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Practical Sailor™



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Is bigger better when it comes to sizing anchor rode?

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Feeding pelicans mark the end of another winter day in Florida.

Father and Son Sail

The boy's father was at the helm—though you wouldn't know it at first glance. He sat to the side of his son with his hand casually nudging the spoke around seven o'clock, so his son wouldn't notice. The boy stood rigid behind the wheel, both hands tightly wrapped at 10 and 12. He stared straight ahead with curious, excited eyes that rarely fixed on one object or person for very long. A bird. A channel marker. The sky.

That was the first thing people usually noticed about the boy: His eyes never rested.

"Just keep it between the markers," the father said, gently pulling the wheel to port.

The father had found the 43-foot cutter languishing in a marina nine months earlier. It had been neglected for several years, but most of the harm came during a few rainy months that summer. A hatch had been left open, and rainwater poured in, filling the cabin with water. Floors warped, cabinet doors fell off their hinges, and the water-logged engine refused to start. A thin layer of mold coated the bulkheads. But the rig was in good shape, the hull was sound, and the sails still crinkled. The father saw potential.

The boy needed something to do. The father knew that. It had been that way for most of his son's life. He couldn't sit still. He spoke out of turn. He laughed when he shouldn't. He talked and talked and talked. The father liked to hear his voice (the boy was always so happy), though it made some strangers nervous.

Autism made a lot of people nervous. Not the father. He had built and rebuilt a lot of boats. Boats that other people had given up on. For him, a boy was a lot like a boat—he just needed some attention and the right ocean.

Give the boy something to do—a broom, a hose, a paintbrush—and he fit in. He was just another boy. "Normal," some people might say. The father bought the boat. And the boy had plenty to do.

The engine came out first, then the fuel tank. (The bottom had rusted out.) To fit the new tank, the father cut a hole in the topsides, then closed the hole again. The bad floorboards became firewood. The settee was enlarged to make more room for more food, supplies, and tools. The boy scrubbed and sanded. He caulked and painted. He talked a lot, mostly about the boat, and where the two of them would go.

A week before Christmas, the boat went in the water. The gelcoat sparkled, the stainless shined, and the new motor hummed in a spotless engine room. They took it out for a sunset cruise.

The boy and the father steered together for a long time. The sun went down, and the Florida sky grew pink. At the end of the channel, they turned the boat around and headed back toward the marina. "Just keep it between the markers," the father said. And then he let go of the wheel.

The father looked back to check the wake (yardstick straight) and to watch the last light of another day fade away. He didn't touch the wheel again until they reached the last marker.



Cover photo: Heavy chain and a lightweight anchor make odd companions on an Australian dock during PS testing. (Photo by Jonathan Neeves)

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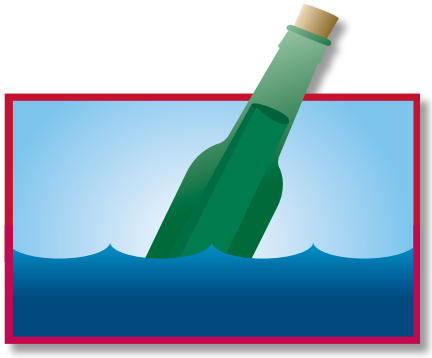
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H2OUT INSTALL

Thank you for your review of the H2Out AVD diesel tank vent filters, and especially the tips on installation best practices (*PS*, January 2014). You've confirmed for me that I made the right move, and more importantly, that I actually installed the unit correctly on my boat.

Sailboats have a bit of advantage over their power cousins in that we have more high spots that can be used creatively. In my installation, the diesel vent line (fuel-grade hose) loops high inside at the transom and back down to the through-hull. Through the use of a check valve, air flows out, but intake air comes in through the AVD, which is attached to the underside of the deck; no additional support needed. The unit is readily available for inspection or replacement through the transom locker, and it is not in the way of any equipment that needs to go in or out. Love the H2Out AVD2 vent filter; kudos to Pindell Engineering.

Robert Senseney
Content, Rhodes (Chesapeake) 32
Herring Bay, Md.

In this installation—which is suitable for diesel but not gasoline systems—the fuel tank breaths out directly overboard and breaths in through the silica-gel vent filter. The tee in the picture contains two check valves, which work to prevent contamination of the media during tank overfills. Unique to H2Out-maker Pindel Engineering, this vent installation method is not directly addressed by any code. The U.S. Coast Guard does not regulate diesel fuel systems, and the American Boat and Yacht Council (ABYC) is mute on this detail.



Photo courtesy of Robert Senseney

Reader Robert Senseney installed a H2Out AVD2 diesel-tank vent filter (above) aboard his Rhodes 32, and reports that it has been a success.

For gasoline systems, the regulations are quite clear: Vents must discharge outside the hull in a location where vapors cannot easily re-enter the cabin, with no exception for valve-regulated systems. The correct practice is to protect against sea water by a P-trap in the through-hull or a high loop. *Practical Sailor* discussed installation in the January and February 2013 issues.

Check valves in raw-water cooled exhaust installations should be monitored. The diesel-vent assembly should not rely on a check valve for preventing fumes from getting inside the boat.

JOKER VALVE SEARCH

I've been looking for a rubber duckbill valve for a vented loop in a holding tank system, and it seems Buck Algonquin (*www.buckalgonquin.com*) has the right fitting. (My understanding is that the words "joker valve" and "duckbill" are interchangeable.)

Nigel Calder, in his book "Boatowner's Mechanical and Electrical Manual," makes an important point when he says "A vented loop in the discharge line will allow foul odors into the boat. It is best to attach a small hose to the vent and run it overboard."

Forespar (*www.forespar.com*) has a replacement duckbill cap assembly (MF-841) that does not vent overboard, and they offer a vent barb assembly (MF-846) that does not have a duckbill. It seems to me that you would want a duckbill in the loop so as to not clog the holding tank vent.

For an installation where you are

WWW.PRACTICAL-SAILOR.COM

Hot Topics: LPG Leaks and Spinnakers

Visit us online to check out the *Inside Practical Sailor* blog's recent tips on boat safety, maintenance, and asymmetrical setups. If you have a portable—or even a fixed—LPG system on board, be sure to read up on inspecting for propane leaks. If you're looking to boost your light-air sailing ability, then you'll want to read the blogs about DIY add-on bowsprits and cruising spinnakers.

Our Facebook team has been busy sharing sailing and boat-owning tips. "Like" us to be kept in the loop. We also feature a different *PS* reader's boat each month in our Sailboat of the Month contest on Facebook; send a picture of your boat—along with your name, boat type, boat name—to photos@practical-sailor.com to be featured. For the latest test updates and seasonal tips, sign up for *Practical Sailor*'s free *Waypoints* e-letter at *www.practical-sailor.com*.

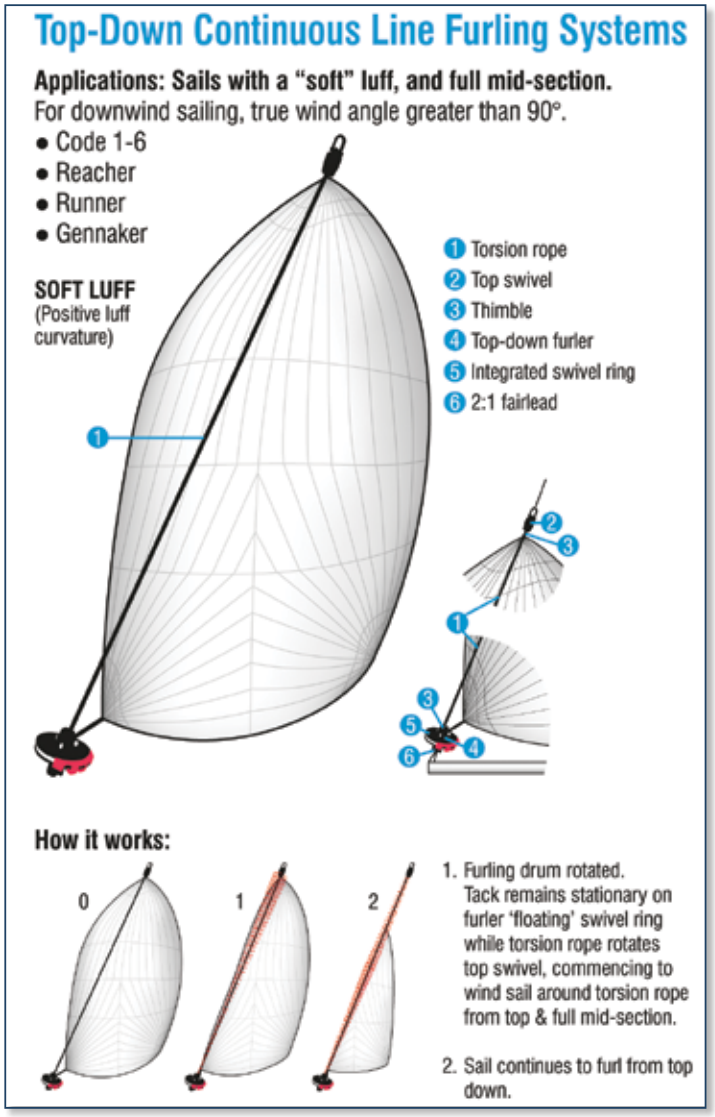


Illustration courtesy of Ronstan

pumping waste overboard, Buck Algonquin's vent arrangement would seem to be the right choice. The joker valve part number is 60VL75CV; it is the one used in the Buck Algonquin 00VL75 assembly.

Ted Wasserman
Outbound 46
Marion, Mass.

Let us know how it works. An alternative would be to simply place a check valve in thew vent line itself. They are cheap, easier to clean, and easy to service inline; we often flush them with a hose or compressed air, and sometimes use acid for cleaning. And yes, a "duck bill" and a "joker valve" are the same thing.

MOORING DESIGN

In response to your blog post, "Boat Mooring Upgrade Primer": I devised a time-tested system to moor our 12,000-pound Ranger 33. An 1,100-pound concrete block with 6 feet of anchor chain was shackled to a 350-pound bounce block with 6 more feet of large anchor chain; one half-inch, three-strand nylon line led from the end of this chain to the boat. Two feet from the chain bottom, I threaded a large, fender-like float to lift about 3 to 6 feet of the rope and chain off the bottom. About 10 feet under water from the boat end, I placed 10 lead ring sinkers and flattened them enough so that they would not slide down the rope. This prevented the slack line from fouling the keel, rudder, or prop at low tides in calm conditions.

I allowed the nylon to collect a large growth of kelp and algae, which attracted fish and acted as a perfect, very squishy sea anchor. I threaded a small conical float—like those used on crab pots—about 5 inches wide by 12 inches long, to the mooring pennant and to each bridle leg, and placed a 3/8-inch stainless swivel (with a Nylox nut) at the bridle mooring-line junction.

In blows, the boat would pull against the two bridles alternately, reducing chafe. Firehose over the line at the bow worked for chafe protection. The floats acted as excellent rollers against the bow and kept the swivel and lines away from the gelcoat. When we left on trips, I snapped a regular mooring ball to the looped ends of the bridle for better visibility.

If I were to redo the system today, I would use a screw anchor and no chain at all.

Ken Russell
Rushwind, Ranger 33
South Puget Sound, Wash.

FURLER QUERY

In regard to your review of top-down spinnaker furlers (*PS*, January 2014 and February 2014): What about long time storage of the spinnaker wrapped around the torsion rope? Will the tight wraps damage the sail eventually? Also, as the tension of the halyard goes all in the tension rope, there does not seem to be a luff trim option.

Giovanni Cirillo
Building 46-foot performance cat

Unlike standard genoa furlers, top-down spinnaker furlers are not intended to be left hoisted with the sail on for long periods when they are not in use. When it is to be stowed, the sail should be furled and lowered. Leaving the furled sail in a bag/turtle and stowed below doesn't harm it at all. As far as the luff is concerned, the only direct connection of the sail and the torque rope is at the head swivel. The sail's tack is attached via a snap shackle or shackle to the furler drum or tack line, which can be used to tension the luff. See the accompanying illustration, which shows how a Ronstan top-down furler works. For more on top-down furlers, check out Part 1 and Part 2 of our test report in the January 2014 issue and in this issue.

CLEANERS vs. CLEAR VINYL

In response to your blog posts on caring for clear plastic on board (Dec. 10, 2013) and homemade mildew preventers (Oct. 14, 2013): Would the DIY mildew cleaner (TSP, baking soda, and sodium carbonate) solution harm

PROPSPEED IN THE FIELD

We first reported on PropSpeed (*www.propspeed.com*)—an expensive two-part etching primer with a silicone-based top coat designed to prevent propeller fouling by being super slick—in the November 2006 issue and gave an update on our field tests in the July 2010 issue. A recent field report from *PS* contributor and bluewater voyager Capt. John Neal of Mahina Expeditions (*www.mahina.com*) confirmed our past findings: While the coating is intact, PropSpeed works. However, we've had mixed reader and tester reviews with regard to the durability and longevity of the PropSpeed coating. It seems that when PropSpeed is professionally applied, it lasts longer than do-it-yourself applications. It's also important to note that for PropSpeed to keep its slick quality and repel fouling, the prop needs to see regular use.

For our original test, we applied PropSpeed to our test boat's prop in March 2008. After six months, the coating was fully intact and clean. However, for the following year, the test boat was used very little and the prop was cleaned only once. A year after application, testers noted some hard growth on the prop, and by October 2009, only about 85 percent of the coating remained and a re-application was necessary.

Our recent report from Neal came about a year after he had his 18-inch MaxProp professionally coated with PropSpeed in 2012.

"We are real sticklers for a clean bottom and prop," Neal explained. "As you can see in the photo (above right), there is some erosion of the coating near the prop tips, but overall, I was extremely pleased. The grease from greasing the MaxProp before launching and underwater mid-season didn't seem to hurt the coating. We generally motor at around 2,200-2,400 RPM and have a 1.97-to-1 reduction gear. In 9,000 miles, we motored in-gear for about 300 hours."



Photo courtesy of Mahina Expeditions

Mahina Expeditions' Capt. John Neal shows off how well his year-old PropSpeed coating has held up. Neal said coating his MaxProp with PropSpeed has saved him numerous hours of prop-scrubbing since it was applied.

the Strataglass, if some were to drip from the canvas onto the Strataglass window?

George Chamberlain
Indefatigable, 1976 Whitby 42
Port Charlotte, Fla.

The washing soda- and borax-based anti-mildew formulas were intended for cabin use. These do-it-yourself formulas are water-soluble, so although they might work to get a canvas dodger clean, they will likely rinse away from the top in the first rainstorm. Nevertheless, we have since tested these, as well as 3M and Goldshield anti-mildew formulas on Strataglass and Regalite. Applied in the normal manner and allowed to dry, all of these will cloud vinyl windows. However, if exposure is limited, and they are rinsed off before drying, no damage should occur. We have seen this same type of clouding damage caused by every highly alkaline cleaner; clear-vinyl windows should be cleaned and polished using only products specifically formulated for vinyl windows. At this time, our recommendation is to use Imar products.

BLEACH ON STRATAGLASS

A recent issue had a short article on the effect of various cleaning agents on Strataglass (*PS*, December 2013). My copy of that issue is in New Hampshire, I am on my boat in Georgia, and I can't find the article online. I am specifically wondering about using a diluted bleach solution to clean the canvas. Can you help?

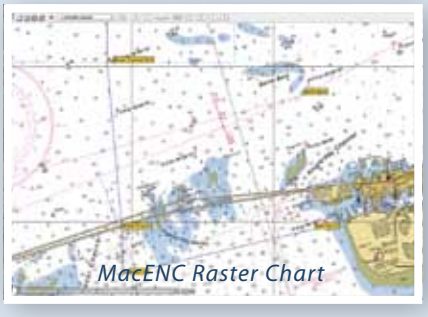
Meg Torbert
Seahoy, Passport 47
Durham, N.H.

According to our very brief tests on Strataglass, bleach had no immediate effect on the clear vinyl, but it is known to cause fogging over time, with repeated use. See this month's report on canvas treatments for more on products that can damage Strataglass.

HOSE CLAMPS

It is very laudable that you would undertake the testing of hose clamps, but there are several points in your article (*PS*, February 2013) with which I take issue. As a retired mechanical design engineer with a good deal of material experience, I know that the review of such a simple device is surprisingly complicated.

First is your conclusion that the magnetic properties indicate corrosion resistance. It is true that annealed austenitic stainless (304, 316, and several others) is essentially non-magnetic, that non-austenitic materials are magnetic, and that in general, the austenitic materials have better corrosion resistance. This, however, overlooks that some non-austenitic materials (such as 410 and 17-4) are magnetic and have sufficient corrosion resistance, and that the degree of cold work in the manufacturing


MacENC Raster Chart


MacENC Vector Chart

Practical Sailor *named MacENC nav software a 2013 Editor's Choice product in the October 2013 issue.*

MACENC

PS readers already know MacENC (*PS*, July 2013) is a good charting program. I recently experienced terrific customer service from the company. I used MacEnc (*www.gpsnavx.com/macenc/*) as my backup chartplotting software on a trip to Bermuda in 2007. A month ago, preparing for another offshore trip, I emailed their customer service, asking whether I could update the program and transfer it to a newer laptop. Within a few hours, I had responses with the download link and an activation code. Before the end of the day, I had the updated software on my new laptop at no additional charge. It sometimes seems that nothing concerned with boats is easy, but this was. Good software, great service.

Ray Smith
Happy Destiny, 2004 Jeanneau Sun Odyssey 43
McLean, Va.

GILL

I recently sent my six-year-old Gill Coastal Racer jacket back to Gill (*www.gillna.com*) for repair of the waterproof zipper. The bottom of the zipper had become distorted, making it impossible to zip. Gill promptly informed me that my model was no longer in production, so they did not have the part to fix it. Instead, they sent me, for free, a brand-new Keelboat Racing jacket even more technically advanced than the one I had sent them. This was beyond my expectations.

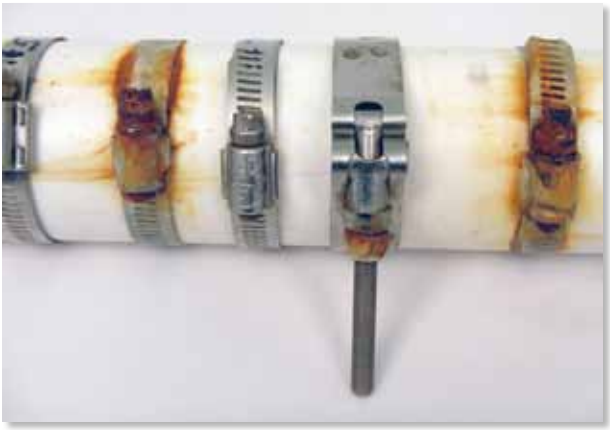
Richard Levitt
Northfield, NJ.

process causes most common types of stainless (304 and 316) to become magnetic. This cold work does not reduce the general corrosion resistance of the materials. Both stainless 304 and 316 are available from the mill in varying degrees of cold work (annealed, 1/4 hard, 1/2 hard, and full hard), and any of these could be used for some parts of the clamp (from the stand point of corrosion), even though the higher hardness types would be magnetic.

For a demonstration, just touch your magnet to a piece of rigging wire, which is cold worked to about the full hard condition. Some manufacturers use cold-worked material where the parts must endure high service stress, such as rigging wire. Also cold work, to some degree, unavoidably comes from the fabrication process. For hose clamps, this could show up in the formed screw housing or the rolled thread on the screw. One manufacturer could anneal the parts after forming, which would return the part to the non-magnetic condition, while another manufacturer (using the exact same material) could leave his parts in the cold worked/magnetic condition. There would be no significant difference in general corrosion resistance. So the degree of magnetic attraction is not a valid indication of corrosion resistance.

Another point about corrosion that appears as surface rust shortly after subjecting the item to corrosive conditions is that during the fabrication process, the tools (drills, shears, etc.) that come in contact with the parts cause small amounts of iron particles to be transferred to the part. It is common to have this iron removed at the end of the fabrication using processes called passivization or electro-polishing. Parts that get less of this post processing will rust a little, but this is actually just the iron particles rusting. It looks bad but has no detrimental effect on the general corrosion of the part. Only a detailed examination can tell the difference between surface rust and general corrosion early on.

The bottom line is that in most cases, hose clamps do not fail from general corrosion, but from stress corrosion cracking (SSC) at the inside corners of a slot in the band where the screw engages the band. The T-bolt and ABA types should have a distinct advantage here. We also frequently see massive corrosion of the screw, but this usually doesn't cause failure of the clamping function, just the inability to release the screw. I have several times seen clamps where the screw was unusable due to corrosion of the head, but the clamp was still holding tight on the hose.



The magnetism test that reader Ed Carter refers to in his Mailport letter was only part of the hose clamp test. A series of bench tests also determined the corrosion resistance (left), clamps thickness, and compression ability.

SSC happens when three conditions are present: a susceptible material, a corrosive environment, and high static stress. Since 304 and 316 are susceptible (some other types of more expensive austenitic steels and titanium are not) and boats live in a corrosive environment, then we should reduce the static stress whenever possible. For hose clamps, this means not torquing the screw excessively. Since for most critical hose clamp applications the pressure is less than 2 psi, the screw torque to seal is very low, and, actually the fit of the hose on the nipple will often prevent leaking. I have seen numerous examples of a clamp band completely broken, and there was no leaking at the joint.

The additional important goal of the clamp is to keep the hose from pulling off the nipple. Unlike the presumption of your article, this should be the lowest screw torque that reliably prevents the hose from being pulled off the nipple – thus protecting the clamp from sudden catastrophic failure of the band due to SSC.

My suggestion for installation is: tighten the screw just snuggly; take a healthy pull on the hose; if there is no detectable motion, it is tight enough; if motion is detected, increase the screw torque a little and repeat the pull test.

Ed Carter
Bold Venture, Islander 37
Seabrook, Texas

Excellent letter. We've covered most of the stainless topics before, but you're absolutely right about the pitfalls of the magnet test, and we should have mentioned them in the article. However, we still believe that for many marine products, the magnet test is useful for the average consumer.

The recommended torque for hose-clamp screws that is stated in the article is consistent with what you are saying, but in our experience, this won't always work with exhaust hose, which is the size that we tested.

DIY WIFI ANTENNA

In response to your April 2010 article on external WiFi antennas: I've opted to put my own onboard WiFi antenna system together with the newer Ubiquit Bullet M2 Titanium. It has a fully enclosed aluminum housing sans LEDs and should be more durable. I'm using an Engenius 8-db omni-directional antenna.

The challenge was the 24-volt PoE injector requirements of the Titanium. It does come with an injector for use with 110-volt AC, but I wanted 12 volt. I did manage to find a 12- to 24-volt PoE injector online. I'm also using a pre-made, shielded outdoor cat-5e cable, which is recommended because of the included drain wire for bleeding off static.

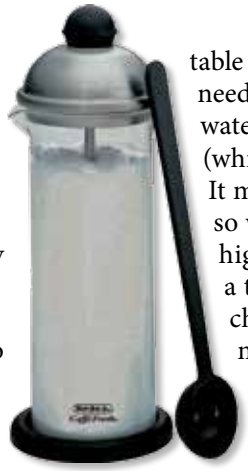
Finally it's all connected to a Cisco/Linksys e5000 WiFi router that was collecting dust in my office. It was a bit tricky to setup, but once I got it sorted out, it's amazing. I gleaned some knowledge from the *www.boatinghowto.com* website.

I have about $225 invested, not including the router. I had been blaming poor service at my marina on bandwidth, but in fact, it was connection strength. I can now stream video. I confess I'm reluctant to share my success with my neighbors for fear of overburdening the network. Also, at a recent stop at another marina where service was fee based, I was able to share the connection with multiple devices (laptop, iPad, iPhone) onboard without multiple charges.

Brian Durfy
Missing You, Beneteau Oceanis 45
Rock Hall, Md.

FROTHY COFFEE

In regard to your January 2014 article on coffee-making methods: I would like to recommend two products to sailors who appreciate a good espresso, latte, or mocha on board. First, the MiPressi Twist, (*www.mypressi.com*), which is a compact and portable espresso brewer that needs only a little boiling water and NO_2 cartridges (whipped-cream chargers). It makes very good espresso without the weight and high electrical demands of a traditional espresso machine. Second, we recommend the BonJour Caffe Froth Maximus Milk Frother, which is available from Amazon.com and many other online sources. It looks like a tall French press and does an excellent job of frothing milk without using a steamer wand. (Tip: For best results, go slowly.)



Bonjour Caffe Froth Maximus

Rusty Gesner
On a Whim, Macgregor 26S
Portland, Ore.

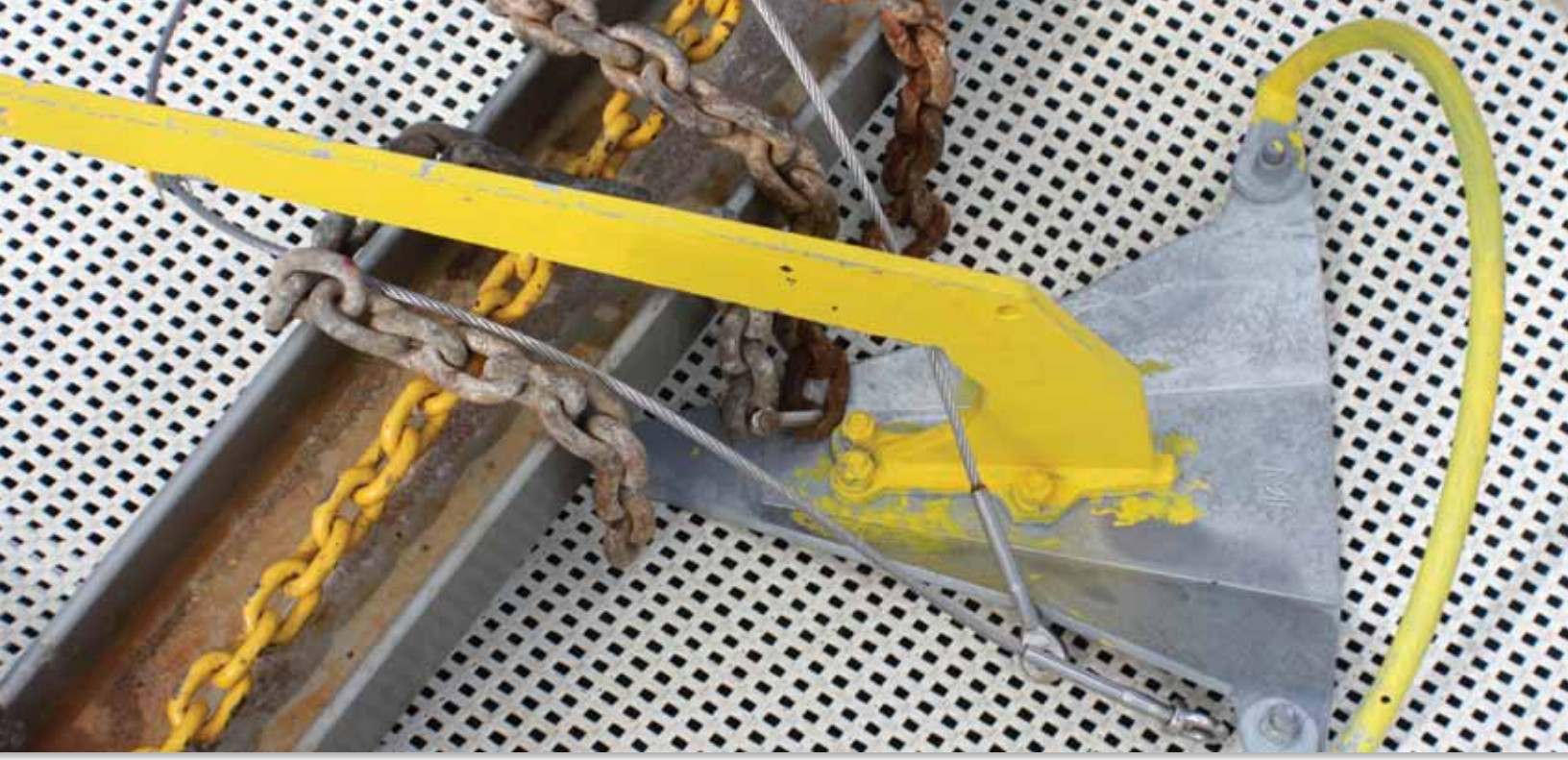
COFFEE TIPS

In response to your coffee article (*PS*, January 2014): I found that a collapsible silicone funnel, used with a Chemex coffee filter, works well for making coffee on board. (Both are easily available from online retailers and some big-box stores.)

I put a thermos in the galley sink, then put the funnel in the thermos opening. It's fairly stable and easy to clean up. You do have to stand there to pour water from the kettle over the grounds though. The funnel is flexible, cheap, and takes up almost no room. I tried the Chemex coffeemaker first, but the glass carafe broke the first time out, despite the fair weather cruise. Nothing glass on my boat ever again.

Barry Needalman
Island Time, 1998 Hunter 410
Boston, Mass.

Practical Sailor welcomes reader comments and questions. Send email to practicalsailor@belvoirpubs.com; be sure to include your name, homeport, boat type, and boat name. Send Gear Graveyard samples to *PS* at 7820 Holiday Dr. S., Suite 315, Sarasota, FL 34231.



This test anchor, a 35-pound Mantus, was painted yellow for better visibility. The test wire (recycled lifeline wire) and chain rodes stand ready to be deployed. If cable were ever to make it into the realm of anchor rodes, swaged terminal fittings would be a poor choice, given their susceptibility to crevice corrosion. Stainless steel, in general, is not a good choice for anchor-rode components.

Alternatives to Anchor Chain?

PS *explores the possibility of a chain-free future in anchoring.*

Practical Sailor has been researching ground tackle for nearly 40 years, but in the controversial world of anchoring, there are always new firestorms to light. Here's one that is sure to spark a lively debate (as if we need another one).

A while ago, when we were researching large oil-rig anchors, we noticed that these rigs were anchored with a spiderweb of stranded wire, or in some cases, Dyneema, a rope made of ultra-high molecular weight (UHMW) polyethylene, a low-stretch, high-strength synthetic fiber.

Lighter and potentially more compact than either chain or metal cable, Dyneema offers several advantages over chain in deep-water drilling operations, but not so many for sailboats. Sailboats don't anchor in the depths that some of the new drilling ships operate in, they must spin around to face the wind, and they rely on the weight of the chain to provide shock-absorbing catenary, or slack, in the anchor rode. Nevertheless, we began to wonder whether Dyneema or a similar fiber might have some application in recreational sailboat anchoring. After all, sailboats are already using these new high-tech fibers for critical above-the-waterline tasks—in everything from standing rigging to shackles and lifelines.

Some of the pros and cons of using a high-tensile fiber or wire-rope are self evident. The most obvious is the potential weight savings. Using a UHMW fiber rope like Dyneema instead of chain would dramatically reduce the weight carried in the bow, making the boat drier when sailing in rough weather and potentially faster and better balanced in light to moderate winds. As our previous article on anchor lockers pointed out, many contemporary sailboats are ill-equipped to handle large quantities of chain (*PS,* March 2011). Resistance to corrosion is another obvious benefit of a fiber rode.

But using a super-strong fiber substitute for chain is inadvisable for many reasons, and it entails certain risks. Disadvantages of a fiber rode include susceptibility to abrasion, incompatibility with conventional anchor windlasses, and, as mentioned, the loss of shock-absorbing catenary. Although a fiber rode may take up less overall space in a locker, chain can automatically lock onto the wildcat of a windlass and drop effortlessly into the bottom of an anchor locker, making it much more reliable with a windlass.

In our view, one of the biggest disadvantages of a high-tech fiber rope rode is that it has no shock-absorbing characteristics and can fail without warning. Although galvanized chain rusts as it is reaching the end of its lifespan, the condition of a fiber rode is harder to assess. As we saw in our test of nylon rodes (*PS*, December 2007), the load-cycling and weathering that a rode undergoes can drastically reduce its tensile strength.

Despite these serious concerns, we decided to go forward with more testing. It seemed that some of these

Photos by Jonathan Neeves

Rodes Tested from Shore and Catamaran

Our test anchors included a small, 11-pound Spade anchor, which we set using a chain winch off a beach in Pittwater, Australia. We set the anchors using two different rodes: 30 feet of 5/32-inch stainless wire strop that we fabricated using old lifelines and 33 feet of quarter-inch, short-link BBB chain. We extended each rode with 5/16-inch chain and aimed for length-to-depth ratio of a 5-to-1.

We loaded the Spade anchor such that it set in clean, soft sand under water at the beach edge. We then increased load until the anchor dragged under a steady load. The anchor remained under the water at all times. We tested with the wire and then the chain rodes attached directly to the anchor, using the same shackle. To compare performance, we measured not only the distance each anchor dragged before setting, but also how deeply the flukes were set. To measure depth, we used a steel probe to penetrate the sand. Each test was repeated three times with each rode.

We followed up the shore-based testing with on-the-water testing aboard a Lightwave 38 catamaran at an anchorage known as Jimmy's Beach in Port Stephens, Australia.

For this second round of testing, we anchored the boat in 10 feet of water with a clean sand seabed. The anchor was buoyed to use as a reference mark. For this test, we used a 13-pound Mantus anchor (see adjacent article for review of this anchor). This anchor was also buoyed, so that it could be more easily monitored.

To judge how various rodes might affect the anchor's ability to set, we used a 55-inch, 3/16-inch wire strop, a 65-inch length of 3/8-inch BBB chain, and a 59-inch length of half-inch BBB chain. We shackled each in turn to our spare 5/16-inch nylon rode. Each test rode was directly shackled, using the same shackle, to the 13-pound Mantus. We dropped the anchor from our dinghy (adjacent to the buoy of the main anchor), set the anchor gently and then dragged the anchor with both engines set at 2,000 RPMs (equivalent to about 675 pounds of load). We held the engines at 2,000 RPMs for 30 seconds. The load (675 pounds) and time (30 seconds) was sufficient to deeply set the Mantus in the chosen seabed.

We could measure how far the anchor had dragged during each setting exercise using the main anchor's buoy as a reference. The test boat never held to the main anchor except to change test locations and rodes. To compare performance, we photographed each anchor as it set and measured the amount of wire and chain buried. We were working on a fairly accurate 5:1 scope, and we subsequently made a calculation of depth of set for the wire and 3/8-inch chain (though our calculations ignore any reverse catenary of the buried section of rode). We tested each of the test rodes three times.



Like similar concave anchors that we have tested, the Mantus picked up a fair amount of mud during testing.

Why not 5/16-inch chain? We chose wire and larger chains because we were looking for results. We suspected that any difference between 5/16- and 3/8-inch chains would be small, and because so many variables were involved in our test, such a closely matched comparison would be subject to misinterpretation. In general, we find that many published anchor "tests" are so fraught with uncontrolled variables that the conclusions are useless. We wanted to avoid this pitfall.

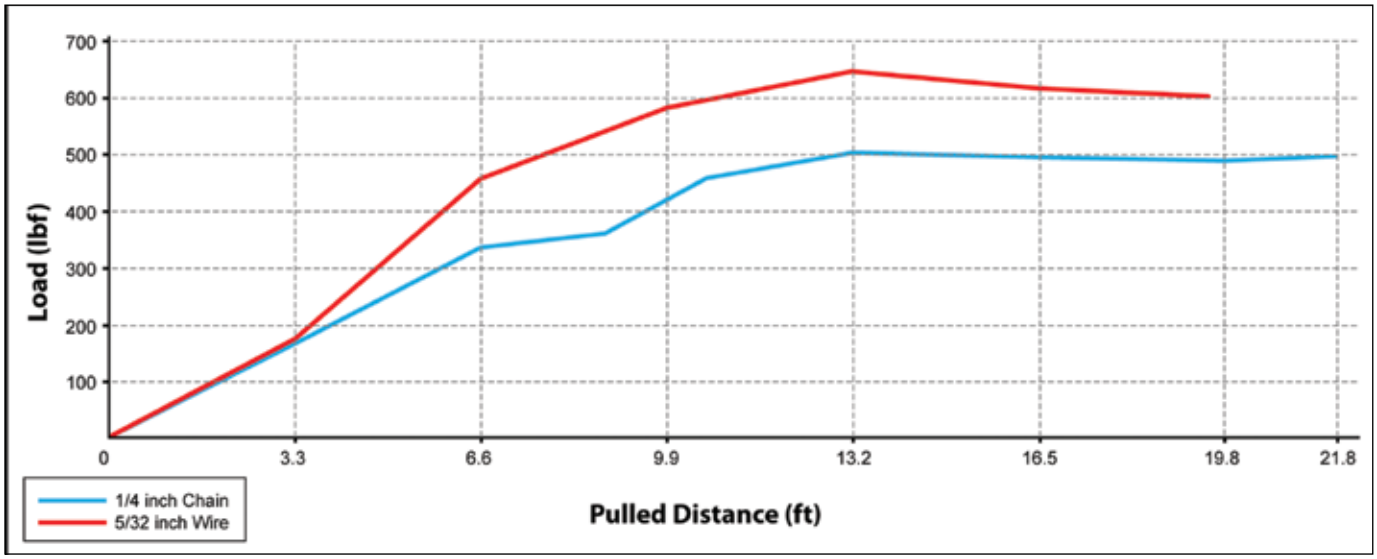
Why not bigger anchors? We used small anchors because we wanted to ensure we achieved ultimate holding capacity (UHC); in effect, we wanted to drive these anchors to the maximum depth the anchors were designed to reach. When an anchor reaches its UHC, it should "burrow" horizontally through the seabed under a constant load. We would not be able to "burrow" a 34-pound high performance anchor; the twin 20-horsepower engines on our test boat simply lacked sufficient power.

Interestingly, the results from the beach test and the on-board tests generally correlated. The beach test allowed more accurate quantification, was much easier to carry out, and allowed us to examine the test anchor and rode at any time during the procedure. Ideally, we would use an underwater video to monitor the on-board testing, but at this early stage of our ongoing look at a rode and anchors, we opted to invest our resources in other tests. (Look for a report on new galvanizing technology later this year.)

shortcomings could be overcome in the future, and we hoped that, as frequently occurs when we roll up or sleeves, our testing might reveal some less obvious advantages of an ultra-high-strength fiber rode. Foremost in our minds was the question of how a fiber rode might affect the anchor's ability to set.

A DEEPER SETTING ANCHOR?

Assuming that the cross-section of the fiber or cable rode is much smaller than that of chain, we suspected that the anchors with fiber or cable rodes would penetrate faster and deeper. As many of our previous anchor reports demonstrate, the makers of new-generation



In shoreside testing, the 11-pound Spade anchor on 5/32-inch wire set deeper than the 1/4-inch chain and had more holding power. Both anchors burrowed about 13.2 feet horizontally before reaching ultimate holding capacity.

anchors emphasize their ability to set deeper and quicker. Some of the claims are so amazing that if a landlubber looked at the marketing materials, he might think these contraptions were designed to carve a path to Earth's core, not hold a boat in place. It stands to reason that a lower-profile rode would enhance an anchor's ability to set.

The idea of using wire cable instead of chain with a recreational marine anchor isn't new. The U.S. manufacturer XYZ used cable leaders on some production models that we tested (*PS*, January 2008).

The purpose of the cable was two-fold. As we saw in our report on anchor shank strength (*PS*, April and May 2013), an ability to dig deeply into a sand bottom is a terrific characteristic—allowing a relatively lightweight anchor to sustain extreme loads—but it can be a problem for anchors with long shanks made of weaker steel. When the anchor is so deeply set that it doesn't rotate and reset in a sudden wind shift, such a shift could easily subject the shank to lateral loads that it isn't designed to withstand. So after just one afternoon squall in the sandy-bottom Bahamas, you'd have a bent anchor.

The XYZ anchor we tested had a very short shank with less lever arm to resist bending. The anchor's cable permitted it to dive deeper into the sand—according to the designer. The anchor held well in our tests, but we had other concerns about the design. And we were curious. How much deeper does an anchor on cable (instead of chain) actually dive?

The thin, lightweight fiber versus thicker, heavier chain question is relevant, even if we intend to stick with chain. For many years, sailors have asked whether downsizing from a heavier Grade 30 (G3) chain to a smaller-diameter, but higher tensile-strength Grade 43 chain would offer enough weight savings to be worth the added expense. For comparison, 5/16-inch "high-test" Grade 43 (G43) chain weighs about 25 percent less than 3/8-inch Grade 30 "proof coil" chain, and it has nearly 30 percent higher safe working load. It also costs about 40 percent more. See the accompanying "Consumer Guide."

Previously, arguments against a smaller-diameter, higher tensile-strength chain have cited price, less catenary (due to the chain's reduced weight), and the brittleness of the higher-tensile metal as reasons to stick with Grade 30. However, if the smaller-diameter chain allowed newer anchors to set quicker and deeper, and we could compensate for the loss of catenary with a kellet (a weight that rides on the rode) or by attaching an effective snubber (*PS*, November 2013), would that tip the scales in favor of the lighter, but more expensive high-tensile chain? There are even high-tensile G70 varieties coming on the market that could permit more dramatic downsizing.

With those questions in mind, we set about testing. For details on the testing, see the accompanying "How We Tested."

WHAT WE FOUND

Rode only disappears below the seabed surface if it is pulled downward by the anchor. The ability of the anchor to pull the rode down is based on the load applied (the boat's engine or the wind/windage) and the anchor's design.

Our assumptions regarding the effect of rode dimensions on setting ability generally proved correct: The smaller a rode, the deeper the test anchor dove, effectively giving it more holding capacity. It's important, however, to put this finding into the right context. (Taken to an extreme, this finding suggests that we use Kryptonite piano-wire on our anchors so they can provide better holding power.)

The fundamental question was, how much smaller should the rode be to provide a noticeable advantage? To determine this, we started measuring. The cross-sectional area of the wire strops was easy to calculate. We estimated that 39 inches of our 3/16-inch wire cable had a cross-sectional area of about 8 square inches. The chain cross-section was more difficult to calculate. We estimated that the cross-sectional area of 39

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PS VALUE GUIDE **5/16-INCH CHAIN GRADES AND SAFETY FACTORS**

GRADE (SIZE)	SUPPLIER, PRODUCT INFO	PRICE	WORKING LOAD	BREAKING LOAD	SAFETY FACTOR
G3	Canadian Metals Pacific DIN 766 windlass chain	$2.71/foot	1,836 pounds	7,344 pounds	4
G4 / G43	Canadian Metals Pacific, ISO high test	$4.60/foot	3,980 pounds	11,940 pounds	3
G4	Maggi, Italy, Aqua4	$4.26/foot*	2,250 pounds	9,000 pounds	4
G4	Chaineries Limousines, France	NA	2,250 pounds	9,000 pounds	4
G4	West Marine, G40	$5.22/foot	3,900 pounds	11,600 pounds	3
G7	Maggi, Aqua7	$9.85/foot*	3,150 pounds	15,750 pounds	5
G7	West Marine, ACCO Grade 7	$6.40/foot	4,698 pounds	14,098 pounds	3
1 x 19	316 stainless-steel wire, various suppliers	NA	2,250 pounds	11,349 pounds	5
DYNEEMA STS (9/32")	New England Ropes, Annapolis Performance Sailing	$3.69/foot	N/A**	19,000 pounds	N/A

* Not available in the U.S. **Safe Working Load varies by application.

Chain suppliers around the world use different safety factors, so the breaking load is usually more accurate gauge for comparing.

Navigating the Grades of Anchor Chain

Anchor chain is commonly sold in three different grades:

G3: also called G30, BBB, Grade L, or proof coil. This chain is manufactured from wire with an Ultimate Tensile Strength (UTS, also called "breaking strength") of 300 megapascal (MPa). It is more ductile than the other grades, and it is the grade *Practical Sailor* recommends for most sailors.

G4: also called G40, high test, or Grade M. This chain is manufactured from UTS 400 megapascal wire. There is a slightly better grade, G43, but the differences in tensile strengths are less than 10 percent. G4 chain is slightly more brittle than G3, but it is also a common anchor chain, more so in the U.S. than in other countries.

G7: also called G70, transport chain, or high-tensile chain. This chain is sometimes manufactured from the same wire as G4 chain, and sometimes from a different steel formulation entirely. All G7 chain is heat treated, sometimes quenched and tempered. The UTS is 700 megapascal, although tensile strength can be degraded during galvanizing by about 10 percent. This chain has found a small niche catering to U.S. yacht owners, but it is beginning to catch on in the Caribbean and Europe.

Because the standards are universal, G3 from one supplier should be similar to G3 from another manufacturer, unless the supplier has poor quality control, etc. Each link is welded shut, and the weld used to close each link should be slightly stronger than the wire used. There might also be a slight difference in wire quality, but they should still all meet the 300 megapascal or 400 megapascal minimum.

Some chain, sold as anchor chain, might not meet all G3 standards, so check when you buy. Breaking strength is directly related to the type of wire used, so the breaking load (BL, also called "breaking strength") for the same size chain of the same grade should be similar. Because retailers often use different safety factors, using the safe working load (SWL, also called "working load") for comparison can lead to confusion. (See table.)

For example, the safe working load for G4 in the U.S. is generally one-third of its breaking load, and in Europe, the safe working load is one-fourth of the breaking load, a more conservative figure. For G3 and G7, the major U.S. chain manufacturer Peerless uses a safe working load that is one-fourth of the breaking load. Meanwhile, Maggi, an Italian manufacturer of G7, uses a more conservative safe working load that is one-fifth of the breaking load. Meanwhile West Marine gives its G7 chain (supplied by Peerless) a more optimistic safe working load that is only one-third of its breaking load. Buyers should beware of any supplier that gives only the safe working load without providing the safety-factor used to determine that number, or the breaking load.

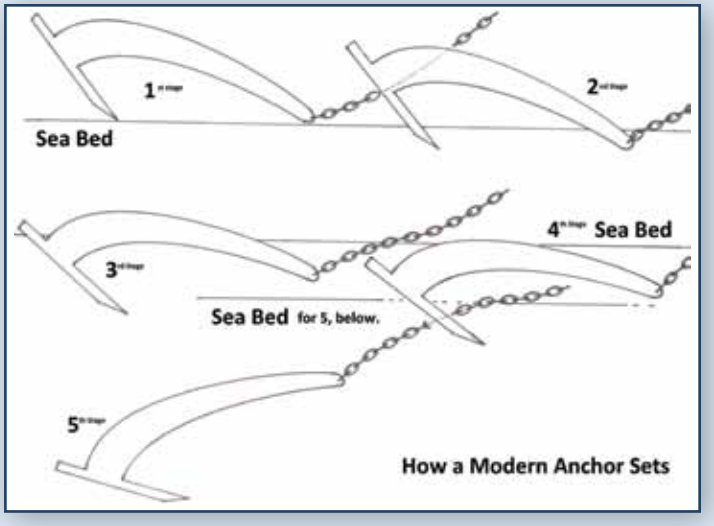
Other grades exist, but these aren't commonly galvanized, or offered in the short link form required by anchor windlasses. Matching a chain to a windlass is also tricky because chain is made to different national size specifications. American, European, and Australian link sizes are very different, and there are even different metric size standards. Windlass manufacturers and chain manufacturers warn that link sizes in some Asian-made chains vary so greatly, the chain won't run smoothly or may even "jump" off a windlass. Ideally, you buy chain from a company that will check your gypsy over the complete length of chain you wish to buy. Chain suppliers (who might often sell chain for lifting) tend to be better able to check compatibility of chains with gypsies than do chandlers.

The Geometry of a Deep-diving Anchor

When a modern anchor is dropped to the seabed, it commonly sits with the fluke on its side and the shackle end of shank touching the seabed. As the load is applied, the fluke toe engages with the seabed and its burial is followed soon after by the shackle end of the shank slowly burying as well. As the toe buries deeper, it "pulls" the shackle end of the shank down with it.

When the anchors is set well, commonly only the top of the shank is visible. As the anchor sets more deeply, now completely buried, the fluke tends toward an orientation parallel to the seabed surface and when it reaches its ultimate diving depth, and ultimate holding capacity, it burrows forward, approximately parallel with the seabed surface. The buried rode takes on the form of a reverse catenary.

In a very hard bottom, the anchor may not have the power to drag the chain under the surface and it could be forced to its ultimate holding capacity, for that hard seabed, with no chain buried at all.



As illustrated, modern anchors are designed to deeply penetrate the sea bottom.

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inches of the 3/8-inch chain was about 42 square inches. For this calculation, we assumed that sand would squeeze through the holes in the chain. In reality, however, the holes add resistance, so the practical cross-sectional area is probably much larger.

BEACH TESTING

During beach testing with an 11-pound Spade anchor (surface area of the Spade is about 62 square inches), switching from the 5/32-inch wire to the quarter-inch chain rode reduced holding capacity from an average of about 610 pounds with the wire to 495 pounds with chain, a drop of about 20 percent. The anchor on wire rode set 26 percent deeper than the anchor on chain (15 inches versus 11 inches), but we saw no significant difference in the speed at which the two rodes set. This was checked by measuring the horizontal distance the anchor dug through the seabed before it reached its ultimate diving depth. Just as we predicted, the wire rode clearly allowed the anchor to penetrate deeper.

After several attempts to mathematically predict the depth of set achievable based on rode diameter, we reluctantly gave up. We simply didn't have enough data to pursue this angle. We also didn't attempt to generate anything more than some very rough predictive curves showing the relationship between holding power and depth of set. While accurate curves would be helpful in assessing the tradeoffs when choosing a rode, the wide variability in bottom conditions would make these sorts of formulas of limited use in practice.

ON THE WATER

During our on-the-water testing with the 13-pound Mantus anchor (surface area of 88 square inches, excluding roll bar), the wire rode took longer than chain to reach its maximum depth of set, but it also set noticeably deeper. With the wire rode, the anchor dug horizontally 48 inches before reaching a maximum set depth of 20 inches. By comparison, the 3/8-inch chain dragged 24 inches before reaching its maximum set depth of 15 inches. The half-inch chain dragged 19 inches before reaching its maximum depth of about 11 inches. Based on this test, there seems to be little performance advantage gained by moving downward from half-inch to 3/8-inch chain.

The anchor buried at a slightly steeper angle using the 3/8-inch chain, but this would not be enough to tilt our preference to one size chain over the other. Given the results of this test, we would expect to see little setting difference between 5/16-inch and 3/8-inch chain. So if you have 37-foot boat and are torn between these two sizes, then you can disregard setting performance as a factor. The old argument of bigger is better seems to prevail—so long as your boat's bow can accommodate the extra weight (or you are comfortable with a shorter length of chain in a combination rope/chain rode).

CONCLUSION

Based solely on our shoreside testing, which has minimal statistical support, reducing the rode diameter by a factor of four with the Spade anchor increased its diving depth and ultimate holding capacity by 25 percent. In on-the-water testing, reducing the rode diameter by a factor of 5.5 increased the diving depth by 25 percent. Based on these rough calculations, it seems clear that to make measurable gains in performance simply by switching rode diameter will require a reduction in rode size that is much more drastic than the usual switch from half-inch to 3/8-inch (a roughly 50-percent reduction in

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The Mantus (above) arrives in three parts (right) that the new owner must bolt together.

Mantus Upgrades to a Stronger Shank

Late last year, we had our first look at the bolt-together Mantus anchor. Although we liked the design, and prices were favorable (around $330 for a 35-pounder), we raised concerns about the shank strength, which by our estimation was the weakest of all anchors of a similar design.

At that time, Mantus told us that they had been working on an upgraded shank. Our report apparently lit a fire under that project, and the company quickly introduced a new, improved shank made with 700-megapascal steel. All anchors sold after Dec. 8, 2013, have the new, stronger shanks. According to Greg Knutsen of Mantus, owners of the older models with mild steel shanks can get the new shank free—paying only the shipping costs. All parts carry a lifetime guarantee.

Made in China, the Mantus arrives as a flat pack in a robust wooden box (strong enough to travel halfway round the world). The anchor is delivered in pieces: roll bar, fluke, and shank. The owner needs to assemble the anchor himself. Assembly is easy and quick, using six high-tensile bolts and lock washers. When assembled, the anchor is completely rigid. The spring washers appear to hold the nuts securely. The anchor is a concave, roll bar—a cross between the Wasi Bugel and Rocna.

The fluke plate has a central flat portion and two slightly raised, folded, fluke edges. The toe is welded thicker and sharpened. The shank has a flange plate that is welded and perforated so that it can be bolted to the fluke. The flange is slotted and welded from both top and bottom. (Other anchors welded in this fashion include Anchor Right's SARCA and Excel, and the Spade, which can be welded on request.) We are always suspect of welds on anchors, but the welding on the Mantus looks professionally done.

The shank on our 35-pound (15-kilogram) model was slightly mis-alinged, but this did not seem to impact performance. Once assembled, the roll bar is very widely set to prevent clogging with weed, but its large relative size offers another place for sheets or guys to catch on the foredeck. This is not a deal-breaker, just something to be aware of. Mantus says its initial testing with smaller anchors (8 pounds) show that it can self right without the roll bar. We did not see that in our limited experience with the larger anchors, but we will be doing more testing—as will Mantus.

The anchor sets very well and develops holding capacity very quickly. We tested both the 15-pound and 35-pound versions. The 35-pounder seems more than adequate for up to around 25 knots for our 6-ton, 38-foot catamaran. The problem is that we can't carry a roll bar anchor without some very expensive modifications.

We tested the anchor in both soft mud and a variety of clean sands, and it works well in all environments so far. We have not yet tested it in weed, nor a hard seabed. We also have not yet had time to test it in trying conditions. As with most roll-bar concave anchors, the Mantus does tend to collect mud.

The Mantus has obvious advantages over other concave roll-bar anchors in that it can be disassembled, making it much easier to store as a spare or stern anchor. Since a disassembled anchor in a locker or belowdecks is relatively useless, however, we see this as more of a boon to shippers than to cruisers.

In previous issues (*PS*, April and May 2013), we also questioned the use of bolts to attach the shank to the flukes. Mantus engineers said all its anchors are shipped with Grade 5 high-tensile 800-megapascal bolts, which are more than adequate for the loads, according to their engineers. However, the bolts on our test anchor were clearly stamped 307A, a lower grade, with a lower tensile strength. We recommend that all Mantus owners confirm that their bolt heads have the markings that identify it as a Grade 5 or higher bolt. A Google-search "determining bolt grade" will turn up several sources for reference.

'Quick and Dirty' Shaft Hardness Test

The only way to truly define steel quality is to use the services of a metallurgical lab, but there is a "quick and dirty" test that will allow you to estimate the tensile strength with a fair degree of accuracy, and allow you to compare two or more anchors. To do the test, you need five things: a big powerful vice, a pea- or marble-sized ball bearing, a collection of bolts, a micrometer, and a friend. Between the local automotive store and the home-improvement store, you should be able to find all but the last.



An anchor shaft undergoes the ball-bearing hardness test. The numbers and letters on the bolt identify it as a Grade 8 bolt.

In this test, you are comparing the hardness of a shank to that of steels (found in the sample bolts) of a designated hardness. The tensile stress of bolts is defined by markings on the bolt head. These "codes" are well documented on the websites of most major fastener manufacturers. The one we often refer to, Appendix A-1 of the Fastenal Technical Guide (*http://www.fastenal.com/content/documents/FastenalTechnicalReferenceGuide.pdf*) offers a guide to identifying bolts and their respective tensile strength by using the head markings. Another option is to obtain scrap of steel plate—of a known grade with a hardness and yield strength that is well documented.

To determine the grade of steel, you'll need to remove a small area of the galvanizing coating. The ball bearing is then sandwiched between the shank "in query" and the "known" standard bolt. The three items are then squeezed, with as much load as is possible, in a bench vice. The indentations on the shank and standard sample bolt are compared with a micrometer. The "softer" metal, with lower yield stress product, will have a larger indentation. If you have enough bolts of varying hardness, you can eventually narrow down the grade of the steel and its tensile strength.

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cross-sectional area) or from 3/8-inch to 5/16-inch (less than a 25-percent reduction in cross-sectional area).

One might be able to drop down two sizes when switching to higher-tensile G70 chain. But, as we'll see in a future report on corrosion, downsizing chain diameter may not be a smart choice. And ultra-high tensile chains are also generally more brittle, a handicap when it comes to anchoring, which entails repeated cycles of dynamic or "shock" loading.

Although our data is limited, it seems to support what we already suspected: The burying ability of an anchor is impacted by the diameter of the rode, but not so much as to justify downsizing from one size chain to the other. In our view, the skipper's skill and wisdom would more than make up for any advantage gained with a smaller chain.

If our choice was between a larger-diameter Grade 30 anchor chain or smaller-diameter, higher tensile steel anchor chain, we lean toward the bigger diameter. Our findings do suggest that a reliable, small-diameter, abrasion-resistant material like Dyneema or wire between the anchor and the chain would allow the anchor to bury deeper. At this stage, however, we don't see any practical option that overcomes our natural reluctance to add more failure points such as swages, splices, knots, or swivels between the boat and the anchor.

The biggest unknown value in our test is how using a larger anchor might alter our findings. Larger anchors tend to dive deeper than smaller ones, but we are not prepared to speculate what difference an increase in anchor (and fluke) size might make.

Seabeds will clearly play a role in the rode-size decision as well. In harder seabeds, the impact of chain diameter on burying ability would seem to be less important as the anchor struggles to bury itself, much less pull a couple feet of chain down with it.

While the weight savings or added length of moving to a smaller chain size seems enticing, we are still not convinced this is a sensible move for most cruisers. Probably the most controversial modification that this study invites is the placement of a wire strop (of appropriate strength) between the chain end and anchor.

Because wire swages or Nicropress fittings used to join wire to an anchor will add a potential failure point, we don't condone this modification, but if one were to experiment with this approach, the wire "leader" should be supplied by a qualified rigger. Buried wire, crimps, and swages will be prone to corrosion, so any such strop should be checked and/or retired on a regular basis. A high-tech fiber leader that is well insulated from chafe offers an interesting option as well, but at present, such modifications—in our view—have a place in future experiments, but not in practice among sailors.

CONTACTS

SPADE ANCHOR,
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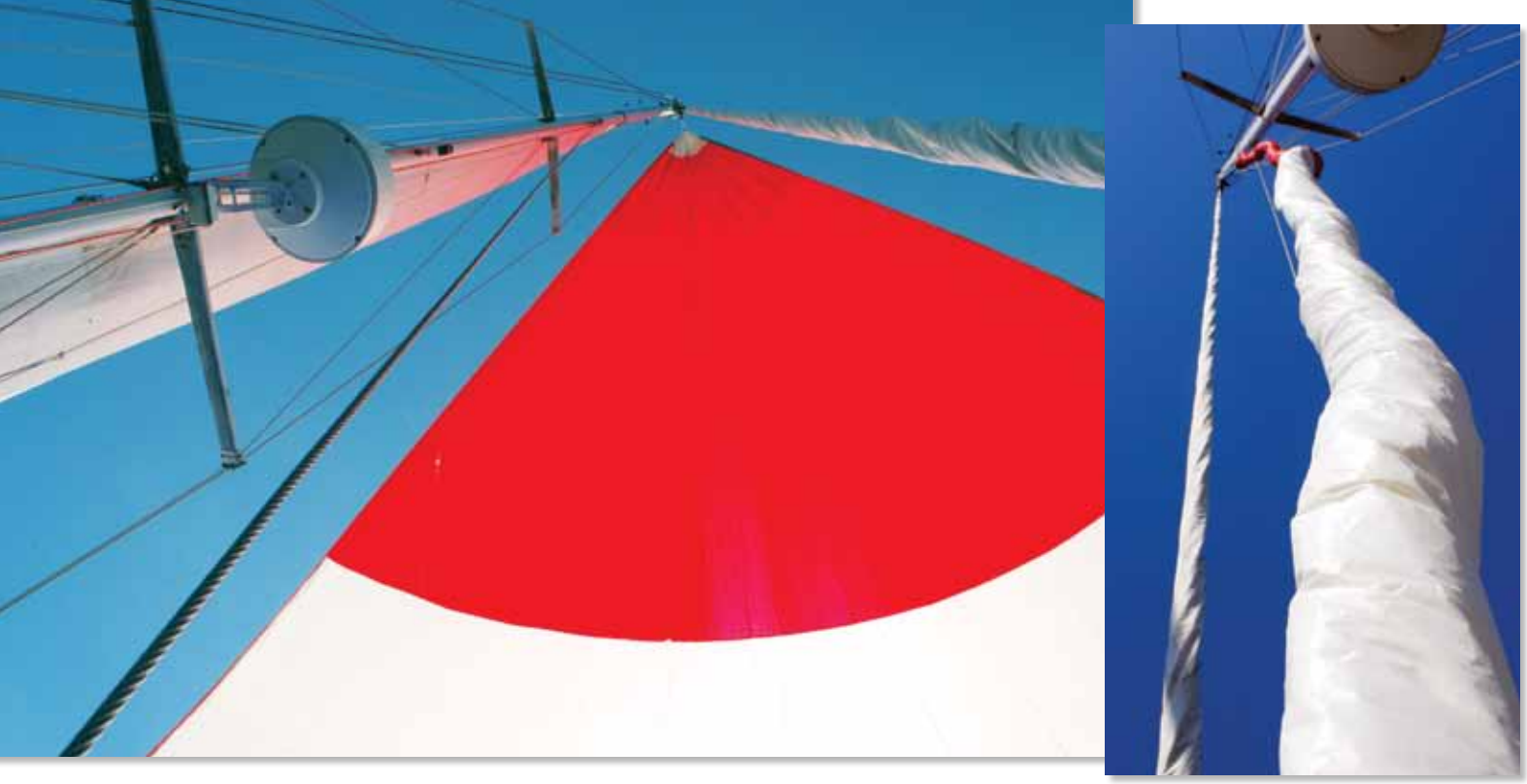
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CANADA METALS PACIFIC
www.canmet.com

PEERLESS,
www.peerlesschain.com

WEST MARINE,
www.westmarine.com

MAGGI CHAIN,
www.maggigroup.com



This 1,100-square-foot UK Sailmakers A-Star spinnaker was a handful to conventionally set and douse aboard the Ericson 41 test boat, but when furled using a top-down furler, it could easily be hoisted or doused.

Five Top-down Furlers Face Off

Part 2: Spinnaker furling systems face sea trials and bench tests.

Photos by Ralph Naranjo

Top-down furlers have proven to be a legitimate means of taking the drama out of spinnaker setting and dousing, and they represent a new breed of hardware that's carefully designed and manufactured to be durable for the long haul. In Part I (*PS*, January 2014) of this two-part report, we introduced five top-down furlers, detailed how they worked, and made a good case for why short-handed cruising sailors should buy into a concept originally designed for hard-core ocean racers. In this article, Part 2 of the report, we'll take a closer look at the furlers, the test protocol, and the results.

There were no out-and-out losers in this test. Each of the five units we tested represents well thought-out engineering and quality materials. Across the board, these endless-line furlers, with their top swivels driven by anti-torsion ropes, successfully tamed the 1,100-square-foot UK Sailmakers A-Star—a cloud of well-shaped nylon that turned near calms into enjoyable sailing conditions. As testing concluded, *PS* Technical Editor Ralph Naranjo noted that a retractable bowsprit and any one of the five top-down furlers tested made his classic Ericson 41 a more versatile cruising boat. Some of the products made furling a little easier, others offered quick-change features testers liked, and the Profurl Spinex 2.5 even came with a string of plastic bearings that allowed the sail to spin off the furler with quick-set alacrity.

WHAT WE TESTED

We tested five top-down furlers from top sailing hardware manufacturers: the Colligo CN3S, Karver KSF2, Profurl Spinex 2.5, Ronstan Series 120, and the Seldén GX15.

There are marked similarities and a few important differences among the units we tested. All worked on the same general principal: a deck-level sheave driven by a looped line spins an extremely stiff, axle-like rope, around which a sizable asymmetric spinnaker can be furled. The sail is attached to the top of the anti-torsion line (also known as a "torque rope" or "torsional furling cable") and hoisted aloft on a spinnaker halyard. As detailed in last month's report, the sail winds around this line starting at the head and working its way to the deck, hence the name "top-down furler." This allows the drum to rotate without causing the lower part of the sail to roll up around its luff. The anti-torsion line becomes both a drive shaft and a mandrel around which the sail furls.

All of the products tested were designed to furl lightweight, free-flying sails—especially those with a curved leading edge. Each works on masthead or fractional rigs. All of the test furlers come with torque ropes, except the Ronstan. Bearing systems vary, and pins, clips, and how the endless reefing line is reeved differ from unit to unit. All feature half-inch-diameter anti-torsion lines, but the line details and terminal fittings varied. The Colligo CN3S was the only one to use a shackle tack; all others come standard with a snap shackle at the tack.

Each furler was put through its paces at sea and in the workshop. For specifics on the test protocol, see the accompanying "How We Tested."

From the Sea to the Shop





The test jig (at left) imposed tension on the torque rope (black), and a secondary line added sideload. Testers used magnets to evaluate the alloy type and quality (above) of hardware like this Selden low-friction shackle.

The test comprised on-the-water and in-the-worksop testing. For the bench-testing component, we set up a test that mimicked furling loads and allowed us to measure the input tension and output torque. In essence, we tensioned a short segment of torque rope and added an angular line load that simulated a sail being furled. These loads (200 pounds and 500 pounds) and angles remained consistent from unit to unit, and what we measured was how much tension had to be placed on the furling line in order to wind up the small segment of faux sail (weighted line). The results show the tension in pounds through the five-rotation furl. The fact that larger drum diameters directly correlate with lower furling loads came as no surprise.

We also disassembled mechanically fastened components and took a close look at all the parts. Because these systems are expensive, we also looked for factors that would likely impact their longevity. Details like a manufacturer's efforts to isolate dissimilar metals and their initial alloy choices were key factors when it came to adding bonus pluses.

For real-world testing, we evaluated the furlers' performances underway. Testers used each furler in calm conditions aboard an Ericson 41 fitted with a Seldén retractable bowsprit and a 1,100-square-foot asymmetrical sail, UK Sailmakers' A-Star. Testers also noted ease of installation, ease of use, and construction quality.

In tests underway, we found that larger-diameter sheaves lessened the load on the furling line and made the pull easier. As with any larger lever arm—or in this case, a bigger sheave—the result can be greater output from the same amount of input; however, Mr. Newton's conservation of energy prevails in this case, and despite more furling gusto, the total work done remains the same. This means that when we make it easier to haul on the furling line, it will also take longer (more pulls) to haul in the sail. In this case, the low-gear nature of larger diameter sheaves got the tester's thumbs up, especially in higher winds. It did take more pulls on the furling line to get the sail in, but we found the leverage increase of the larger diameter sheave worth the cost of a slightly slower haul-in rate.

Those looking to use the furling system for both cruising and racing should take a close look at how each system expedites the set-up process and makes it easy to clear the gear from the foredeck once the sail is furled and dropped. We found that a tack snap shackle and easy-to-use quick pins designed into the jaw of the furler and swivel greatly sped up the process. Users must decide whether or not to clear the deck completely, or perhaps leave the drum and swivel attached to the halyard via a short pennant. This will help you decide which system best suits your needs.

COLLIGO CN3s

Colligo's CN3s furler is built around a large-diameter drum with an efficient bearing package that delivers a smooth and easy furl. It features a 6.3-inch-diameter, anodized-aluminum sheave rotating on a titanium, spindle-type axle and surrounded by a pan-like molded plastic cage. The sealed, angular contact bearings are housed in a compact, watertight hub and can handle thrust and axial loads. The lightweight top swivel runs on Torlon bearings, and the jaw uses a ring pin. A non-swiveling Tylaska snap shackle is optional for the tack.

We set up the endless-line drive using snatch blocks to insure a straight run to the furler. By placing another snatch block on the loop and tensioning it with a bungee cord lashing, we were able to keep the line taught and running smoothly during both the inhaul and outhaul process. In a permanent setup for this unit, or the other furlers, we would have placed some small but efficient bullet blocks on the endless line prior to splicing it together, and used them to fairlead the furling line.

Bottom line: Colligo hit a sweet spot with its large-diameter drum, moderate weight, ease of operation, and very favorable price. The least expensive in the test field, the $1,399 Colligo is the Budget Buy.

PS VALUE GUIDE TOP-DOWN SPINNAKER FURLERS

MANUFACTURER	COLLIGO	KARVER	PROFURL	RONSTAN	SELDÉN
MODEL	CN3s $	KSF2	Spinex 2.5 ✓	Series 120	GX15 ★
PRICE	$1,399	$3,030 *	$3,030 *	$2,195	$1,545
MAXIMUM SAIL AREA	1,000 square feet	NA	44 feet LOA	44 feet LOA	1,238 square feet
SAFE WORKING LOAD	6,600 pounds	5,511 pounds	5,000 pounds	3,970 pounds	3,300 pounds
DRUM DIAMETER / DRUM WEIGHT	6.3 inches / 2.72 pounds	5.67 inches / 2.26 pounds	5.9 inches / 2.08 pounds	4.75 inches / 1.38 pounds	5.9 inches / 2.8 pounds
DRUM CAGE MATERIALS	Full fiberglass	Full fiberglass	Stainless steel	Teflon band	Full stainless / fiberglass
SHEAVE LOCK	No	Yes	Remote	Yes	Remote
TACK HARDWARE	Shackle; snap shackle optional	Snap shackle	Snap shackle	Snap shackle	Snap shackle
JAW HARDWARE	Ring pin	Quick pin	Quick pin	Push pin	Fixed
TEST RESULTS					
EASE OF INSTALL	Excellent / System is plug and play	Excellent / System is plug and play	Good / System is plug and play	Good / No line, no clamps	Fair / end fittings more challenging
MAGNETIC	Low	High	High	Low	Low
PULLS @ 200 POUNDS	4 to 8	6 to 9	5 to 8	7 to 12	5 to 8
PULLS @ 500 POUNDS	14 to 22	17 to 25	16 to 23	23 to 31	15 to 23

★ Best Choice ✓ Recommended $ Budget Buy *Price with torsion line

KARVER KSF2

The Karver KSF2's superbly engineered drum and swivel combo sports nicely machined, user-friendly, singlehand-usable jaw pins and an easy-to-operate tack snap shackle, which makes setup and disassembly easy. There's a removable drum lock that prevents unwanted unfurling, and the system works just like a window shade, requiring only a tug on the furling line to release the lock.

Prior to unfurling the sail during tests, we just hauled in a bit on the furling line, let go, and yanked away on the leeward sheet. When it came time to haul in the sail, we headed the test boat just a little below a beam reach, eased the sheet to spill the breeze, and hauled away.

It took a few yanks to deliver enough torque aloft to start the furling process, and as the sail wound around the torque rope, the sheet needed additional easing. It's important to watch the lazy sheet and make sure it does not get caught up in the furling sail. This is another reason we prefer working from the max beam/mast step part of the boat where all can be seen and responded to.

Bottom line: Karver got a nod of approval for jaw-pin operation and tack-shackle handling. It also scored points with its unique removable locking system controllable with a tug of the furling line.

PROFURL SPINEX 2.5

The Profurl Spinex 2.5 furler was the most complex of the top-down systems we tested. It had more hardware than the other furling systems, making it heavier and a bit more of a challenge to hoist. Testers also found the coiling and bagging process more complicated, especially on smaller boats. The tack swivel is part of the torque rope rather than the furling drum, and this allows the NEX drum to remain in play as a bottom-up furler after the spinnaker has been doused and stowed.

Testers liked the ball-like rollers on the Spinex 2.5's torque rope, a feature that makes unfurling the sail more like a well-orchestrated mark rounding than a typical cruising experience. The system also seemed more tolerant of snafus that would likely cause a back wrap problem on torque rope-only furlers.

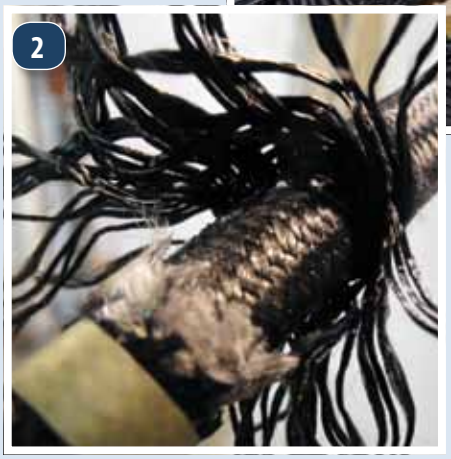
The Spinex 2.5 features a nicely machined and anodized sheave, a stainless-steel sheave cage and little touches of


Colligo CN3s


Karver KSF2

The 'Anti-torsion' Rope





1. *All of the torque ropes were quite stiff. Note the Spinex system, with the balls in the background, which was designed to solve the problem of back wrap.*
2. *Dissecting a torque rope revealed that beneath the outer braided cover are tightly woven inner yarns formed around a central elastomer.*

Testers noted that all of the units we evaluated worked better when we added enough halyard tension to remove most of the curve in the torque rope, without over-tensioning the halyard. Working out a fair lead for the endless-line loop also helped to make the furling process even easier. When it came to how much tension was put on the halyard, a good rule of thumb was to eliminate the swayback look but not to crank it up like a headsail luff in heavy air.

The term "anti-torsion rope" used by many riggers and equipment manufacturers is a bit misleading, and many engineers will quickly point out that the purpose of the line is to actually transfer torque from the deck- or bowsprit-attached drive sheave to the top swivel that's attached to the head of the sail. Colligo calls this twist-resistant line a "torque rope;" Marlow ropes feels "torsional furling cable" is a more descriptive term. In all of the systems tested, the rotating upper swivel starts the rollup process, and the descriptive "top-down" term defines how the sail is wound about the rigid line or torque rope.

The rope itself reminds a sailor of the proverbial sheet from hell—a line that's so stiff it's bent rather than faked into a coil. But in this case, the semi-rigid characteristic, so detested in jib sheets or dock lines, is just what's needed. By being resistant to twisting and hockling, the line does a great job of transferring rotary energy up to the top swivel. It achieves this ability by using a stiff core line or central elastomer around which high modulus, + -45-degree yarns are braided, and then an outer braided cover tightly cinches up the line.

Maxi and mega yachts use carbon fiber; smaller craft use less esoteric fibers. But delivering a rope that favors torque transmission and exhibits minimal stretch remains the goal. When we intentionally substituted a double-braid Dacron sheet as a makeshift torque rope, the line twisted, hockled, and increased tension, but the net effect was extra load on the bearings and a big decrease in rotational force delivered to the top swivel. All of the units tested came with or recommended similar torque ropes measuring approximately a half-inch or 11- to 13-millimeters. When we unbraided a 120-millimeter length of the line (in order to make up a Seldén terminal), we found 24 woven strands tightly bundled around an elastomer central core. A double layer, tightly braided cover sealed up the inner layers.

elegance such as stainless-steel inserts where high-load carrying clevis pins penetrate the aluminum hub and swivel jaw. Testers noted the extensive use of high-tensile stainless for clevis pins and the central shaft of the furler, a feature that provides higher safe working loads but also yields a surface more prone to oxidation and crevice corrosion. Small increases in ferrous content allow stainless to be made into stronger alloys, but it also makes the metal more chemically and galvanically reactive.


Profurl Spinex 2.5

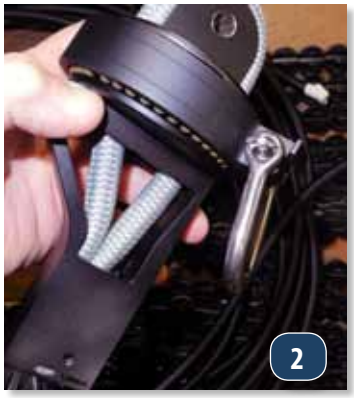
Bottom line: Although hoisting and bagging were impacted by the bulk and weight of the additional gear, Profurl's more complex design and bushing-like plastic balls made for the easiest in-and-out operation. It earns a *PS* Recommendation.

RONSTAN SERIES 120

Sporting the lightest and smallest sheave of the test field, the compact Ronstan Series 120 furler still managed to get the job done during tests. However, once the wind picked up, testers missed having the leverage that larger-diameter sheaves provided. With less leverage delivered by the 4.75-inch sheave, it sent less torque to the head of the sail. So when furling in 15-knot conditions, we had to pull a lot harder on the endless furling line than we did with units driven by larger-diameter sheaves. Our shop tests also reflected the impact of less leverage.

In order to cope with decreased torque underway, we de-powered the sail by steering deeper, closer to 120 to 130 degrees (apparent wind angle),







The Difference is in the Details

The options list offered by each manufacturer can add a lot to the functionality of these systems. For example, Seldén's dual cam-cleat fairlead makes the endless-line loop even more user friendly (photo 3). Profurl uses a ratchet block and a lightweight tackle to put tension in its endless loop, and both of these options can be used as a line lock to prevent unfurling (photo 3). Ronstan's small-radius thimbles are good for half-inch or 13/32-inch torque rope, while Colligo's elegantly simple line clamps and thimbles make quick and easy splices. Their Dyneema soft shackles are just right for connecting the head of an asymmetric spinnaker to a top swivel thimble.

Testers noted an across-the-board use of Torlon bearings for tack swivels, but most manufacturers remained committed to sealed stainless bearings for the sheave axles and top swivel. Colligo used Torlon ball bearings in its top swivel and unscrewing four screws offered access to the 13 replaceable balls (photo 1). The fact that top-down furlers do not remain exposed to the elements on a 24/7 basis is another boon to their longevity.



1. *Colligo's CN3s's top swivel features Torlon ball bearings.*
2. *Profurl's well-designed quick-connect torque rope clamp.*
3. *The test furlers' locking systems: Here you see the Profurl Spinex's ratcheting furling line lock versus Seldén's versatile, dual-lead and double cam-cleat line lock.*
4. *When setting up the Selden GX15 system, testers used hose clamps to help coax the torque line's core strands through the unique compression terminals.*

blanketing more of the breeze with the mainsail. The de-powered sail was easier to furl, but we had to watch carefully to keep the lazy sheet from getting trapped in the furling sail.

Sailors who furl the spinnaker at the first sign of white caps will find that there's enough torque in this light, compact furler to handle the task at hand, but the more adventurous sailors who ignore the signs and regularly get caught with too much sail up, a larger-drum furler and a 10-millimeter (rather than 8-millimeter) furling line would be a better option.

Bottom line: The lightweight Ronstan is a good choice for use with smaller spinnakers.

SELDÉN GX15

Seldén's GX15 handled furling tasks quite nicely. It's a good combination of materials and engineering, carrying on the company's sensible commitment to investment-cast stainless steel. At the heart of the drive system is a 22/32-inch, stainless-steel axle shaft that snap shackles to the tack. At the opposite end of this 2-inch shaft is a unique compression fitting that locks the torque rope in place. The 5.9-inch-diameter sheave spins on a substantial, sealed, stainless-steel thrust bearing. We found no magnetic signature in the castings, but did note that the swivel axle was magnetic.

The split sheave in the endless-line drum is molded fiberglass that's held together efficiently with a multi-slotted interface and seven small stainless screws. This drum design allows for replacing the aluminum "teeth" that enable the swiveling sheave to tightly engage the furling line—an important attribute during higher-wind furling. Its torque-rope end fittings rely on a custom compression fitting rather than the easy-to-install thimble and clamp approach others use. It's more time consuming to assemble,

Continued on page 31





Reader Experiences with Top-down Furlers

Following the publication of Part 1 of this report, we heard from several readers about their experiences with top-down furlers. Here are a few of their comments.

SELDÉN

I installed the Seldén GX10 last summer along with a Seldén bowsprit. It works as described in the January 2014 article, and I am happy with it. The only issue I've had is that after furling the spinnaker with the sheets wrapping around the lower portion of the sail, when unfurling on the next spinnaker usage, the sheets do not unfurl easily, and the most reliable fix I've found is to remove the sheets after furling and reattach them. Perhaps it is only my limited use; any comments appreciated. Also, with the Seldén, there is not a way to have an adjustable tack line. Any idea how to modify the tack attachment to allow adjustment?

Dan Rees
Via email

Testers did not have the sheet problem you mentioned, but we single-sheeted the asym—afterall, the easiest way to jibe the sail is to furl it. Once the sail was furled, we swapped the sheet to the other side and unfurled the sail. The single sheet is tensioned, and there's no lazy sheet to wrap up in the opening or furling process. With only one sheet wrapped around the furled sail, we had no unfurling issues after bag stowing.

Seldén offers an optional adjustable tack swivel for the GX furler, but you can also rig your own setup. Simply add a small shackle to one of the three clevis-pin attachment points on the drum swivel. After the sail is furled, connect a tack-line lead block to the drum swivel and run the tack control line to a winch or the anchor windlass. Unsnap the original tack snap shackle, and ease off on the new tack line to control shoulder projection. Haul in on this line prior to furling, and reclip to the original tack snap shackle, finally releasing the trimmable tack line.

KARVER

My friend and I both have Karver top-down furlers. We can hoist, furl, and jibe fine. But the learning curve is long, and when you blow it, you have to take the whole rig off the boat, find a large field, wrangle the sail off the line, and then re-furl on the boat. The failure comes when the sail starts to wrap from the bottom prematurely. The next time you unfurl, the tight bottom starts to wind in as the top winds out.

The trick is to keep the sail billowing away from the furling line so the bottom doesn't get caught and wind in. Also, make sure the rigging is perfectly free so that there is no torque at all on the tack fitting. Like Goldilocks, when it is good, it is very, very good, but when it is bad, it is horrid. On balance, I am not sure it that much better than using a spinnaker sock—both with a crew and singlehanding.

Andrew Lippman
Via *www.practical-sailor.com*

Continued from page 19

but because it's only done once, this is not a major drawback. (Those who have not had much experience with rope work may want to hire a rigger to make up these end fittings.) While the added end fittings mean more system complexity, it also means the GX15 offers a streamlined, permanently connected drum, torque rope, and swivel.

Bottom line: Seldén, a master of carefully engineered stainless construction, delivered a unit that's designed to stand the tests of time. It gets the *PS* Best Choice for a top-down furler for cruising sailors.

CONCLUSION

The bottom line is that we found each of these units had a certain nuanced spin that was all its own. All perform well and are well made. But when all was said and done, the Seldén GX15 captured the Best Choice award for cruising boats, the Colligo earned the Budget Buy pick, and testers Recommended Profurl's Spinex 2.5. The others were nipping at the heels of the winners, and as mentioned earlier, there were no losers in this roundup of top-down furlers.

Amidst all of this top-down furler enthusiasm, we'd like to offer a couple of precautionary thoughts. First of all, this technology allows a shorthanded crew to handle way more sail area than would be the case in a normal cruising context, and getting caught with an asymmetric spinnaker unfurled in too much wind is anything but a walk in the park. The second serious consideration is that although the furled spinnaker may look like other furled headsails, it's not meant to remain hoisted and furled for prolonged periods.

One local sailmaker spoke of a client who had grown accustomed to leaving the sail up once furled. Apparently, while motoring through a calm, a chafed-through spinnaker halyard caused the furled sail to drop into the sea. Before the crew could get to the helm and switch off the autopilot, the sail, torque rope, and sheets got wrapped around the shaft and shut down the diesel in a very undesirable manner. The point being, top-down furlers make asymmetric spinnakers much more user friendly, but they also up the ante when it comes to the seamanship and decision-making process that goes hand-in-hand with their use.

For related *PS* articles and illustrations, check out the online version of this article.

CONTACTS

KARVER (EURO MARINE TRADING), 401/849-0060, www.euromarinetrading.com

COLLIGO, 480/703-3675, www.colligomarine.com

PROFURL, 401/683-5055, www.wichard-usa.com

RONSTAN, 401/293-0539, www.ronstan.us

SELDEN, 843/760-6278, www.seldenmast.com



Members of the all-volunteer VISAR (Virgin Islands Search and Rescue) team practice transporting an injured sailor. While an air-ambulance service can provide peace of mind, everyone on board a cruising boat should have basic first-aid training.

Comparing Medivac Services

Air-ambulance services offer varying levels of protection.

Editors note: Although we recognize that only a handful of our readers ever venture to remote regions of the planet, we know that many dream of doing so. The advent of affordable satellite communications has introduced an array of medivac and telemedical services for remote travelers that were impractical only a few years ago. We decided to find out more about these services. Because a balanced test seemed impossible, we submitted detailed questionnaires to three principal providers, and tabulated relevant information that could be used for comparison. As each company spokesperson indicates, which service—if any—suits your proposed adventure will depend on a number of individual factors that you will need to discuss with prospective providers.

Imagine you're sailing off the coast of Patagonia, Africa, or Indonesia, when a crew member complains of abdominal pain so severe it could be a sign of appendicitis.

Knowing appendicitis can be fatal if left untreated, the captain uses his satellite phone to reach the pre-contracted service in the United States that provides medical advice, air-ambulance service, and remote evacuation, if needed.

Since the boat is several hundred miles from land, a helicopter won't be coming to the rescue. Besides, hoisting a seriously ill or injured person from a sailboat is dangerous business for all involved. The company operations center says it can arrange a medical flight once the patient is ashore. Meanwhile, the ailing sailor must be stabilized while the boat heads toward an acceptable harbor. And even then, the nearest surgical hospital where Western-style medicine is practiced will likely require a long, bumpy road trip.

As this emergency unfolds, the skipper must decide on a course of action that will, in many respects, be predicated by decisions made weeks or months before setting out on the expedition—when captain and crew met with the contracted company's staff of emergency medicine, communication, and survival experts. The meetings were essential because while evacuation by air might be part of the service contract, implementing one isn't always possible.

Such pre-planning can include the assembling of comprehensive medical kits capable of addressing a wide range of sicknesses and injuries, from broken bones and lacerations to dental emergencies and malaria. The most useful kits are stocked with prescription drugs matched to the medical conditions of those aboard. These drugs are commonly used to treat asthma, high blood pressure, hypertension, heart disease, or diabetes.

Some remote evacuation companies employ ex-military personnel—often Navy SEALs and Army Rangers—to oversee assembly of these medical kits, provide crew members with emergency medical training, and teach them how

Photos by David Liscio

PS VALUE GUIDE **MEDIVAC SERVICES**

SERVICE PROVIDER	GLOBAL RESCUE	INTERNATIONAL SOS	REMOTE MEDICAL INTERNATIONAL
HEADQUARTERS	177 Milk Street, Boston, Mass.	3600 Horizon Boulevard, Trevose, Penn.	4259 23rd Avenue West Suite 200, Seattle, Wash.
WEBSITE	www.globalrescue.com	www.internationalsos.com	www.remotemedical.com
NUMBER OF OPERATION CENTERS	Four; 100 medical center affiliates is 32 countries	Offices in 79 countries; 27 assistance centers; 35 International SOS clinics	27 hospitals, 2 international offices, 3 regional contacts
HOSPITAL AFFILIATES	Johns Hopkins; 2,400 specialists and sub-specialists	1,200 physicians employed full-time by International SOS; 76,000 qualified and vetted providers in global network	Cega Group; Columbia Asia Hospital Network, George Washington University Medical Faculty Associates
MEANS OF EMERGENCY CONTACT	Sat phone or email	27 assistance centers worldwide accept calls (including collect); e-mail, sat phone; from their own Assistance App; etc.	Sat phone or email
NUMBER OF HELICOPTERS, PLANES	180 tier-I contracted aircraft	Owns 9 jets on standby; also uses third-party contractors	Third-party aircraft contractors
OPERATIONS AS OF 2012	1,200	Handled 4.7 million calls globally; 18,417 medical evacuations	Information not available
YEARS IN OPERATION	10 years	15 years	10 years+ (Founded in 1985 as AEA International)
MEMBERSHIP COST	Varies from $579/ year family plan	$435/year per adult; up to 3 children under 18 free with two paying adults	Variable

to operate the satellite phone and other communications equipment aboard. After all, there may be circumstances like the one described in which the company cannot deploy rescue personnel to the location due to distance, weather, location, or war, so the thoroughly equipped and trained sailor stands a better chance of survival. That's where the importance of telemedicine enters the picture.

Although the technology behind telemedicine is rapidly advancing, it's still not a matter of pushing a button to activate a two-way video transmission in real time between the sailboat and a team of doctors. It's not Star Trek—at least not yet.

Practical Sailor recently took a look at a handful of global companies that offer telemedical and medical evacuation services for those sailing the less-developed parts of the world. The first step to deciding if membership to a medivac service is right for you is to assess your needs, cruising area, and ability to address medical emergencies or injuries on your own.

GLOBAL RESCUE

"We strongly recommend people who are going to sea get some kind of satellite phone," said Dan Richards, founder and chief executive officer at Global Rescue, a U.S.-based company that provides medical advisory services, security, and emergency flights almost anywhere in the world.

According to Richards, maritime radio communications can pose a challenge when trying to diagnose and treat illnesses, and satellite uplinks afford the most reliable channel. He was reluctant to endorse GPS messenger devices such as the popular SPOT Personal Messenger (*PS*, September 2008), which can send out alerts to would-be rescuers. Although such devices—called SENDs (satellite emergency notification devices)—relay the sender's latitude and longitude to those on the monitoring end, there's no two-way communication as there is with a satellite phone such as the Iridium Extreme and SPOT Global Phone.

"Ninety-nine percent of the SPOT alerts we receive are false," Richards said.

Because satellite phones and related transmission charges can be expensive, Richards said some travellers to remote regions are relying on newly developed smart-phone applications and devices such as the DeLorme inReach (*PS*, March 2013), which links a smart phone with a satellite via Bluetooth.

"But you are limited in the number of characters you can text, and if you need immediate medical assistance, texting doesn't work very well," he said. "With a satellite phone, we can put you on speaker (phone)."

Texting typically leaves the device



Most evacuation services contract with regional providers for transportation. Ambulances in other regions can be rudimentary compared to this one in the Virgin Islands.

user with no free hand to address an injury, help sail, or perform other duties.

Global Rescue, a major player in the remote rescue industry, has 24-7 operation centers in Massachusetts, New Hampshire, Thailand, and Pakistan. The company also maintains a partnership with Johns Hopkins Hospital in Baltimore, Md., where doctors are on standby. Members who subscribe to Global Rescue are provided a phone number and email address to use in an emergency.

"When the first phone call comes in, you could be speaking with a paramedic. We get lots of calls per year that involve cuts or bleeding or people experiencing cardiac arrest," Richards said. "It's no different on a sailboat. We can walk you through it. Some things you can do on the phone with help from medical professionals. We provide advisory services more often than we evacuate people. Our medical team works with you. If you're in the middle of the Atlantic or the South Pacific, thousands of miles from land, your options are limited. We can walk you through and mobilize resources to move in your direction."

Those resources can include arranging helicopter or plane flights piloted by subcontractors worldwide; setting up ground transportation; staffing a field clinic with paramedics; and identifying the most appropriate hospital in the region.

"We're the only company in the world that comes to your location. We did 1,200 ops this year," Richards said, adding that over the past 10 years, his company has provided medical, security, and evacuation services at just about every major global disaster. Earthquakes in Haiti, a tsunami in Japan, the Russian invasion of Georgia province, rioting and political instability in Egypt, terror attacks in Mumbai—these all required Global Rescue evacuations.

"Every day, we get folks whose events don't make the paper—animal attacks in Africa, lions and cheetahs, people who end up in an encounter," Richards said. "We had a woman gored by a Cape buffalo in Zimbabwe. We got a call from the safari guide after the woman gave them her Global Rescue card or number. We deployed a helicopter for field rescue, to Victoria Falls, where we got her to a clinic. She was evaluated and stabilized, then a fixed-wing aircraft evacuated her to South Africa, where she stayed in a hospital for three weeks to stabilize before going back to Texas where she lived. We saved her life, although she never regained use of her lower extremities."

A few years before that incident, a recreational sailor in the Bahamas got his leg trapped between the vessel and a pier. "His lower leg was broken. There was no clinic on the island. We instructed the people with him (via satellite and cell phones) on how to construct a splint. We actually got some pictures of the guy's leg. And we got a fixed-wing aircraft to evacuate him to Miami."

INTERNATIONAL SOS

The procedures are much the same at Global Rescue's competitor, International SOS, a worldwide provider of medical assistance, security, and evacuation services, with offices in 76 countries.

Patrick Deroose, general manager of International SOS's Corporate Assistance Division, said recreational sailors in remote regions might best bone up on emergency medicine procedures and acquire long-range communication equipment.

"If you are sailing off the coast of Mozambique, we would have to get you to a port of call that we use," he said. "We would determine if the best care is locally or whether you must be evacuated."

International SOS has nine fixed-wing jets that serve as air ambulances. It also partners with an Iraqi company to extract people from war zones. The company makes use of existing aircraft providers but maintains its own planes in New Guinea, Namibia, Singapore, Beijing, and Africa. "And other places where you don't expect to have aircraft. These are dedicated aircraft waiting on the tarmac for something to happen," he said.

Like Remote Medical, the company charges an annual membership fee based on a variety of factors.

"For sailors, it all starts with preparation," said International SOS spokesman Michael Burkhart. "A lot depends on where the voyage is going. We provide country guides, city guides, make assessments of what's on board, the crew's medical conditions, and any existing problems. We try to get a basic understanding of each guest on board and that information goes into our files. Based on that, we make recommendations for what they should have on board for first aid, depending on the length of the voyage. It could be up to a full paramedic bag."

Burkhart said commercial maritime vessels often have a device on board that can monitor a patient's vital signs and transmit the information via a digital base station to doctors who can analyze the data.

REMOTE MEDICAL

Tom Milne, relationship manager for corporate logistics and executive services at Seattle-based Remote Medical,

Planning Ahead for Medical Emergencies

Although the Global Marine Distress and Safety System (GMDSS) and the Automated Mutual-Assistance Vessel Rescue System (AMVER) are established to provide all mariners with assistance in case of an emergency at sea, connecting with a doctor for guidance or organizing a medical evacuation through these government-based networks in remote places of the world is hardly straightforward. Whether you might benefit from one of the services profiled in this article depends upon a number of factors.

The first step is deciding on the scope of your sailing expedition. How far do you intend to travel from home? Will you be sailing in remote regions where doctors and clinics are few and far between? What is the projected length of your journey? Who are your crewmates? Do any of them have health concerns or allergies that would require specific medications or treatments? Do you have all necessary medical supplies aboard, enough to last several months, including prescription drugs and devices to treat a heart condition, diabetes, or other ailments?

Once these questions are answered, you're on your way to picking a company that can remain in almost constant contact during your travels—usually by satellite phone—and has the global resources to put you in touch with a doctor or paramedic at a moment's notice.

Such a company will likely ensure you understand the basics of emergency medicine and how to operate the onboard communications systems before you leave the dock. While the company may have access to air ambulances, your remote location may make immediate rescue impossible.

Standard travel insurance policies protect you against lost or stolen baggage and missed flights, while those with a medical evacuation supplement may reimburse part or all of your expenses related to a domestic air ambulance.

But if you expect someone to intervene on your behalf during a medical emergency overseas, you are better off with an annual contract with a company capable of arranging for a flight that will take you to the nearest quality hospital once ashore. If they can't get to you, they'll provide step-by-step guidance by satellite phone or email their database already loaded with information about the health of each crew member and what medical supplies are aboard.



Satcom equipment such as the DeLorme inReach (center, shown paired with iPhone at left) expedites emergency calls, but many medical professionals prefer two-way voice communications via a sat phone such as the new SPOT Global Phone (see Chandlery) or the Iridium Xtreme (right). A well-stocked medical kit, such as the PS *Best Choice Adventure Medical 3000 (below) should be supplemented with medicines to suit individual needs (*PS*, December 2008).*



a company providing on-site and telecommunicated emergency medical services in far-flung regions of the world, said sailors must prepare for more than evacuation.

According to Milne, sailors must consider the distance their boat will be from the nearest medical help and take every precaution necessary before embarking on their journey.

"We operate in remote areas to provide medical support to our clients. These are locations that don't have direct access to the Western healthcare structure," he said.

Milne said many travellers mistakenly believe all bases will be covered if they purchase travel insurance that includes a medical evacuation plan. "People think, if I get this in place, I'm taken care of. That is dangerous thinking," he said.

Remote Medical looks at the integrated package, he said, explaining that training, provisioning, and medical and logistics planning are as important as the evacuation plan.

"It's not Disney World. Things go wrong," he said. "Evacuation can be part of the mix, but medivac is typically complex, can take a long time, and whether or not you have insurance it can be costly."

To illustrate his point, Milne hypothesizes an accident aboard a sailboat in the South Pacific. "If you have the proper training, you can identify what might become a bigger issue later on," he said. "For example, you need to know how

to treat a wound effectively. In tropical areas, it takes only 12 to 24 hours to become a systemic infection that can be fatal."

Milne offered another scenario. "If somebody has an allergy or is stung by an insect, it's going to require immediate treatment with the right equipment. If you don't have (an epinephrine) pen on site, your window of opportunity is closed in 20 minutes. So one of the first things we do at Remote Medical is get people to understand the context of their challenge."

Remote Medical staffers routinely discuss these possibilities with cruisers, he said, adding, "We want to understand what their trip is about, their existing capabilities, and what their goals are."

Proper provisioning, multiple medical kits, a logistics support package, and a subscription to an associated telemedicine service are key, as is emergency medical training, Milne said.

"Remote Medical will fly an instructor to the yacht's location before its crew departs. Typically it's a medical instructor. We have a family right now doing a three-year boat trip to South America, the Caribbean, and then the Northwest Passage. We are flying an instructor down to meet them in Southern California. We have flown instructors recently to New Zealand and Fiji," he said.

If a medivac is possible, several considerations will impact its speed and effectiveness, including the availability of the appropriate aircraft; the aircraft's point of origination; the capability of its crew to handle a medical transfer; rules governing medical flights; and any existing airspace issues where the political climate is less collaborative.

"You might be a slam dunk and have a plane on site in 24 hours. But in remote areas of the South Pacific or Antarctica, a straight shot with a big plane might be seven hours. And then there's the weather. You can experience no-fly weather in Antarctica for more than a week," Milne said.

When Remote Medical receives a call for a medivac, depending on location, it can contact Cega Group, its UK-based business partner.



A VISAR (Virgin Islands Search and Rescue) boat speeds toward shore where an ambulance lies waiting during training exercises.

"Cega owns a variety of air ambulances," Milne explained. "The company provides medical and security evacuations on a global scale, doing 50 evacs a month and 2,000 repatriations each year." (Repatriation means moving a person who needs medical care but is not in critical condition).

"We can access their medivac assets," he said. "People need to understand that in the interest of patients, companies look at the worldwide network of medivac providers. Any provider with a dedicated fleet would be a finite asset. Most important is to have the coordination. People should also understand that some patients are not good to fly. Once we understand a client's circumstances, we can set them up to go to a specific medical facility or pharmacy."

Remote Medical also has the option of diverting patients to another partner, the Columbia Asia network of hospitals.

CONCLUSIONS

Whether you should subscribe to one of these services depends on a number of factors, not the least of which is how much risk you are willing to take. Those who are coast-hopping in developed nations will likely be served fine by local rescue agencies. And some health insurance policies include evacuation coverage, but you'll want to read all the fine print to make sure you know what exactly is covered and what isn't. Companies providing global security as well as remote medical evacuations tend to distinguish themselves from those simply in the business of providing travel insurance. All advised taking a hard look at blanket travel policy provisions and restrictions.

"Look at your travel policy carefully," Milne said. "Our service can begin in the middle of the ocean and doesn't end until they get you home or to a hospital."

Richards was equally emphatic. "We can deploy security personnel to you, evacuate you to a safe location, and bring you home," he said.

Even if you decide to subscribe with one of these medical services, it is important to remember that there is no assurance that they can reach you quickly in some of the most remote regions of the world, such as the middle of the Pacific Ocean. Sailors looking to venture farther afield need to plan ahead by training in emergency medicine and learning how to operate the satellite communications aboard their sailboat so that a doctor back on land can tell them how to proceed.

RESOURCES

GLOBAL RESCUE
www.globalrescue.com

INTERNATIONAL SOS
www.internationalsos.com

REMOTE MEDICAL
www.remotemedical.com

The SPOT Sat Phone



The number and popularity of satellite-based communication gadgets have grown rapidly over the last few years. These devices range from one-way communication electronics like the SPOT and SPOT Connect (*PS*, January 2013), to two-way texting devices like the Cerberus CerberLink (*PS*, January 2013) and DeLorme units (*PS*, March 2013), and satellite phones like the Iridium Extreme 9575 (*PS*, March 2013).

SOS buttons and two-way texting are handy, but nothing beats being able to actually speak with someone in the event of an emergency. This is the great appeal of owning a satellite phone, but the prices of both sat phones and service plans have stubbornly remained above the pain threshold most sailors are willing to bear, even though they've certainly become more affordable over the last decade.

All that may change with the newest satellite phone to enter the market: the SPOT Global Phone, offered by Louisiana-based SPOT, a subsidiary of satellite communications entity Globalstar and maker of the SPOT line of satellite trackers. With a purchase price of $499 and month-to-month plans starting at just $25, the SPOT Global Phone appears poised to wrest the satellite phone from the martini-holding fingers of James Bond types and place it solidly into the calloused palms of the common sailor.

We recently conducted some limited on-shore tests of the SPOT Global Phone, and we plan to run it through its paces during a season-long cruise to the Bahamas. In the preliminary tests, we placed some test calls from various locations within the eastern U.S. with satisfactory results. Calls were easily dialed (1 plus the number) and took roughly 20 seconds on average to connect. Each had decent clarity, with no lag time or dropped calls noted, although these pre-test calls typically lasted less than 3 minutes. We have heard from some users who reported an increase in dropped calls for longer conversations; we plan to investigate this claim further during our field test.

Measuring a scant 5.3 inches long by 2.2 inches wide and 1.5 inches thick (with the antenna stowed), the 7.1-ounce SPOT Global Phone is compact and can easily be stowed or carried in a foulie jacket pocket, a daypack, or a ditch bag.

The four-line, 12-character color LCD screen is a minimal, no frills, "just the facts ma'am" kind of display, providing just the essentials like call information and phone status, etc.

This is the phone you'll use when you're out of cell-signal range, and you need to pass an itinerary change to a worried spouse, or when there's trouble afoot, and you need talk with rescuers. It is not the phone you'll use to Tweet, peep, toot, snort, or Facebook. But for those who simply cannot unplug, the SPOT Global does offer the capability to send emails, surf the Web, transfer files, etc., utilizing the optional data kit ($20), but with speeds of 28 Kbps or less, it won't be fast or particularly economical. Most SPOT Global billing plans are priced by minutes used, with monthly plans running from $25 for 10 minutes included to $150 for unlimited voice and data.

Overall design and construction of the mostly plastic SPOT phone is decent, and it should hold up well during normal use. But unlike the Iridium Extreme (advertised as the toughest military-grade satellite handset ever built), the SPOT phone isn't ruggedized and carries no water-resistance rating. You'll definitely want to invest in a waterproof and shock-resistant protective case or bag for it. SPOT recommends using an Aquapac pouch and a SPOT Global Phone case.

The SPOT Global's Lithium-ion battery has an advertised life of four hours of talk time—the same as the Iridium Extreme—and 36 hours on standby. For charging, the SPOT phone comes with only an awkward charging brick (similar to a laptop), which takes up almost as much space as the phone itself, and has no option for USB charging—a con in testers' opinion.

Things we liked about the SPOT Global were its portability, battery life and ease of use, as well as features like the backlit color display and lighted keypad.

As to negatives, one would be that the phone is not GPS enabled, meaning it can't provide location data, a handy feature in the event of an emergency. The limited global coverage of the Globalstar satellite system may not be broad enough for all users. But even if you can't make calls from Antarctica, Globalstar's coverage will be more than adequate for most users. (Coverage area can be seen on the SPOT website.)

A couple of things to note regarding phone use. First off, you can't make or receive a call unless the antenna is fully extended and has a clear view of the sky. Callers can leave a voicemail, however, which the phone will notify you of when it is powered up and connected to the satellite network. Unless making a call or waiting for a call at a specific time, we recommend turning the phone off while not in use to conserve battery power. You can power it up a couple of times a day to check messages.

Each SPOT Global Phone includes a standard 10-digit U.S. phone number. When making outbound calls, caller ID will display it as "Unknown," something you should warn family and friends about prior to heading out.

BOTTOM LINE

With a purchase price and basic service plan comparable to a typical cellular smart phone, the SPOT Global phone is positioned to bring affordable, two-way satellite communication down to earth. Stay tuned for long-term performance test results in an upcoming issue.

CONTACT

SPOT INC., 866/651-7768,
www.findmespot.com





Practical Sailor*'s canvas-treatment panel test (above left) narrowed the field down to four finalists that advanced to on-the-boat testing (above right). Testers were careful not to cross-contaminate the test panels with spray from other products.*

Stopping the Annoying Drip

PS *long-term tests waterproofing treatments for Sunbrella.*

Canvas dodgers and biminis are the hallmark of a cruising yacht, keeping the sun at bay and allowing the crew to "dodge" the worst of the weather. On board, canvas also protects sails, windows, and machinery. Collectively, these represent a substantial financial investment, and we wanted to find the best way to protect the investment and get the most life out of the canvas.

Sunbrella makers recommend that routine maintenance include frequent freshwater rinsing plus spot cleaning the fabric. After a more thorough cleaning, Sunbrella advises owners to apply a treatment (specifically Gold Eagle Products' 303 High Tech Fabric Guard) to restore the fabric's repellency. In this article, we take a look at treatments designed to keep on-board canvas water repellent and looking its best.

Waterproofing canvas is based on making the surface hydrophobic enough that water cannot wet the surface. Factory canvas comes with some pretty effective treatments, but after two to three years in the sun, they tend to wear off. Treatments containing waxes, PTFE (Teflon), and silicone promise to renew the repellency, if only for a month or so.

When we refer to "canvas" here, we mean acrylic marine fabrics like Sunbrella, not cotton duck, which some traditionalists still use. The chemistry of cotton and acrylic are quite different—cotton accepts treatments more readily, but acrylic is more naturally repellent—and we've previously tested water repellents for cotton duck (*PS*, June 2004).

For maximum water repellency, boat owners could use impervious waterproof fabric instead of canvas, but that typically isn't a good idea. Waterproof sail covers hold moisture, mildewing sails more quickly. Waterproof dodgers sweat and hold condensation, drying slowly and mildewing. Waterproof machinery covers would trap salt and humidity, accelerating corrosion. For most on-deck equipment-protection tasks, water-repellent, breathable, durable acrylic fabrics are best. These include Top Gun, Weathermax, and Sunbrella, which we tested and reported on in the December 2011 and November 2012 issues.

WHAT WE TESTED

For this evaluation, we tested seven treatments formulated to add water-repellency to marine canvas that has been in use for a few years. The test field featured: AquaTech Marine Water Repellent, Marykate Waterproofer (CRC Industries), 3M Outdoor Watershield, Gold Eagle 303 High-tech Fabric

Photos by Drew Frye

PS VALUE GUIDE CANVAS WATERPROOFING TREATMENTS

MANUFACTURER		AQUATECH	CRC INDUSTRIES	3M INC.	GOLD EAGLE	NIKWAX	STAR BRITE	IOSSO
NAME		Water Repellent	Marykate Waterproofer	Outdoor Watershield	303 High-Tech Fabric Guard ★	TX-Direct Spray-on ✓	Waterproofer with PTFE $	Water Repellent
TYPE		Spray	Spray	Aerosol	Spray	Spray	Spray	Spray
PRICE *		$19.50	$21.07	$4.88	$44.99	$21.50	$23.99	$19.99
SIZE		16 ounces	30 ounces	10.5 ounces	32 ounces	16 ounces	22 ounces	32 ounces
PRICE PER OUNCE		$1.22	70 cents	46 cents	$1.41	$1.34	$1.09	63 cents
TEST RESULTS								
PANEL TEST	24-HOUR WATER RESISTANCE **	Excellent / < 10%	Good / 20%	Excellent / < 10%	Excellent / < 10%	Excellent / < 10%	Excellent / < 10%	Excellent / < 10%
PANEL TEST	30-DAY WATER RESISTANCE **	Fair / 40-100%	Poor / 80-100%	Excellent / < 10%	Excellent / < 10-20%	Good / 20-50%	Excellent / < 10-20%	Fair / 40-100%
BOAT TEST	30-DAY WATER RESISTANCE **	N/A	N/A	Good / 20%	Excellent / < 10%	Good / 20%	Excellent / < 10%	N/A
BOAT TEST	30-DAY STAIN RESISTANCE**			Good	Excellent	Good	Excellent	

★ Best Choice $ Budget Buy ✓ Recommended *Prices may vary, depending on retailer. **Percentage is % wetted out; less is better

Guard, NikWax TX-Direct Spray-on, Star brite Waterproofing with PTFE, and Iosso Water Repellent.

The 3M Watershield is an aerosol product, while all other test products are spray-on liquids. Refills are available for the AquaTech, Star brite, and Iosso products, and all but the NikWax and Iosso contain petroleum distillates. Both Strataglass clear vinyl and Sunbrella manufacturers advise strongly against the use of silicone-containing products; they have been implicated in fogging vinyl windows and damaging the long-term stain resistance of Sunbrella. Use of silicone-containing products may even void product warranties.

HOW WE TESTED

The canvas treatments lie right on the fabric surface, making them very vulnerable to weathering, so of course, the treatments' performance after a month of UV exposure doesn't always equal their Day 1 performance.

Industry tests for waterproofing treatments are based upon the percentage of the surface wetting, or how well the treated surface beads water. Our tests, designed to be more long term, evaluated the treatments' performances at 30-day intervals over a four-month period.

Testers applied the test products to clean swatches of Sunbrella mounted to test panels and to Sunbrella aboard a PDQ 32 catamaran for real-world testing during extended periods of the Virginia summer.

The test panel Sunbrella swatches (8 by 10 inches) were cut from a well-weathered, 16-year-old boat cover and were affixed over cut-outs in painted plywood sheets that were mounted outdoors for 24-7 exposure. We selected old Sunbrella as we felt that the factory treatments on new Sunbrella material would overwhelm the effectiveness of the spray-on products. The test canvas was washed through two standard cycles with laundry detergent (without fabric softener), and then washed once again without detergent to ensure complete rinsing. Each sample included one horizontal lap-felled seam with the open side down. The samples were treated every 30 days according to manufacturer instructions and exposed to the weather for up to four months. One untreated control was included on each panel.

To gauge the performance of the canvas treatments, we identified their most important—and measurable—traits: compatibility with clear vinyl (as in bimini windows), water repellency (initially and after one month), and stain resistance.

While we did not test canvas cleaners, we did investigate what effect cleaning would have on the longevity of water-repellent treatments. What became clear is that vigorous cleaning with the surfactants needed to remove stubborn stains from canvas will remove all spray-on treatments and that you will need to reapply the treatment after cleaning.

Most canvas treatments are not compatible with clear vinyl, so care must be taken when spraying it around windows on dodgers or biminis. Keeping overspray from the vinyl isn't always easy, so we checked the compatibility of our test products with vinyl. (For more on the dangers of treatment overspray and vinyl bimini windows, see the accompanying "On a Side Note" sidebar and the December 2013 article on protecting clear vinyl.)

Testers evaluated water repellency by exposing the samples to a light spray of water for 10 minutes with the panels set at a 45-degree angle. Samples were rated for dripping, surface wetting, and dampness on the reverse side. During the initial two test periods, no cleaning was performed. During the last test period, testers scrubbed the swatches lightly to gauge what effect cleaning would have.

A more directed spray from 2 feet was then used on each panel; every treatment failed this test; light mist penetrated the fabric. Perhaps the results



Of the seven products tested, four advanced to the second phase of testing: 3M Outdoor Watershield, 303 High-Tech Fabric Guard, NikWax TX-Direct Spray-on, and Star brite Waterproofer with PTFE.

would be different with new Sunbrella.

Water repellency and stain resistance would seem to go hand in hand. The theory is that anything that prevents wetting should prevent stains from penetrating the fabric; they should rinse right off. Exploring the stain resistance theory with our test canvas required finding some dependable fouling birds and nice big stretches of canvas right under the rigging. A second sort of stain repellency is mildew and algae resistance; it stands to reason that anything that can keep the canvas dry will help.

Once the test results were tallied from the panel testing, the top four performers were applied to canvas aboard one of our test boats, tester Drew Frye's PDQ32 catamaran. The products were: Star brite Water Repellent with PTFE, 303 High Tech Fabric Guard, 3M Outdoor Watershield, and NikWax TX-Direct Spray-on. Testers applied the products to sections of the previously untreated windshield cover (eight months old) and mainsail cover (16 years old). We graded the treatments for coverage, water repellency, and soil resistance.

OBSERVATIONS

Remarkably—and a testament to the durability of Sunbrella—not even the untreated controls leaked during light-spray testing. However, the untreated samples did wet quickly, wick, and drip where the frame made contact. All of the test products continued to prevent seepage for over 60 days, even though surface beading stopped by that time on some samples. Well-sewn seams were no more prone to leaks than plain fabric.

None of the treatments seemed to draw any more dirt than any other, nor did they keep the canvas noticeably cleaner. Interestingly, the products tested on panels and on the boat tended to perform better on-boat than in the shoreside panel test. Testers believed that this was because of differences in the amount of atmospheric fallout (fine dirt); having dirt on the canvas degrades the treatments' performance. This highlighted the fact that you should not apply repellent treatments to soiled canvas; it will reduce the effectiveness of the treatment and will seal the dirt in. During on-boat testing, we confirmed that regular treatment with effective repellents and hosing off the canvas occasionally was a more-effective approach.

Across the test field, ease of application and product coverage were pretty much equal, with a few exceptions as noted below. All of the test products are applied until the fabric is wet, and each covers 50 to 75 square feet of canvas per pint, depending on how thoroughly you wet the fabric; more is better up to the point of saturation. As with most coatings, manufacturers recommend two thin coats versus one heavier coat.

For covers that are not drum tight, we found it preferable to remove them, lay them flat, and smooth out all wrinkles, and then spray on the treatment.

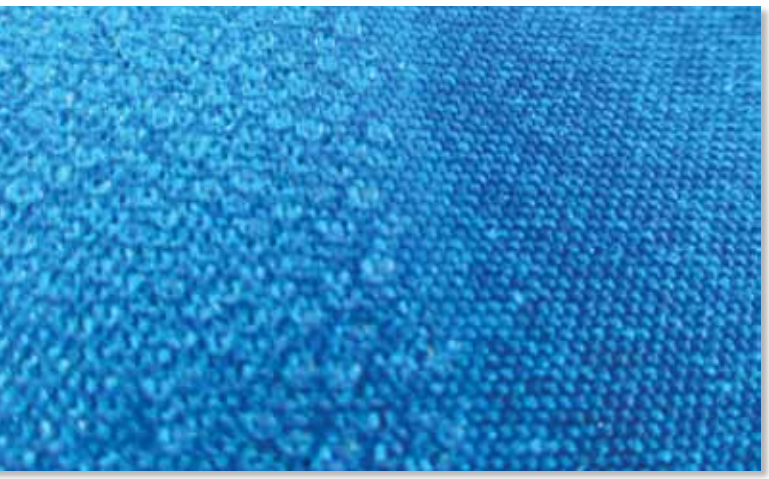
The spray patterns of the hand pump bottles seemed more even than that of the 3M aerosol spray. The pump sprayers also were more efficient. Testers found the 3M aerosol to be a bit more difficult to apply, especially in any kind of breeze. The mist is very fine, and in a breeze, users must hold the can closer to the canvas than is optimum, making it difficult to get a smooth coating. All products must be allowed to dry completely before it rains.

After drying, the products caused no color change in the canvas. The noticeable color differences in the photographs—between treated and untreated areas—are the result of absorbed water darkening the areas that wetted out. The obvious corollary, of course, is that as water repellency fails, the appearance of the canvas can become blotchy. If appearance matters, don't just touch-up the areas that are leak-prone; instead, apply an even coating.

All of the effective repellents allowed stains to rinse way with zero to minimal residue. However, once a spot is soiled by a bird, the repellent coating is removed from that spot, and the area will wet out and appear darker, and it may leak. Time to re-apply. Mildew and algae resistance followed the same pattern; because the wetting of the fabric is reduced, treated canvas showed very little growth, while untreated areas only inches away turned solid green.

IOSSO

Less effective than other products, the Iosso Water Repellent did prevent



This photo shows an example of treated (left, with Star brite with PTFE) and untreated Sunbrella (right). Note the difference in water-beading action.

Effects of Treatments on Clear Vinyl Windows

TEST RESULTS	CHEMICALS vs. CLEAR VINYL
PRODUCT	OBSERVED EFFECT*
Marykate Waterproofer	No effect
Iosso Water Repellent	No effect
Star brite with PTFE	No effect
AquaTech	Badly fogged; window ruined
303 Fabric Guard	No effect
NikWax Tx-Direct	No effect
3M Outdoor Watershield	No effect but has silicones known to fog vinyl over time
100% DEET Bug Repellent	Window melted; sticky for weeks
No-Ad SPF 40 Sunscreen	Some permanent fogging
Windex	No immediate effect but known to stiffen vinyl over time
Ammonia	No immediate effect but known to fog vinyl over time
Bleach	No immediate effect but known to fog vinyl over time
Vinegar : Water (10:1)	No effect; accepted as safe way to remove water spots
Rain-X	Slight effect; known to dull finish over time

** Allowed to dry; single application*

Many canvas waterproofing treatments—as well as other common boat maintenance chemicals—can damage clear-vinyl dodger windows. Even a small amount of overspray can cause the vinyl to haze. To determine whether the canvas treatments in this test would harm vinyl, we set up a quick two-hour exposure test and applied the products—plus some common onboard chemicals—to Strataglass swatches. Check out the accompanying table to see how the test products and other chemicals performed.

The test found a few bad actors and drove home the point that you really must keep all products that aren't approved for clear vinyl off the windows. Be very careful regarding overspray when applying waterproofing treatments to canvas near bimini and dodger windows.

Lay a towel or blanket over all of the vinyl before applying any treatment to the surrounding canvas, even with those that registered "no effect" in our brief test. We didn't do any long-term testing, and it is certainly best to play it safe. It's always best to test any new treatments on a small sample of clear vinyl first, or at least in a hidden corner; some are quite bad. Allow the repellent to dry and see if it rinses clear easily. Even if it does, some treatments may compromise factory UV- and scratch-protection coatings.

So what causes the damage? It seems to be the chemistry of the petroleum solvents that make the difference. In our test, DEET mosquito repellent was clearly the most harmful, and judging from the types of damage we saw, we believe the more-aromatic solvents (like benzene and xylene) carry greater risks; those treatments with more gentle solvents (paraffinic solvent and oils or linear alcohols) were safer. Silicones are also known to cause clear-vinyl fogging and failure of the surface coating (pealing).

Given that many of the chemicals known to cause fogging over time did not show any effect in our quick test, we can deduce two things: The factory protective coatings are very effective, and this test does not tell the complete story.

For more on maintaining clear vinyl windows, see the December 2013 and January 2014 issues.

complete wetting of the fabric and penetration by light spray. It seemed safe for use around vinyl, and it does not contain petroleum distillates or silicone.

The 32-ounce bottle sells for $20, but it also available as a concentrate.

Bottom line: At 63 cents per ounce, the Iosso in inexpensive, but its repellency didn't last as long as some other test products.

STAR BRITE with PTFE

Tied in performance with 303 High Tech Fabric Guard, Star brite's Waterproofing with PTFE (Teflon) showed good initial repellency and good durability. It was still more than 80 percent effective after 30 days on the test panels, and after several months on newer canvas. Star brite recommends the treatment for boat tops, covers, tents, and clothing. It does contain petroleum solvents, but in tests, it seemed harmless to clear vinyl.

At 98 cents per ounce—not the cheapest product in the line-up—the Star brite with PTFE provided the most waterproofing durability for the dollar. Our only reservation is that it contains minor amounts of trimethalated silica, and we don't know how this will perform long term, compared to silicone oils. Early trials suggest that it does not increase staining, but we plan to follow up.

Bottom line: A top performer at an affordable price, the Star brite spray earned the Budget Buy pick.

NIKWAX TX-DIRECT SPRAY-ON

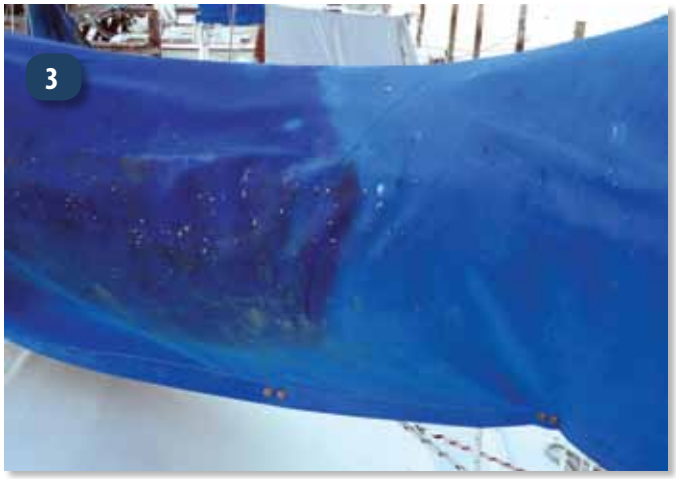
A general-purpose product from perhaps the best known producer of after-market waterproofing treatments for outdoor clothing and gear, the NikWax TX-Direct spray ranked in the top three in our tests. It is the sole product approved for use on Gore-Tex and Event PTFE laminate fabrics.

The TX-Direct showed Excellent initial repellency that mostly lasted the long haul; it was still over 50 percent effective at the 30-day mark. However, it didn't seem to be as durable in the sun.

Because it is a water-based product, it can be applied while canvas is slightly damp—it was the only test product where this is approved by the manufacturer—though applying it to dry canvas will give slightly better results. Testers also believe the NikWax spray may be the safest for use near vinyl windows because it is water based and solvent-free.







1. *While both the Star brite and 303 sprays allowed for easy hosing-off of bird bombs, the bombs left areas of wetted fabric, creating a splotched appearance until the fabric dried.* ***2.*** *Here's a close-up of 303-treated Sunbrella and a bird-bombed area after cleaning. There was no staining.* ***3.*** *Untreated areas of canvas often turned green and black with algae and mildew, while treated areas stayed mildew-free.*

NikWax's wax-based products, while effective, had a reputation for attracting dirt. The TX-Direct uses a completely different technology, formulated for use with more technical modern fabrics. As a result, this product is also the most suitable of the group for use on rain gear and windbreakers.

Bottom line: While more expensive—the 16-ounce bottle costs $1.34 per ounce—it is a handy, multi-purpose product that we Recommend.

AQUATECH

Almost as effective as our top choices, the AquaTech Water Repellent provides good waterproofing with decent durability. Unfortunately, it also rapidly hazes clear-vinyl window materials, making any overspray a serious risk. It was the only test product to affect the 40-mil Strataglass test swatch within two hours of application. Although we cannot recommend this product for use on dodgers for this reason, it is still an excellent choice for treating sail covers and any canvas away from vinyl windows.

The 16-ounce bottle costs $1.22 per ounce.

Bottom line: An OK performer, AquaTech should not be used on biminis or dodgers with vinyl windows.

MARYKATE

Less effective than other products at the 24-hour and 30-day marks, CRC Industries Marykate Fabric Waterproofer did prevent complete wetting of the fabric and penetration by light spray. And although it contains petroleum solvents, it seemed safe for use around vinyl.

Bottom line: At 70 cents per ounce (30-ounce bottle), Marykate is one of the least expensive sprays in the test field, but it was not a top performer.

3M OUTDOOR WATERSHIELD

While providing excellent repellency, the coverage of the aerosol 3M Outdoor Watershield seemed significantly less consistent than the sprays. In any breeze, the fine mist is more difficult to apply.

Once we got an even coat, it worked well, providing perhaps the best initial repellency of the group and lasting fairly well. Testers noted that the 3M contains silicones, which give us concern about using it around clear vinyl, though our brief test showed no damage.

Bottom line: The least expensive of the lot at 46 cents per ounce, 3M's Outdoor Watershield repelled water well, but testers preferred the pump-spray, silicone-free products.

303 HIGH TECH FABRIC GUARD

Made by the same company that brings us STA-BIL fuel treatments, 303 High-Tech is a dependable performer, doing very well in both panel and on-boat testing. Generally, this is considered to be the gold standard for Sunbrella waterproofing treatment, and we agree.

Bottom line: The most expensive product in the test, the 303 Fabric Guard was also the top performer, earning testers' Best Choice pick.

CONCLUSION

The 303 High Tech Fabric Guard, Star brite Water Repellent Treatment with PTFE, and NikWax Direct sprays performed the best, with the top pick going to 303 High Tech Fabric Guard.

All products tested provided significant improvements over untreated canvas, preventing through wetting and leaking for at least two months. Soil and mildew repellency was effective as long as the water repellency lasted—three to six months for the best products.

We cannot recommend any product that affected vinyl windows.

CONTACTS

3M, 888/364-3577, www.3m.com

AQUATECH, 910/270-6037, www.aquatech-marine.com

CRC INDUSTRIES, 800/556-5074 www.crcindustries.com

GOLD EAGLE (303), 800/367-3245, www.303products.com

IOSSO, 847/437-8400, www.iosso.com

NIKWAX, 800/563-3057, www.nikwax-usa.com

STAR BRITE www.starbrite.com



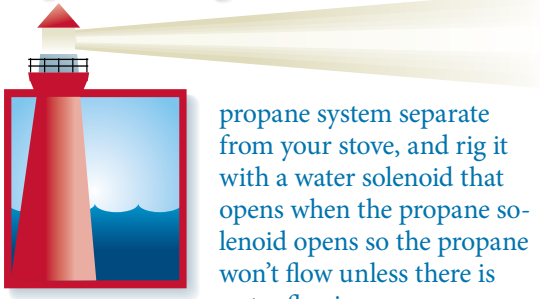
ON THE HORIZON
BOTTOM PAINT UPDATE
RESOLING SHOES
RUBBING COMPOUNDS
MULTIPLEXERS

Practical Sailor™

Tankless Gas Water Heaters

Install in well-vented space and get a CO_2 alarm.

I recently acquired a project boat, and the former owner had purchased a tankless propane water heater that he was planning to install on the boat. Any comments, considerations, or warnings on installing such an item on board?



PS ADVISOR

Steve Horinek
Tropic Whisper, Irwin 42
Fort Myers, Fla.

Tankless propane water heaters carry serious risk of causing carbon-monoxide poisoning or oxygen depletion when mounted in a tight or sealed space. Because a boat is more tightly sealed than a shoreside home, the carbon monoxide is more likely to become trapped. Multiple boater deaths have been attributed to tankless water heaters, and several brands have been recalled over the years—among them Wolter Water Heater, Paloma, and Rheem-Rudd—because they posed a carbon-monoxide poisoning hazard.

That said, you will find tankless propane water heaters on some production boats, but it is buyer beware, in our opinion. Where you mount the heater, how it is installed, and how it is vented are of critical importance. We've heard of boat owners mounting them successfully in vented spaces such as cockpit lazarettes, galleys, and anchor lockers, and many install them with heat shields. For extra precaution, you could run the water heater on a propane system separate from your stove, and rig it with a water solenoid that opens when the propane solenoid opens so the propane won't flow unless there is water flowing.

If you decide to install the tankless water heater despite the risks, you should first be sure that your heater hasn't been recalled. We also recommend investing in a quality carbon monoxide detector like the Fireboy/Xintex (*PS*, December 2005), and always keeping a hatch open in the shower when using the heater. Also, check out our recent blog on inspecting marine systems for propane leaks (Dec. 30, 2013). It wouldn't hurt to look into your other water-heating options as well; you'll find a good sampling of what's available on the marine market in our December 2013 water-heater test.

PVC BILGE LINES

I am thinking about replacing the hose for the bilge pumps and was wondering about using PVC pipe instead of hose. Have you ever seen such an installation? As I understand it, I should get better flow due to less resistance, it should last forever, and it would probably be cheaper than using hose. Thoughts?

Lloyd Herman
Rendezvous, 1987 Nonsuch 30U
Port Washington, N.Y.

The American Boat and Yacht Council's standards do not address rigid PVC plumbing in bilge systems. But plumbing must be able to withstand temperatures as low as 40 degrees below zero, and it must be supported so that it would not fail under stress. All joints have to be able to withstand this as well.

We agree with past *PS* contributor Steve D'Antonio (*www.stevedmarineconsulting.com*), whose plumbing durability test is a good rule of thumb: Any plumbing components that could lead to flooding in the event of a failure must be able to withstand being stood upon. "If I can't stand on it without worrying about causing a failure and flooding, it's simply not rugged enough," D'Antonio explains in his blog. "Many PVC components and some metallic ones won't pass this test."

The plumbing must be supported so that it won't crack or split when you step on it or some blunt object comes in contact with it—as may happen after a knockdown, when stuff is flying around. Flexible hose is pretty impervious to that sort of thing. And then there is the risk of the pipe splitting if there is water in the line when temps dip below freezing, and the headache of finding hose-PVC pipe sizes that match.

Also worth considering: Each turn in the plumbing run will add resistance, and with PVC pipe, you're likely to need more turns and connectors. There are plumbing tables to calculate how much "head pressure loss" each elbow, etc., puts in the line, but basically, each fitting you add is the equivalent of adding a length of hose.