge.

Windshield screen in position over adjuster bracket.

screen so the windshield adjuster can move. Reinforce cut edges with stitching, glue or clear caulking. The screen sides can be held to the windshield frame with button snaps but since we rarely remove our screen, we used screws and finishing washers. Velcro's another option.

7 Because of the slant of our windshield, it's awkward to attach any fittings to the bottom of the frame. We left a few extra inches of screening material that holds the screen bottom in place with a wood batten pushed against the windshield frame.

As an alternate framing material for some applications, make the screen frame with self-adhesive sail repair tape. This eliminates the need for the interim carpet tape but the resulting frame will not be as stiff.

— David and Zora Aiken have been meandering by boat for more than 20 years and are authors of numerous books on boating, camping and travel. They live aboard "Atelier," a 35' (10.6m) 1963 Chris-Craft center-cockpit sloop.

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Seeing Clearly

A redesigned pedestal grab rail utilizes a clever force-fit slit tube "fastening" method to connect to the existing rail.

6

Story and photos by Chuck Husick

Figure 1
The pedestal-mounted grab rail obscures the plotter screen.

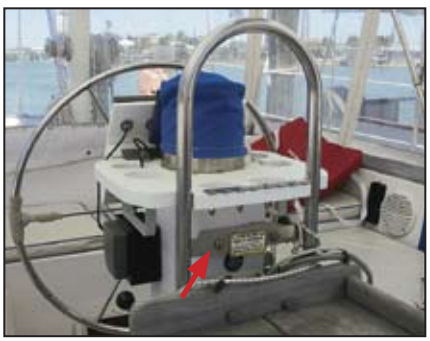

Figure 2
Details of original rail (plotter removed) that is bolted to the cockpit sole. Note placement of support brace.

When we bought our Irwin 46 ketch in 1980, the only chart plotter was a small nav desk for paper charts. Radar displays were usually installed below, out of the weather where it was dark enough to allow the screen to be seen. Things change. We now have a Furuno 1833C chartplotter/radar combo installed in the cockpit, immediately accessible to the helm.

We initially installed the 1833C at the forward end of the cockpit table where, although it was a bit far from the helm, it was reasonably visible and could be controlled using the unit's TV like IR control (**Figure 1**). We recently created a new mounting for the unit that would clear the table for its intended use and place the 1833C within reach of the wheel. We tested the proposed new location of the 1833C for adverse influence on the steering compass and found none. Unfortunately, the new location placed the screen close to the cockpit's center grab rail (which also supports the table), making it difficult to see parts of the screen.

Looking at and photographing the situation showed that making the rail much wider, higher and minimizing the radius of the upper corners would greatly improve visibility of the plotter and, at the same time, improve access to the rail when used as a safety handhold while moving around the cockpit. (Large cockpits are great, provided there is always something to grab onto when things get dicey.)

It took only a few minutes to design a new configuration for the upper end of the railing; however, we did not want to modify the part of the rail that is thru-bolted to the cockpit sole and supports the cockpit table. We decided to replace just the upper section, supported by the existing railing, joining it just above the welded horizontal brace and preferably without having to weld it to the existing rail (**Figure 2**).

We took our drawing of the proposed new railing assembly to Embree Welding, a specialist in marine stainless steel fabrication in St. Petersburg, Florida. Doug Embree reviewed our proposed design and agreed to fabricate the new railing, using a 19" (48cm) long, 1-1/2" (381mm) wide, 1/4" (6mm) thick piece of stainless steel as the base. The upper rail was made of 1" (254mm) OD type 304 stainless tubing purchased from the mill and polished to grade #10.

Embree suggested using the method they use for making continuous stainless rails. Four narrow slits are cut into lengths of stainless tubing only slightly smaller in diameter than the inside diameter of the 1" (254mm) diameter rail. In this case, the slits measured 4" (101mm). Welded to each side of the bottom of the new rail, these two slit tubes present a force-fit in the original grab rail (**Figure 3**). The cost of this beautifully finished custom fabrication was a very reasonable US$170.

Joe VanVeenen

Figure 3
Details of slit tube.

The existing rail was cut, using a hacksaw, and the edges smoothed with a fine file in preparation for the insertion of the new top end. Installation took only a few minutes using percussive persuasion with a block of hardwood and a heavy hammer to drive the projecting slit tubings into the existing rails.

The result is totally successful (**Figure 4**). The new rail is every bit as strong as the previous setup. The higher, wider rail is easier to grasp when moving into or around the cockpit. The chartplotter is easy to see and reach. The IR port for the handheld remote (still very useful) is never obstructed and the open area is sufficient to allow the next, undoubtedly larger, generation of chartplotter screen to be seen clearly.

Figure 4
(top) New rigid and strong grab rail offers a clear view of the screen. (bottom) Back side of the plotter shows additional construction details.

— An electrical engineer, commercial pilot and former chairman of Chris-Craft, Chuck Husick has sailed the U.S. coastal waters and Great Lakes since the early '70s.

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Placement of inboard end of the lifting boom made dinghy launch and retrieval difficult.

Improved Dinghy Hoist

A modified one-handed dinghy launch and retrieval system for trawlers.

Story and photos by Garrett Lambert

8

When I purchased a four-year-old 40' (12m) Pacific Trawler in 2006, it came with a hard-bottomed (RIB) Zodiac stored on the upper deck. Launch and retrieval was via a mast and boom arrangement controlled by a pair of hand-cranked sailing winches. I quickly discovered that it was a somewhat perilous process, as the photo above shows, because the boom hinge is lower than the top of the dinghy.

This configuration required winching the boom to at least 45° to lift the dinghy out of its cradle, which causes it to swing into the boom, bounce off and careen around. After the RIB is brought under control, the boom swings 90° and lowers to enable it to clear the side of the deck, whereupon the other winch comes into play to lower it. This is a job for a pair of orangutans.

Were the mast not also carrying various antennae and a radar dome, I'd replace it with a small crane mounted in the aft corner of the boat deck. I might yet go for the crane and eliminate just the boom but I thought I'd first try raising the boom hinge point and replace the manual dinghy winch with an electric unit that I could, if necessary, transfer later to the crane.

This was actually my second attempt at automation. I had earlier mounted an inexpensive 12-volt ATV winch in place of the manual dinghy winch and powered it from a spare battery in the false funnel (pseudo smoke stack). While it handled the dinghy well, I still had to choreograph its controls and boom movement by hand and charging the battery was a real nuisance. With the decision to raise the boom's hinge-point, I also chose to switch to a 110-volt AC winch for various reasons: the temporary installation of a dedicated battery in the false funnel, which is also the propane locker, is not permitted under ABYC standard A-1 (nothing is to share the space dedicated to propane cylinder storage) and, in any event, a dedicated charger is expensive and would also require a 120-volt outlet; 12 volt cables for the 30' (9.1m) run from the battery bank would have to be 2/0 at a minimum, making for a very heavy, awkward to install and expensive arrangement; the ATV winch draws upwards of 80 amps under load and is used at the least convenient time (while at anchor) for battery recharging; a 120-volt winch draws 7.5 amps and is quieter and faster.

Winch Service

An online search located a few 120-volt outdoor rated winches but all were of the unrecognizable brand name pedigree. The made-in-USA Superwinch seemed the best pick but, of course, at more than twice the price. I was then lucky enough to stumble across an inexpensive one at a second-hand tool store but not quite so lucky as I had first thought.

It came with a control box on the end of a 6' (1.8m) tether and, being a tinkerer by nature and wondering what was inside, I took it apart. Ouch. Although the winch had run without problems in the store, all the controller terminals were corroded and both push-button switch housings (plastic) had broken away from the screws that should fasten them to the metal box. Concerned, I disassembled the winch too and fortunately, it proved to be in good condition.

I phoned Superwinch and was told that, for outdoor operation, the 120-volt unit and controller must be kept under cover, except when in use and must be connected to a GFCI circuit. When I learned the price of a new controller, I went back and refurbished the original parts. Wire brushes got rid of the corrosion and it was simple to make a compartmented acrylic tray to fit the controller box and the switches. Acrylic cuts with woodworking tools and a special glue (IPS #16 Weld-on Cement), available at hobby stores, literally welds pieces together.

I drilled and countersunk the tray to match the holes in the box and then fastened it with the original switch screws. Two blobs of 5-minute epoxy locked the switches in the tray. Almost as good as new, actually, better than new. When not in use, the controller now hangs with the winch under a weatherproof cover.

Saddle Construction

With a working winch in hand, there was no excuse for further dithering, so I asked a local welder about attaching a couple of new gudgeons to the aluminum mast. He said it would be a very bad idea to have sparks landing on gelcoat and suggested I bring the mast to him instead. This was definitely not on my to-do agenda, so I took a sketch to a machine shop and asked if they could make a saddle that bolted to the mast. "Sure, that's about US$345 with tax." Being thrifty and more important, a DIY kind of guy, I went instead to the local metal supermarket where US$25 purchased some 1/4" (6mm) aluminum plate and a 6" (152mm) length of 4" (101mm) Schedule 40 aluminum pipe. With an inside diameter of 3-1/2"

Restored winch and mast saddle components.

Saddle welded and winch plate drilled.

Final step is the application of primer and a color matched enamel.

(88mm), the pipe exactly matches the mast outside diameter.

One of aluminum's attractive attributes is that it's friendly to woodworking tools. I made a vee-shaped wood block from a piece of 2x4 and rested the pipe in it to safely cut it in half, lengthwise. I used my band saw with a 6 TPI band with a little paraffin wax on the blade to keep the teeth from clogging but a jigsaw would do the job, too. Wear safety glasses, because a jigsaw blade throws up a lot of sharp metal chips. I set the Superwinch on the plate, drew its outline, marked the mounting holes and then cut and drilled the holes. From a template of the existing mast gudgeons, I drew, cut out and drilled two new ones from the remaining plate. I now had everything I needed.

To ensure everything lined up correctly for the welder, I also cut a piece of scrap tubing as a spacer and bolted the two gudgeons together. A quick trip to the welding shop and a US$20 minimum charge completed the saddle.

I drilled and countersunk four holes in the saddle corners for the 1/4"-20 TPI flat-head machine screws that would hold it to the mast. To drill holes in the winch plate to match the four tapped holes (also 1/4"-20 TPI) on the boom boss, I used the original sailing winch as a template.

A couple of spray coats of zinc chromate aluminum primer followed by another couple of coats of semi-gloss enamel to match the mast color and I was ready to assemble.

Assembly

It took about 20 minutes to clamp the saddle in position on the mast, drill and

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(left) New saddle attaches boom gooseneck to the mast and electric winch mounts to inboard end of the boom. (middle) Custom cover weatherproofs the winch.

GFCI receptacle mounted on the flying bridge locker.

tap four holes, drive the screws home and then shift the boom up using the original bolt, washers and cap nut. Another 30 minutes saw the winch mounted. Screwing on the plate was simple but the winch was awkward and heavy for one person, so I ended up lashing it to the plate to insert the bolts and get the nuts started and then tightened all the fasteners. My wife made a waterproof vinyl cover to protect the winch.

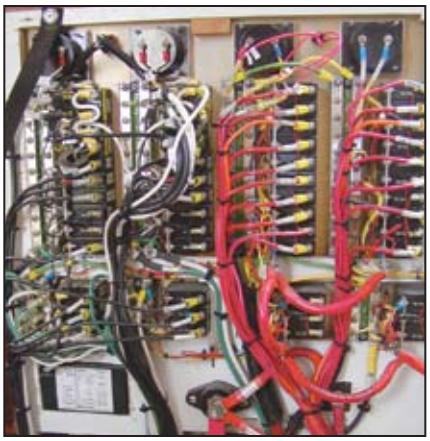
Powering Up

All that was now needed was to deliver power to the winch. After removing several wooden race covers inside the pilot house, it was obvious that the best route was the one that provided a straight run through an existing conduit from the electrical panel into the starboard flying bridge locker. That settled the question of where the GFCI receptacle would be installed. I bought an outdoor kit with a lid that opens vertically and used the jigsaw to cut an opening in the locker's aft end to receive it.

The wiring was easy once I'd figured out the back of a service panel that manages two 30-amp shorepower circuits with a transfer switch, 6kW generator, 2,500-watt inverter/charger, has AC and DC circuitry on either half, etc., etc. This learning process took longer than all of the rest of the work combined but I considered it a real bonus, something I'm glad to have finally done. I'd made a couple of abortive attempts at it earlier but they were exercises in the abstract. Sorting it all out within the context of this project was much more productive.

I ran 12 AWG cable with two conductors plus ground from the GFCI

Sorting through the electrical maze.



receptacle to a breaker fed by the Heart 2,500 inverter. Since the Heart automatically switches between shorepower and inverted power, this gives me the best of both worlds, as the winch is plugged in only when needed.

I have to admit I learned something on this job by making a potentially hazardous mistake but, since I was careful to follow Rule 1 — cut all power to the panel first — no harm was done to me or the boat. Full of confidence that my study had penetrated the panel's deepest mysteries, I unplugged the shorepower cord and switched the inverter off. The new wiring would meet ABYC guidelines but I looked for the most convenient way to do it. With only three wires involved: a ground, a hot and a neutral, what could be simpler? In that kind of thinking lies the possibility of jeopardy.

Using a meter, when I was sure I had identified the correct terminals, I made the three connections. Turns out I was wrong but at least not dead wrong. When I plugged the shorepower cord back in, I saw red lights on the board. Never before has a shorepower cord been disconnected so quickly! Hoping I hadn't done any damage, I finally solved the cause; namely, that not all buses are created equal. I had connected the hot lead to a breaker hooked into a bus serving one of the 30-amp shorepower connections and the neutral to a bus serving the other 30-amp shorepower connection. Shifting the neutral to the correct bus put everything back in phase and all LED's were now green. Whew!

I went up to the boat deck, plugged in the winch and depressed the controller's "Out" button and then the "In" button. Happiness was mine.

While the initial condition of the controller was a transitory disappointment, I had purchased the US$500 winch for just US$200 and saved US$300 by making the saddle myself. That leaves me US$100 ahead. With paint and fasteners, total cost was about US$260. More to the point, the revised launch and retrieval system works as planned so itinerant orangutans need not apply.

– A career diplomat, Garrett Lambert is contributing editor of "Circumnavigator" magazine, editor for woodcentral.com and writes technical articles for boating and woodworking publications in Canada and the U.S.

Power Winching

Need a power assisted winch? Besides fast cranking, this device doubles as an effortless method of hoisting someone up the mast or back onboard or lift the dinghy on deck.

7

Custom-made adapter lets you power winch with a right angle drill.

Boat shows are full of stuff that you cannot live without, which, before the show, you didn't know existed. A few years ago, my must-have item was an electric winch handle. Like many sailboats that have evolved under various owners, rather than springing forth perfect in every way like today's mega bucks show boats, "Clairebuoyant" has its share of contradictions. One is the space conflict between the mainsheet and staysail winches and the dodger. One can't swing the winch handle full circle without striking the dodger frame. This defeats the purpose of two speed winches and adds to the list of changes to the boat that the "Admiral" finds to be less than optimal in execution.

Those nifty winch drivers that operate in forward and reverse, have variable speeds and require no effort other than to hold them stationary. They had but one serious flaw: the two models available each cost about US$895. "I'd rather have a new radar," said the Admiral and that ended the discussion.

Like many things ingenious, electric winch "handles" appear to have started life as something else; in this case, a right angle drill motor with a rechargeable battery. Instead of a drill bit they are fitted with a winch handle end to engage the top of the winch. While one model was modified with the chuck replaced by the winch handle fitting, the other device simply has the fitting gripped in the chuck. Retaining the function of using the drill to actually drill holes seemed like a good idea.

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Stainless steel Cranker chucks into a drill and fits any standard winch.

The ideal drill did not take long to find. The one listed in a Harbor Freight Tools (harborfreight.com) mail order catalog was exactly what I needed and cost 10% of what the boat show models cost. They also offered a two-year replacement warranty at extra cost.

The winch handle fitting was more challenging. I found an old aluminum locking winch handle on the boat. The locking mechanism, being stainless steel in an aluminum handle was seized. I cut the business end off and also the locking mechanism. If you can't find an old handle in the locker, a new one is relatively cheap, about $30. Be sure to get one with the locking mechanism. The hole bored for the lock saves the trouble of trying to drill a true hole in the part.

After cutting the necessary part off the handle, tap the hole left by the locking mechanism. I bored it out and tapped it for a 3/8" thread. The original hole was about 1/4". In retrospect, I could have simply used a 5/16" tap and used a 5/16" socket head machine screw. The head of the machine screw would fit nicely in the recess left by the locking mechanism. Since I used a 3/8" machine screw, it was necessary to reduce the size of the machine screw head by turning the screw with a drill and filing it down a bit.

After smearing epoxy in the hole, I screwed in the machine screw and then threaded a nut on the back so that it could not unscrew when the drill was run in reverse. After the epoxy cured, I filed three flats on the end of the machine screw to engage the drill chuck.

If you would like an electric wincher at reasonable cost but you are not up for the hassle of cannibalizing an old winch handle, an alternative exists. You can purchase a winch bit for $20 at thecranker.com. Naturally, I discovered this after all the effort to make my own. While my version worked pretty well, the inventor of the Cranker got it right, so you are not just buying a piece of machined metal, you are also getting some thoughtful design work.

While operating the Cranker, I noted a couple features worth mentioning. First, the end that engages the winch is a bit undersized compared to a conventional winch handle. This is a good thing. It allows the large and slightly cumbersome electric drill to easily engage and disengage the winch without binding and it provides a bit of angular flexibility while operating the device. Unlike a manual winch handle, this is not something that one might easily store in the winch between adjustments, so the loose fit is not really a problem.

The other end of the Cranker, the one secured in the drill chuck, seems a bit long for this drill, extending about 1/2" (12mm) beyond the chuck. This is probably more a matter of taste than utility. It makes the electric winch handle stand up an extra 1/2" (12mm) but extra height would be easily remedied with a hacksaw. The last, and admittedly trivial reservation, was the inventor's decision to leave this end round rather than mill flats on the shaft so that it would not slip in the chuck. The rationale is explained on the Cranker website but with the keyless chuck on the drill, it's not possible to get it tight enough to avoid slippage at high loads. On the other hand, it's better the chuck slips than the drill gears break. If your drill, like mine, has a keyless chuck, be sure to set it sufficiently tight. Otherwise, the Cranker will find it's way to Davy Jones' locker!

The Cranker, combined with the US$80 Harbor Freight drill, perhaps with an extra battery (US$30) is a nice alternative. While this drill does not have the power or robust construction of the Milwaukee drill, it's adequate for most applications on board and, at under 5 lb (2.26kg), easier to handle.

Understand that the drill was not designed for marine service. Unlike a manual winch handle, it was not meant to enjoy the rigors of life in the cockpit and will much prefer the sheltered life of its plastic case below deck, when not in use. A two-year extended service policy is available and a good option.

The drill/winch handle is impressive in operation. I suggest that you run it only on the low speed range. Even on low, the drill can do 450 rpm. This quickly pulls in the slack from a jib sheet during a tack. Be careful not to let any fingers or loose clothing be pulled into the winch, especially if it's a self-tailer. Remember, this is a power tool and must be operated with care and respect to "safety first."

— Quentin Kinderman has 40 years experience sailing and restoring many sailboats for fun and profit. He currently is outfitting "Clairebuoyant," a Pearson 424 for extended cruising.

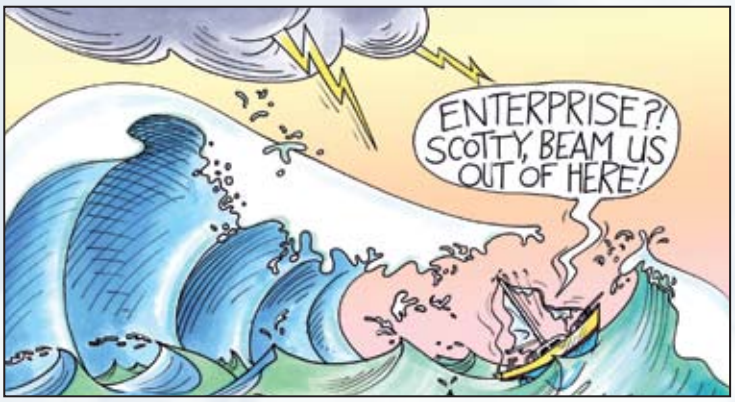
View from the Stern

Ad Hoc Systems

Consider these stopgap measures to prepare for potential problems onboard.

By Roger Marshall

Have you ever been at sea in 50 or 60 knots of wind? If you have, you'll know that there are some gods that sailors pray to more often than others. The "get-me-outta-here" god seems to be the most in demand. Following that is the "hope-to-hell-my-boat-stays-together" god and fortunately, this is one god whose services you can do something to avoid long before you head offshore. This spring, look closely at your boat and decide what measures you can take to make sure that prayer doesn't some day become your only recourse at sea.



While you can't do much about the shape of your boat's hull or its displacement, you can do something about the interior, the deck layout and the rig. As the first step, check the deck and below for adequate handholds. If you cannot walk from bow to stern on deck and find a handhold exactly where you need it, add another one. Imagine being out in heavy weather, wearing your safety harness and looking for somewhere to attach it. If you can't find a suitable location, you may wrap it around the mainsheet track or around a totally inadequate lifeline. If your boat does not have jacklines fitted, take a look and see if you can install them. They'll help you go forward safely in heavy air or rough seas. Make sure that the jackline ends at least 6' (1.8m) forward of the transom. Then, if you fall off and are hooked to the jackline, the end of your harness tether will be at the transom, allowing you to pull yourself back onboard. If your jackline ends at the transom and you fall off, you may not be able to reach the transom and get back onto the boat.

Next is to go through your boat and put non-skid on any slippery surface. Try out your boating shoes to make sure they are slip-resistant on a wet deck. I have worn a few "sailing" shoes that made ice skates look like climbing pitons on a wet deck.

This is also a good time to make sure that you carry spare fuel filters, spare hoses and belts and the tools to change them. In strong winds, the fuel in the tanks gets pretty roiled and all the sediment that has settled in the tanks gets stirred up. If there is enough sediment, it will block your fuel filter, leaving you with no power at what could be a critical time. Having spares gives you time to fix everything and get going again before you need the get-me-outta-here god. Of course, if you can't take hanging upside down in heavy winds changing fuel filters, you may need a seasickness pill or two and a prayer to the god of Technicolor yawns (or a large barf bag).

Now is the time to take a look at your steering gear, too. Check each part meticulously, because if the steering fails you'll need to pray to the god that drives a great big red and white helicopter and who will haul your butt out of there. Be sure to lubricate the steering sheaves and the chain. Didn't know your steering gear had a chain? Lift your compass off the binnacle and voila, there's a chain. Check all the cable connections, the quadrant and the attachment points for the sheaves. Make sure the quadrant is clamped tightly to the shaft and that the key is in place. If you have hydraulic steering, check all the seals and make sure the hydraulics move easily and are well lubricated.

If you have an autopilot, make sure it's fitted to its own quadrant or steering lever on the rudder shaft. Should your main steering let go, you'll then be able to get home by autopilot. Or at least it will get you close to the harbor, at which point you should be able to get a tow home. Talking about tows, make sure that your BOATU.S. towing subscription is paid up for the year and that you have a spare full fuel can on the boat safely stowed, of course.

Lastly, a couple of final notes, not for your boat, but for you personally. When you sail with your partner, make sure that he or she can handle the boat if you happened to be disabled. Imagine what would happen if you fell off the boat. Could your partner come back and get you out of the water? Or lower the sails to allow you to swim to the boat? Or turn on the engine? Could your partner operate the VHF radio to call the Coast Guard? Know the answers to all of these questions. It might save your life.

If you routinely wear an inflatable lifejacket while sailing, use the inflation cylinder from last season and try the jacket out in a swimming pool. (You should check the inflation cylinder each spring.) Learn how to swim wearing the lifejacket. When the sea temperatures warm up, do the same thing next to your boat. But before you do, check one thing. How will you get out of the water? I found that the hardest part of swimming in a lifejacket was getting out of the water onto the boat. You'll be surprised how difficult it is. What you learn, could save your life.

About the author: Roger Marshall is a boat designer and author of 12 books.

Wire Color Codes

SAMPLE WIRE COLOR CODE

COLOR	ITEM	WIRE USE
Black or yellow	Ground	Negative mains
Blue, dark	Cabin & instrument lights	Fuse or switch to lights
Blue, light	Oil pressure	Oil pressure sender to gauge
Brown w/yellow stripe or yellow*	Bilge blowers	Fuse or switch to blowers
Gray, dark	Navigation lights Tachometer	Fuse or switch to lights Tachometer sender to gauge
Green or green w/yellow stripe	Bonding systems	Grounding conductors
Brown	Generator armature Alternator charge light or alternator Pumps	Generator armature to regulator Generator terminal Auxiliary terminal to regulator Fuse or switch to pumps
Orange	Accessory feed	Ammeter to alternator or generator output and accessory fuses or switches
Pink	Fuel gauge	Fuel gauge sender to gauge
Purple	Ignition Instrument feed	Ignition switch to coil and electrical instruments Distribution panel to electric instruments
Red	Main power feeds	Positive Conductors
Tan	Water temperature	Water temperature sender to gauge
Yellow w/ red stripe	Starting circuit	Starting switch to solenoid

*If yellow is used for negative, blower must be brown with yellow stripe.

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