



Photo: United States Coast Guard

Avoiding Capsizing and Swamping

A study of five years of capsizes and swampings reveals how they happen and what you can do to avoid them

IT WAS JULY 4, 2012, when a 34-foot cabin cruiser headed out into Long Island Sound for the fireworks show. The boat, called *Kandi Won*, was packed with 27 people – eight of them high on the flybridge – and when the fireworks ended, the boat headed home along with many others, all jockeying for position and all creating wakes. Shortly after, the boat, probably rocked by several large wakes, rolled over, spilling passengers into the water. Tragically, three children were trapped in the cabin and died. While capsizes are far more common on smaller boats, it's a sobering reminder that even large boats can capsize under the right conditions.

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It's all about stability



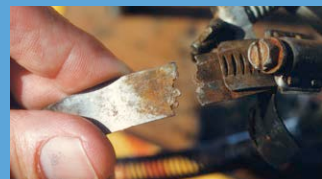
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WHEN IT RAINS, THEY SINK

Your April magazine was timely, as usual; another scupper event happened to me when I pulled our 16-foot aluminum boat for the winter and pulled the drain plug. Over the winter, leaves covered the drain hole, resulting in rain water freezing and damaging the transom enough to leak.

Regarding floor hatches, our 26-foot power cat has two that are two feet by six feet with a foam-rubber gasket, and even though there are troughs for drainage, every rainstorm there is a substantial amount of water in the compartments.

My last three boats, all purchased new, had very haphazard (emphasis on hazard) wiring; the latest, a 2016 22-foot pontoon boat for saltwater use, was the worst. It had six wires on the positive post, no battery off/on switch, and battery service required removal of a glued-on seat (which I modified with a hinge and clampdown fixture), and a bundle of wires from the engine that passed over a sharp aluminum edge – after a week of occasional use, it was already showing wear.

The industry has to make a standard for itself and follow it and issue some kind certification. I'm sure the public and BoatU.S. would benefit and safety would be served.

Our pontoon boat cost \$44,000. Can you imagine a car being sold with

these issues and the manufacturer still in business?

Robert G. Paans

Big Pine Key, Florida

Fortunately, the industry does have standards for boatbuilding. The majority of boats are made by companies who belong to the National Marine Manufacturers Association (NMMA), who certify that

their boats are built to American Boat & Yacht Council (ABYC) standards. The issues you cite on your new boat would all be in violation of those standards, and would have to be corrected under warranty. The bad news is that not all builders, especially smaller ones, are NMMA members. Pontoon-boat manufacturers have in the past had spotty reputations for quality, though that is changing as more of them build to ABYC standards.

This is how I cover my boat every night, even if there's no rain in sight.



This picture was taken just after a major storm in Ruskin, Florida; my boat made it through with no problem.

Gary Gardner

Williamsport, Pennsylvania

CHECK YOUR SOSPENDERS



I'd like to tell you right off that I enjoy reading *Seaworthy* as soon as it hits my

mailbox. The things I learn from the articles absolutely blow me away.

I came across a little something not long ago and thought I just had to share it with your readers. I do a lot of flats fishing, and I'm a safety nut, never going without everything in working order. I've seen too many news reports of fishermen lost and stranded on the water all because of not taking proper safety precautions ahead of time.

With that in mind, I took out my two sets of Suspenders PFDs and found that they had both self-inflated due to a leaky, nonwatertight, compartment. This was not the first time this had happened, so I had extra charging kits ready. While pulling the dead CO² cartridge out, I felt a second cartridge on the opposite side (I didn't know it was there!). This live cartridge was so rusted that it was stuck to the fabric of the PFD and almost impossible to remove. After finally freeing the cartridge, I was shocked to see the condition it was in. I've had these PFDs for several years and never knew the second cartridge was there (my error in not knowing my safety equipment). This was true for both my PFDs. I am including a picture of one of the rusted cartridges. I can only imagine what would have happened if they had explosively discharged while wearing them. Please feel free to share the photos with your readers so they may avoid a serious problem later on.

Russ Gardner Sr.

Lehigh Acres, Florida

We contacted Coleman, who is the parent company of Stearns, who made Suspenders, and learned that before Coleman bought the company around 2002, some models were made with two cartridges. If you have an older Suspenders model, check for a second cartridge. Better yet, a 16-year old inflatable life jacket might be due for replacement or at least testing.

MORE ON LIGHTNING PROTECTION

While sailing through lightning storms in Central America, we always dragged a heavy battery cable from the mast base to the water to help divert heavy electrical current to ground should lightning strike our boat. Our boat was never hit through numerous storms we encountered. Let me emphasize, our experience proves nothing about the effectiveness of our strategy.

My working theory is that grounding the mast in this manner assures it is close to the electrical potential of the surrounding water. If a mast becomes charged to a higher potential before a strike, it would seem the lightning would find it an easier path to follow. But the cable ground may in effect provide a continuous path to reduce mast charge buildup. Akin to the phenomenon that lightning strikes are often seen to hit mountaintops and the tallest masts in an anchorage – events we have witnessed several times.

Carlos Valencia

Channel Islands Harbor, California

James Coté responds: *Dragging a chain or battery cable in the water will not prevent a strike. The metal surface of the chain or cable in contact with the water will provide a minimal level of grounding.*

Also, if the chain or cable is attached to a chainplate and a strike does occur, the strike current may flow through the stainless steel shroud or stay, possibly damaging it. (The conductivity of stainless steel is about two or three percent that of copper).

Thank you for the article entitled “Modern Lightning Protection On Recreational Watercraft.” I have long sought an answer to a seemingly simple question regarding lightning safety and oil rigs. As I regularly fish a 26-foot boat near oil rigs up to 50 miles off the Texas Coast, lightning



can quickly become a serious matter. In the summer, afternoon thunderstorms can form and then dissipate rapidly and will occasionally pop up so as to surround the boat and then close in when there are no routes of retreat. Obviously, the best advice would be to avoid getting into such a situation. That said, I have long wondered whether there is any safety advantage to staying very near to (or perhaps far away from) an offshore rig during a lightning event?

Simply put, if given no option of wholly avoiding a lightning storm, should a small boat run to or away from a nearby rig? If running to the base of the rig is a good idea – is there a specific distance or formula for the best distance to maintain from the legs?

Also, I believe there is a significant typo in the article. The author states that “All objects inside the imaginary sphere will NOT be protected by the air terminal, which means the area protected often differs in size and shape from the cone of protection model.” I assume this should read “will be protected.”

William Alberts

Austin, Texas

James Coté responds: *A tall metal oil rig with a large metal surface in contact with the water would provide excellent lightning protection for any vessel completely within its “zone of protection.”*

With regard to the “significant typo,” this is not the case. The sphere is not centered on the air terminal, but rather refers to a large imaginary “rolling ball” that rolls along the surface of the water and comes to rest against the air terminal. This rolling ball represents the “lightning strike danger zone” [conceptually, the lightning strikes from the center point of the sphere or ball]. The air terminal’s zone of protection is the boat side of the area outside of the rolling ball as it leans up against the air terminal and then all around it.

I read your recent article on lightning protection and have long thought about installing some protection on my 40-foot sport fisherman. I have an aluminum radar arch, which would serve as the top of my cone. I was thinking that if I ran a #4 wire down from it to my two bronze rudders they would serve as better grounding plates than anything I could install on the bottom, since their total wetted surface is much higher. My engines also have ground plates, but I doubt they are sufficiently large enough. Has anyone, to your knowledge, used their rudders for grounding, and were there adverse results? I suppose there would be some risk to frying the stuffing boxes, but I wondered if this has been tried.

Michael Savage

Tuckerton, New Jersey

James Coté responds: *Actually, metal rudders without fairing are acceptable as lightning grounding points with the caveat that a long horizontal wiring run to the grounding point (or points) is not desirable. Also, please ensure that the lightning down conductor is attached to the rudder posts, not the rudder tube. Finally, since bronze propeller struts would be more forward than the rudders, these may make better sense.*

What causes boats to capsize? In a word, instability. Boats are inherently stable until something causes them to become unstable (see “Stability,” page 5). And that something is weight – where it is and how much it is determines when a boat will tip over far enough to capsize or fill with water. BoatU.S. Marine Insurance analyzed five years of capsizes and swappings, to find out what you can do to prevent your own boat from capsizing.

A capsize is defined as a boat rolling over onto its side or completely over; *swamping* typically means that a boat fills with water (often from capsizing) but remains floating. So to simplify, we’ll use the term capsize from here on. As mentioned, the study showed that boats capsize because they become unstable, but there are three main reasons for that instability: too much or unbalanced crew or equipment weight; leaking water, which also creates too much weight; and bad weather, which causes instability as a boat is rocked and filled with water. First, we’ll look at which boats have the highest capsize risk, then we’ll look into what exactly makes them unstable enough to capsize.

CAPSIZES BY BOAT LENGTH



HOPE IT FLOATS

There is always a very real possibility of injury when passengers unintentionally go in the water with nothing to hold onto. The U.S. Coast Guard (USCG) has addressed this by requiring monohull powerboats built after 1972 under 20 feet in length to float when filled with water. This is a good thing, because without it, most of the small boats in the study would have sunk out from under the crew, leaving nothing to hang onto while waiting for rescue. The bad news is that boats larger than 20 feet that don’t have built-in flotation will eventually sink if capsized, and even smaller boats with flotation can still sink if grossly overloaded. (Note: Boats up to 26 feet built to the American Boat & Yacht Council (ABYC)

standards adopted by the National Marine Manufacturers Association (NMMA) also have flotation). Inboard and sterndrive boats have less rigorous basic flotation requirements than outboard-powered boats. If your boat was built before 1972, it wasn’t required to – and probably won’t – have flotation at all. (See “Does It Float,” page 6.)

WHICH BOATS CAPSIZE

One thing that stood out is that the majority of incidents – not surprisingly – were small boats (see chart above). Almost 10 percent were 8-footers, mostly dinghies, and capsizes here often didn’t cause much damage. But the biggest group, as the chart shows, comprise the 15-19 footers, representing 41 percent of all capsizes. These boats were typically fishing boats, of-

Most powerboats built before 1972 have no flotation and will sink out from under the crew if swamped.



Source: BoatU.S. Marine Insurance claim files

ten with large, hard-to-drain cockpits, sometimes out in poor weather, and were sometimes overloaded.

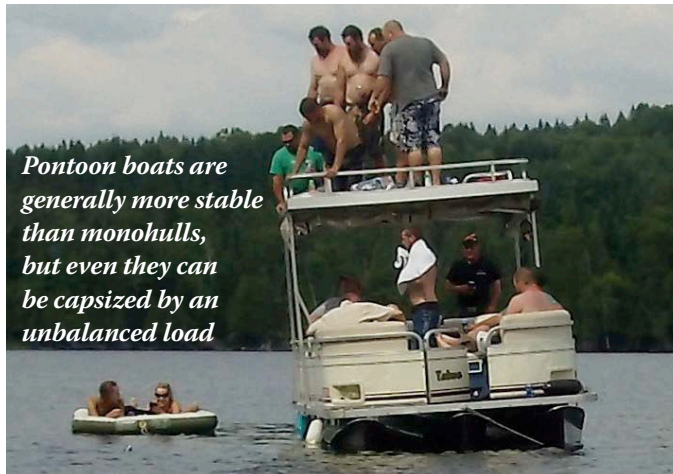
The next most common group are boats in the 20-24 foot range, representing a quarter of the total; half of those were outboard-powered 22-footers. Larger boats tend to be more stable and rarely capsize, though there were several boats over 38 feet that capsized.

WHY THEY CAPSIZE

Nearly all capsizes can be assigned one of three causes. The most common is too much or poorly distributed weight. Small boats are much more susceptible to an extra person or two or a couple of heavy coolers aboard than larger boats. Older boats especially may have gained weight over the years as more gear is stored aboard. On boats with cockpit drains, an extra beefy friend or a second cooler might be all it takes to make the water come back in through the drains, filling the boat. While most of these under-20 foot boats are required to have flotation, they also must have a capacity plate that states how much weight and how many people can safely be aboard. Pay attention to this number, and keep in mind that the number of *seats* in a boat is not always an indication of the number of people it can carry safely. Exceeding the capacity limits, even in calm water, is asking for trouble; and in many states, operators can be ticketed for it. All it takes is a stiff wind, a large wake, or an unbalanced load to flip over. Safe passenger loading is also controlled by the number of "underway seating positions." For example, two slim adults taking four or five small children out for a spin on a boat designed to seat four would be taking a big safety risk, even though the total passenger weight might be well under the boat's stated capacity. Where the weight is distributed is almost as important as the amount. Too many people on one side of the boat (*Hey, look at that whale!*)

Pontoon boats are generally more stable than monohulls, but even they can be capsized by an unbalanced load

Photo: John Silver



forces the gunwale too far down, potentially allowing water to pour in. Boat manufacturers often provide a diagram for each boat showing where passengers can safely sit so as to not upset the boat's balance.

Some boat manufacturers, such as Sea Ray, label upper decks on their larger boats to indicate how many passengers can be on upper decks. Weight that is substantially above the

waterline raises the boat's center of gravity and makes the boat less stable and more likely to capsize (The ABYC is working on recommending upper deck capacity labels for larger boats.) Another thing to keep in mind is that people

have gotten larger over the years. The Centers for Disease Control and Prevention (CDC) says that the average weight of an individual in the United States has increased to 185 pounds, up significantly since commercial passenger-carrying regulations went into effect in the 1960s, when the average American weighed 160 pounds. Those extra pounds can quickly add up, causing your boat to be unbalanced. While

STABILITY

Dave Gerr, nautical architect and author of (among other books) *The Elements of Boat Strength for Builders, Designers and Owners*, believes that all powerboats should carry capacity plates, and he has recommended that the ABYC adopt the requirement as a standard. Gerr, with a group of other naval architects, investigated the sinking of *Kandi Won*.

"It was immediately apparent to all of us that this was crazy," he says. "You don't put 27 people on this boat." So a bunch of us said, "OK, that's our intuition, it seems like we all agree. Let's take a look at the stability numbers, and see if the numbers prove that conclusively."

The numbers, it turned out, were the easy part. The hard part, Gerr says, was reconstructing the boat. Silverton was in bankruptcy, and plans for the older boat were difficult to come by. He had to start from scratch, developing a mathematical model as well as a computer drafting simulation to analyze the boat. Once he had those models, he was able

to determine the stability of the vessel when it was loaded with people.

"My original results were surprising," Gerr says, "so I had a couple of people look at it. Basically, it was quite a nice boat. Quite safe and stable. But with 27 people onboard, including eight on the flybridge, the stability was very questionable. It had almost no reserve stability at all."

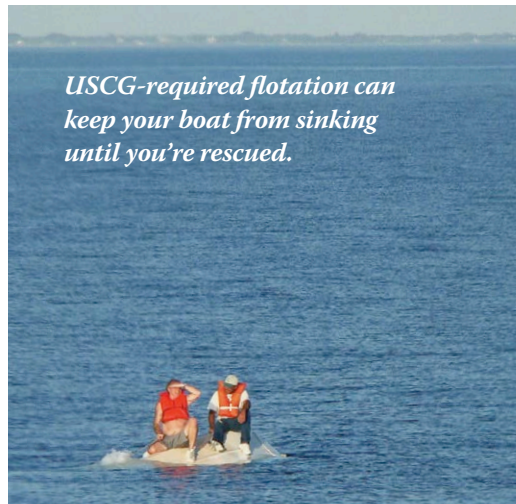
His conclusion: "A boat that size was probably safe with 15 or 16 people onboard. Maybe even a few more."

A real-world test of his finding was fairly simple. Marine consultant Eric Sorenson piled weight on the rail of a similar Silverton 34 and measured the angle of heel. In a detailed article in *Soundings*, Sorenson was more conservative in his preliminary findings. "Some feel that 15 [passengers] would be permissible in calm waters in daylight if half of them are kids," he writes, "but I think this is excessive because of the complications so many people create in the event of an emergency."

you may not want to carry a scale with you, it's good practice to eyeball your guests and try to get a ballpark weight before you take out a larger group.

Installing a four-stroke engine on an older boat can add 10-15 percent more weight that the designers, who built the boat for lightweight two-strokes, didn't anticipate. Water can backflow into the cockpit and cause the boat to take on water.

Fishermen and hunters in small boats can make the boat unstable simply by standing up because their center of gravity rises. Some of the most severe injuries from capsizing



are from this group of boaters during the winter; immersion in cold water

seriously shortens your chance of survival, especially if you're alone.

The bottom line is that loading too much cargo or too many passengers in one part of the boat can affect its stability, even if the total load is within the boat's maximum capacity. Weight needs to be evenly distributed, especially in smaller boats. One other thing worth mentioning is that capsizes can also be caused by modifications that affect the stability of the boat. Even a small tuna tower can severely change the center of gravity, especially on a smaller boat. Contact the manufacturer or a naval architect if you're unsure how a modification will affect stability.

DOES IT FLOAT?

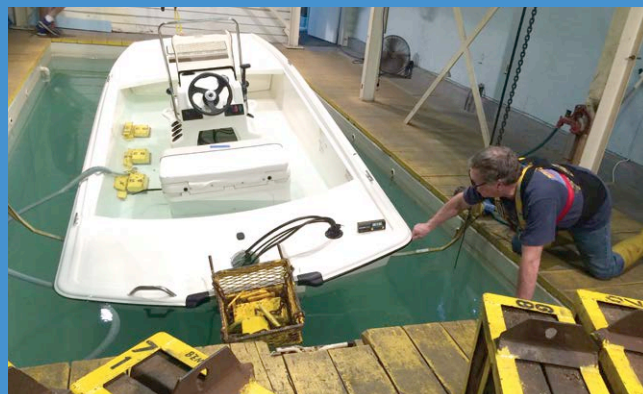
Inside an old World War II-era aluminum building in Solomons Island, Maryland, that was once used to train troops, visitors are surprised to find a 25-by-10-foot pool of deep blue water. Even more surprising perhaps, is finding a 19-foot boat floating in the pool while a group of engineers and technicians gather round.

This odd building, and the people in it, are making boating safer by making sure that the USCG-mandated flotation regulations do what they are designed to do - keep boats afloat while swamped - and making sure that when they're swamped, they don't roll over easily.

Most powerboats under 20 feet in length (multihulls are an exception) are required by the USCG to have a plate affixed to them that states the maximum number of passengers they can carry, along with the maximum horsepower rating of the boat's engine. These are usually based on manufacturer calculations and not necessarily real-world usage; unfortunately some boats don't meet the regulations, despite the plate. With thousands of registered boat manufacturers, and hundreds more new ones every year (and hundreds more that go out of business every year) the USCG wants to make sure that builders aren't just slapping a number on a plate and selling the boats to an unsuspecting public. This is where the old aluminum building and the workers come in to play. For years, the USCG has contracted with a company called PPG to test a sampling of boats each year, to verify the capacity plate is accurate.

PROCESS

Every year, PPG visits boat manufacturers, dealers, and boat shows, looking at boats, especially new models. With a practiced eye, employees spot boats that may not pass the tests, and then anonymously buy them - about 35 boats every year. The engines are removed (just in case), the boats are



put in the pool, and weights are added to represent the missing engines. More weights are added to simulate the maximum capacity shown on the plate, and then a large pump begins to fill the boat with water until it's full to overflowing. If the boat doesn't sink and makes it this far (65 percent of them don't), it's left for an 18-hour "soak test" to simulate a capsized boat waiting for rescue. If all is still well the next day, weights are then placed near the sides of the boat to represent some of the passengers collecting on one side of a swamped boat. Boats with the correct amount of flotation in the right places won't capsize and will still float relatively level. If they don't, they fail the test.

It's a fair bet that manufacturers don't want the USCG knocking on their door, telling them that their boat failed flotation tests. That's because it almost always results in a recall, forcing the manufacturer to fix the problem on every boat of the type that failed, usually by adding more or better-placed flotation. As the USCG finds more boats that fail, word gets out, and builders take more care to insure their boats won't be a part of an expensive recall campaign.



Large waves can overwhelm a boat and cause it to capsize. Keeping the bow into the waves can prevent the boat from rolling.

LEAKY VESSELS

The second major cause of capsizing is leaks. Sometimes it's as simple as forgetting to put the drain plug in; other times it's leaking fittings. Water sloshing around in the bottom of the boat affects stability and waves or a wake can cause it to flip. Tying the drain plug to your boat key is a simple way to remember the plug. On the other hand, leaking fittings that can fill the boat with water are usually out of sight, often in livewells and bait boxes. Several claims were reported when an owner installed a livewell fitting using cheap PVC pipes and valves, and at least one livewell had no shut-off valve at all with no way to stop the ingress of water once it began leaking. Any fitting that penetrates the hull

needs to be closeable and should be made from stainless steel, bronze, or Marelon. One more thing the claims revealed: Some livewells are plumbed in such a way that they'll flood the boat if the valve is left open while underway.

Many older outboard-powered boats have low transom cutouts that can cause the boat to flood simply by slowing down too quickly, especially with excess weight in the stern. Newer outboard boats have a well that reduces the risk.

Some boats have cockpits that drain into the bilge (generally considered a poor design), requiring the use of a bilge pump to even stay afloat. Bilge pumps are designed to remove nuisance water only, not to

keep a boat from sinking. If your boat's cockpit drains into the bilge, be aware that if the bilge pump fails, your boat can fill with water and capsize or sink.

BAD WEATHER

Weather is another major cause of capsizes, sometimes in concert with overloading. Small boats are easily overwhelmed by modest waves or even wake, especially if they've got a full load and sit low in the water. A sudden squall can flip even a larger boat. Check the weather forecast before you go out, and keep a weather eye on the sky. In most areas, NOAA broadcasts continuous weather via VHF radio. If you're within range, smartphone apps can show you detailed weather maps, including radar, which can indicate approaching storms. Weather changes quickly on the water, so at the first sign of bad weather, head back to the dock. If you're caught out in a squall, have your passengers stay low near the center of the boat to maintain stability.

LIFE JACKETS

Life jackets can buy extra time until you're rescued, but they have to be worn to work. BoatU.S. Foundation tests showed that even modest waves can make it very difficult to don a life jacket when you're in the water, a job made harder still if you have to search for one after capsizing.



Storms can overwhelm small boats. Always check the weather before you leave the dock.

How to Get Your Claim Settled (And Get Your Check) Faster

Knowing how the process works can help

by Charles Fort

SOMETIME A COUPLE of summers ago, Bill Meyers of Grand Rapids, Michigan, got a call from his teenage daughter and her friend who had decided to stay overnight on Bill's 36-foot Trojan. Something was wrong, she said. Bill had recently remodeled and refurbished the boat and couldn't imagine what the problem could be. The girls noticed that the power to the boat was off when they arrived, and when they flipped a tripped breaker, everything started working again. The main problem, they said, was when they opened the refrigerator for a cold soda, they were greeted with a smell that was, as the girls put it, *gross!* Just as important, they said, the new flat-screen TV wasn't working. With those critical items nonfunctional, the girls cut short their visit. Bill visited the boat the next day and found that most of the boat's electronics were not working. After talking to a couple of dockmates about a recent thunderstorm in the area, it was beginning to look like the boat had been hit by lightning. Fortunately, a quick check of the bilge revealed no water, and the boat didn't seem to be in immediate danger. At that point, Bill knew he needed help, and he called the BoatU.S. Marine Insurance claim center.

THE CLAIMS PROCEDURE

If you've ever had to file a claim with your car insurance company, you know it's a pretty simple and standardized process. In many cases, you simply call your insurance company, drive your car to an authorized shop, and a few days later you pick up your car, sign a document, and you're on your way. Boat claims are different because of the vast differences in boats, the lack of standardized repair parts, and the challenges of making sometimes complex repairs using a much smaller pool of repairers. Boat repairs also are often significantly more expensive than owners expect. Here's what to expect if you ever have to file a claim with BoatU.S.

STEP ONE: REPORTING THE CLAIM

The first step is pretty similar to how auto insurance works: you contact your insurance company, either by phone or online. If you call by phone, a BoatU.S. claims representative will take a "first report of loss" from you. They'll ask you several questions regarding the loss, such as how and where

it happened, then give you some instructions, as well as a claim number. Then the company will assign you a claims adjuster, who will assist you through the claims process

and will contact you within a day or so. They'll also ask you to provide a statement about what happened. (Note: This is a good time to take photos of the damage for your records.) The best way to avoid a potential coverage issue is to report any sort of accident immediately, so that the insurance company has every opportunity to determine the cause, nature, and extent of the claim.

For some people, human nature being what it is, making the first report is the hardest part. They wonder whether or not the claim will be more than their deductible, if the claim will raise their insurance rates, or if they should wait until they're sure they even need to file a claim. Susan Holler, assistant vice president and manager of BoatU.S. Marine Insurance Claims, says, "If you're not sure, call anyway, and call right away." The damage may look minor to you, but it could be much more expensive to repair than you think. And if the damages turn out to be less than your deductible, you can always withdraw your claim; if there is no loss payment, it's not considered a claim and will have no impact on your premium. Delaying the call can cause problems. One of the biggest issues, according to Holler, is when too much time passes between the moment the loss occurs and the first report of the claim to BoatU.S. Marine Insurance. If damaged parts were replaced and then discarded, for example, the insurance company can't verify the cause, nature, and extent of the damage, and your claim could be denied. In one claim, a boat took on some water, which damaged an air conditioning unit. The owner had the boat fixed and then weeks later called in a claim. Because the repair shop had thrown away the old unit, there was nothing to inspect, and a claim determination couldn't be made. Calling immediately prevents such problems. In the case of an injury – or even a possible one – it's even more critical that you call the claims department immediately. Holler notes that over the years, there have been claims involving injury to friends or acquaintances of an insured who got hurt on the insured's boat. Initially, the injured person told the owner that it was no big deal, so no claim was reported. Months or even years later, the surprised boat owner (and insurance company)



was served with a lawsuit, something more common when there's a significant amount of money at stake – even with close friends. Don't ignore a potential injury. Calling the claims department right away allows the claims department to begin an early investigation and be better prepared if one of your guests later decides to sue or pursue a claim against you. Delaying makes investigating the loss much more difficult and can jeopardize coverage.

STEP TWO: PROTECT YOUR INVESTMENT

All policies require that an insured take all necessary steps to protect the boat and its equipment from further loss. Let's say a storm comes through and rips off your canvas canopy, exposing your electronics to more rain. Throwing a tarp over everything will reduce the possibility of further damage. If your boat sinks, immediate notification of the loss is critical so that the insurance company can make arrangements to have the boat salvaged. Once the boat is raised, you would need to make arrangements to have the engines flushed and pickled to avoid further damage while awaiting repair. If your boat is hit by lightning, it needs to be hauled out to inspect for hull damage. These things will mitigate damage, and the policy will pay reasonable expenses for them under the Sue and Labor provision, which is in addition to hull coverage.

STEP THREE: GET AN ESTIMATE

The next step illustrates another difference between auto and boat policies. Because of the millions of claims auto insurers deal with every year, they often contract with body shops who do the estimate, repair, and billing. With a boat claim, on the other hand, the insurance company will usually send out a representative, who could be a general adjuster or marine surveyor depending on the extent of the damage, to investigate what happened. For smaller claims, they may be able to prepare a damage appraisal on which your settlement will be based. For more extensive damage, you'll need to get estimates from reputable shops. It's your boat, so find a repair facility you're comfortable with, because your settlement will be based on their estimate. Tip: Don't use an automotive repair facility. They often don't know the need for special ignition-protected items in the engine room, and an auto body shop may not be able to adequately repair a fiberglass hull to withstand pounding on the water. If you've been assigned an adjuster or surveyor, try to schedule a time to be present during the inspection. No one knows your boat better than you do and surveyors welcome the opportunity to go through the damage with you. You might see problems you weren't aware of if you had not been there. Don't be afraid to ask questions. If you can, find recent maintenance records to send in with your estimate. Certain items, such as canvas or mechanical parts,

have a limited lifespan and are depreciated over time. Don't sign anything related to your claim without contacting your claims adjuster.

STEP FOUR: SUBMIT THE ESTIMATE

Once you have the estimate from your chosen repair facility (or if an adjuster or surveyor provided the estimate), the BoatU.S. claims department will review it. If it's fair and reasonable and related to the loss, the claims department will approve it and provide you with a settlement letter detailing your loss-related settlement. Payment will be made (minus your deductible and any applicable depreciation), and you can then authorize your repair facility to begin repairs to your boat. Keep in mind that if you have a lienholder, payment will likely be made in your name and theirs unless they have provided written authorization to remove their name from the payment.

STEP FIVE: GET YOUR BOAT FIXED

Remember Bill's boat? The day after he called, the boat was hauled out, and a surveyor inspected the boat. Bill was right; the boat had been struck by lightning. In fact, two other boats in his marina had been struck by lightning during the same storm. The good news is that the surveyor didn't find any hull damage. The bad news is that most of the boat's electronics were damaged, including lights, radios, fish finders, TV, the battery charger, and a bilge-pump switch. Bill supplied estimates for the repair and replacement of the damaged equipment, and a check for the full amount was sent so Bill could get back on the water.

ADVICE FROM A SEASONED EXPERT

Alison Mazon, a surveyor in Portland, Oregon, has handled hundreds of insurance claims. Her best advice for a boat owner with an insurance claim is to be engaged in the recovery and repair of their vessel. It's the owner's boat, she says; the adjuster and the surveyor are only there to assist and the insurance company can only write a check. The owner, or an owner's representative, has to authorize any and all work done on their vessel and it is up to them to initiate it.

WHAT NOT TO DO

The owner of a 31-foot powerboat in Louisiana stored his boat on the hard for several years. He called the Marine Insurance Claims Department saying the engines and generator on his boat were somehow water damaged and wouldn't start. Unfortunately, the yard had already nearly finished the repairs, and most of the parts had been discarded. BoatU.S. sent a marine surveyor to inspect the boat and found that aside from a rusty engine block and a dismantled generator, there was nothing to inspect and therefore no way to approve the claim.



Not So Stainless Steel

Why do they call it stainless if it still rusts?

by Alison Mazon

A COUPLE OF BOAT show attendees stopped at my booth and looked at the section of a sailboat bow and foredeck we had on display. My astute associate had rescued it from a boat that was being scrapped due to years of neglect. A number of the fasteners securing cleats, anchor-roller bracket, pulpit mounts, stem fitting, and so on, were heavily corroded – especially on the underside of the foredeck. One turned to the other and said with great certainty, “Those bolts aren’t stainless steel,” and off they walked. Unfortunately, that encounter is emblematic of the level of misunderstanding about stainless steel and corrosion.

In fact, the fasteners used by that sailboat manufacturer were likely a good quality 300 series stainless steel. So, why were the fasteners on this bow section, and so many other pleasure boats, so heavily corroded? The answer is as hidden as the source of the corrosion itself. First, we must learn a little about what makes stainless steel stainless.

The science of stainless steel is incredibly complex, and a deep understanding is a formidable task. Fortunately, the average boat owner doesn’t need to know much beyond the basics to be able to prevent or to recognize and correct

most stainless-steel corrosion. Most marine-grade stainless used on production boats is from the 300 series. These stainless steels are suitable for a wide range of marine applications. Type 304 is a good, multipurpose steel. The Gateway Arch in St. Louis is clad with 304. Type 316 and 316L have a slightly higher nickel content and added molybdenum to improve their corrosion resistance over 304 – especially with regard to pitting and corrosion in chloride environments. Type 316L has a lower carbon content than 304 and 316 to avoid carbide precipitation in welds.

The single most important fact about stainless steel that all boat owners should know is that the chromium in the steel combines with oxygen to form an invisible surface layer of chromium oxide that prevents further corrosion from spreading into the metal’s internal structure. According to Anne Marie Helmenstine, Ph.D., “This protective film will self-repair if damaged, if sufficient oxygen is present. Stainless steels have poor corrosion resistance in low-oxygen and poor circulation environments. In seawater, chlorides from the salt can attack the passive film more quickly than it can be repaired in a low oxygen environment.”

With this basic knowledge, what makes decent quality stainless steel corrode aboard your boat? For simplicity, let’s assume that whenever the word stainless is used, we are referring to a grade-300 series such as 304, 316, or 316L, as these are typically very suitable for a majority of marine exterior applications. Also, in the spirit of simplicity, we will use the general term “corrosion” to represent the many

different types of corrosion that can attack stainless steel. Differentiating between them can require a metallurgist and usually isn't necessary for our purposes.

Stainless steel is "normally" corrosion resistant if the correct grade is selected, properly fabricated and finished, and correctly installed in the appropriate application. Most U.S. production boats were built with appropriate grade stainless steel and are reasonably well assembled. So, what caused the fasteners on our section of bow to corrode so heavily? The short answer is the same as the reason this vessel was cut up and sent to a landfill: lack of maintenance.

The knowledge of what causes stainless steel to corrode is one part of the equation. Knowledge of basic vessel construction of decks, cabin tops, and cockpits (horizontal surfaces) is the other crucial part. The horizontal surfaces on most production boats are a composite or sandwich consisting of an inner and outer layer of fiberglass with an inner core of plywood, end-grain balsa, or foam. The upside of this type of construction is that it adds rigidity with relatively light weight; plus it provides excellent thermal and acoustic insulation. The downside is that the core can absorb water if the caulk used to seal the deck fittings breaks down. Since very few boatbuilders isolate this core from the fasteners, it will absorb moisture if there are any leaks. And, it holds the moisture in contact with the fasteners just like a sponge.

Deck hardware requires periodic recaulking to prevent leaks. This is especially true of hardware subject to high or sudden loads like stanchion and pulpit bases, anchor rollers, windlasses, cleats, and chainplates. Time and flex breaks the bond between the caulk and the hardware. This allows water to leak alongside the fastener where it passes through the structure. This moisture is held alongside the stainless

VIGILANT BOAT OWNERS CAN HELP PREVENT UNDERWATER GEAR CORROSION:

Remove barnacles to prevent pitting that will develop under their crusty little bodies (even a small surface pit on a prop shaft can cause cavernous areas of crevice corrosion below the surface).

Apply a proven anti-growth coating such as Prop Speed or Velox Plus at the next haul-out to prevent marine growth.

Periodically run the engine(s) in gear to flush stagnant, oxygen deprived water out of shaft logs and cutlass bearings.

And, don't forget to keep anodes fresh and active to protect bronze and aluminum underwater gear from galvanic corrosion.

steel where it penetrates the deck or cabin top. Over time, the oxygen naturally contained in the water is consumed, and the chromium oxide film on the fastener is eroded. The result is the stainless switches gears from passive to active. As the iron in the fastener corrodes, it expands and begins to push in all directions resulting in the rust blobs on the underside of our chunk of foredeck rather than as the result of using non-stainless steel fasteners. Boat owners often describe the staining around the base of deck hardware as a "blush" caused by saltwater. While a very light surface staining may fit this definition, in most cases it is the result of water getting in under hardware. Visible corrosion requires immediate action.

The lack of oxygen in the presence of an electrolyte (water) is only one reason stainless steel goes bad. A number of other factors can cause stainless steel to corrode or fracture. Some examples can be found on imported vessels of the 1970s and 1980s. Much of the stainless was of questionable heritage; welding was often improperly performed; installation techniques were often poor; and water leaks seem to have been engineered in. Corroded hose clamps, pulpits, hand rails, mufflers, and tanks were commonplace. A majority of them corroded in or adjacent to the welds.

Boat owners must be vigilant when purchasing stainless steel. Fasteners, clamps, valves, and other fittings are sold by a wide variety of vendors. Don't be lured in by low price or the convenience of a neighborhood store. Specify the grade stainless you want. Ask the clerk to verify the grade he is selling you. Take a small magnet with you when you shop. 300-series stainless steel will be nonmagnetic or very close to it. When checking hose clamps, test the clamp screws as well the bands. Many "stainless steel" hose clamps have plated-steel screws that will turn into rust blobs allowing the clamps to take a swan dive into the bilge. Quality costs. But, it only costs once.



These stainless cleat fasteners corroded over time when seawater leaked through the deck.

Photo: Alison Mazon

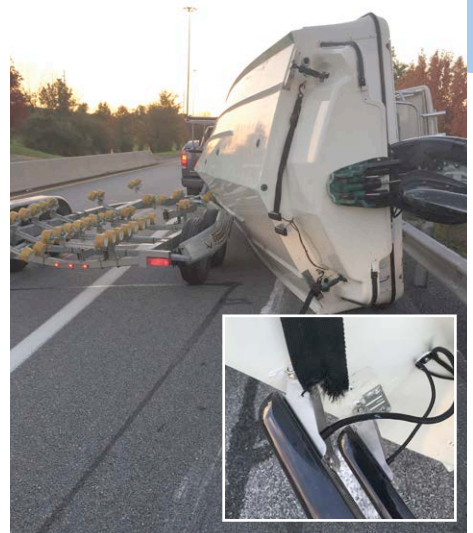
Alert

CHECK YOUR STRAPS

Over the years, we've talked a lot about the importance of taking care of your boat's trailer; your boat depends on it to safely get around while ashore. This accident though, wasn't due to the trailer. The owner of this boat was going around a curve when the boat came off the trailer – the sound of crunching, scraping fiberglass must have been pretty unpleasant to hear. It wasn't hard to figure out what happened, as you can see in the inset. The owner had strapped the stern down, but unfortunately had led the straps over the sharp edges of the trim tabs. It

didn't take long before the straps lost the battle to chafe, allowing the boat to slide off the rollers and drag along the road. Fortunately, the damage was superficial, and the boat was soon back on its trailer – with new straps crossed to keep them away from the trim tabs.

Even if your straps aren't in danger of chafing over a sharp surface like trim tabs, inspect them carefully every time you put them on. If they look frayed or if the ratchet is a rusty mess, replace them. It's cheap insurance to keep your boat from ending up with road rash.



FUEL TANK HOSES

When marine surveyor Mike Hunter of Springfield, Missouri, sent us this picture, our first thought was *Yikes!* Looking at the fuel-tank fill hose, we noticed that not only was it partly attached with a plastic zip tie (gasoline fill hoses must be double-clamped, but with *real* hose clamps), the hose itself was deteriorated enough that it was leaking onto the gas tank and no doubt into the bilge. A single spark could have caused this boat to explode (see the April *Seaworthy* for more on explosions). But there was even more than the leaking rotten fuel fill that got our attention. Notice the fuel vent line

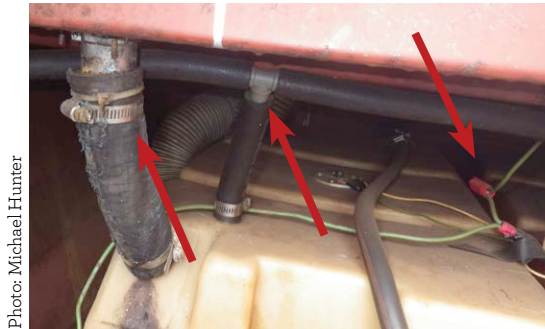


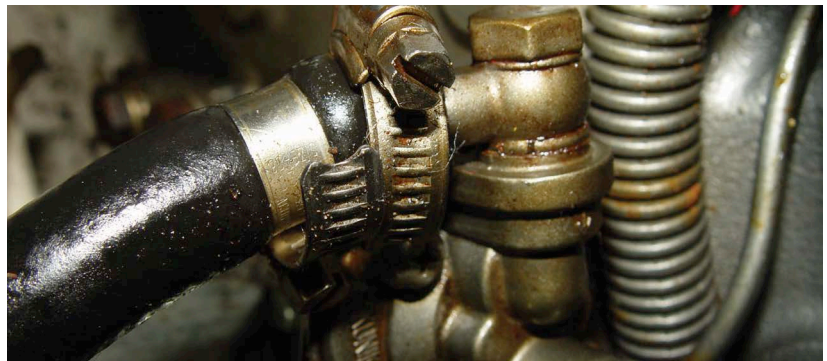
Photo: Michael Hunter

just behind the fill hose that is missing hose clamps at the top. These hoses are usually filled with gasoline vapors; and if they come off, those vapors will sink to the bilge. In case that's still not enough, one of the wires lying on

the tank is connected with a twist fitting. Not only are they prohibited by the American Boat & Yacht Council (ABYC) because they subject the bare wire to corrosion and tend to cut strands of wire during installation, they're capable of contributing to a spark. The sloppy taping job on the crimp connector (at least someone got one connector right) is evidence that this boat was not maintained with an eye toward safety. The entire fuel system should be inspected with a fine-tooth comb to look for further "shortcuts."

MORE ON HOSES

While the ABYC requires fuel fill hoses to be double-clamped, other fuel hoses don't have to be – and some shouldn't be. Simply throwing on another clamp can actually do more harm than good because the clamp can damage the hose and cause it to leak; exactly what you're trying to avoid. If a hose has to be put on a short spud, like this one, use a single clamp, but make sure it's high-quality all-stainless.



AND EVEN MORE ON HOSES

Where's the only other place the ABYC says hoses must be double-clamped? If you answered exhaust-hose connections, you're right. While double-clamping hoses is usually a good idea even if it's not



required, such as on thru-hull fittings, two clamps aren't better than one if the hose is not installed right. This exhaust hose is the right kind and still in good shape, but the installer didn't get the hose far enough on the spud. The first clamp is not even holding the hose on the muffler, and the second is just

along for the ride. Two problems if the hose comes off: First, deadly carbon monoxide will leak into the boat; and second, cooling water will dump directly into the bilge, which could sink the boat. As you can see in the picture, the hose is already leaking. Tip: Attaching a contrary hose to an almost-too-big spud can be made easier if you dip the hose end in hot water for a few minutes, which will let it stretch just enough to make it fit.

SWAGE HORRORS

If you've been putting off having that wonky swage replaced on your sailboat, take a look at this one. The picture on the left shows a swage that's way past its life. Cracks formed, which eventually allowed water to seep inside. Over time, the water may have frozen and expanded, damaging the fitting further. Then rust got a foothold inside the fitting, which can also expand it outwards, further damaging it. Either way, a swage fitting that looks like this is not going to keep your rig up for long. And as you can see from

the second picture, this one didn't. The rusted fitting broke during a gentle breeze, bringing the mast down on top of the boat. Fortunately, no one was injured.



Take a few minutes once a month or so to check the swage fittings on your sailboat. If any of them look iffy, replace them straightaway. They're

usually even worse on the inside than they look, so take care of them before the rig is at risk. For more on this subject, see "Inspecting Your Sailboat Rigging" in the January 2016 issue of *Seaworthy*.

FIRE EXTINGUISHER HIDE AND SEEK

Quick: spot the fire extinguisher in this picture. Not easy, is it? Now imagine the curtains over the galley stove caught fire, and you've got seconds to grab an extinguisher to put out the fire before you and your guests have to jump overboard. Fire extinguishers don't do any good if you can't get to them *right now*, which is why marine extinguishers come with mounts, so you can put them strategically throughout the boat. Portable extinguishers should be located near the galley, the engine compartment, and all living spaces.



If you *did* find the hidden extinguisher in the picture and tried to put out the fire, you'd be sorely disappointed to find that it won't put out that kind of fire. Portable extinguishers are

rated for the type of fire they can fight: Class A fires are fueled by combustible, solid materials such as wood, paper, cloth, and plastics. Class B fires involve flammable liquids like gasoline, diesel, and varnishes, while Class C fires are powered by energized electrical circuits or equipment. The extinguisher in the picture is a class BC, which, while great for flammable liquids and electrical fires, is pretty useless for fabric. To make life less stressful, just buy type-ABC extinguishers – and make sure they're mounted, visible, and readily accessible. For more on boat fires, see "Your Boat's ON FIRE. Now What?" in the June/July issue of *BoatU.S. Magazine*.



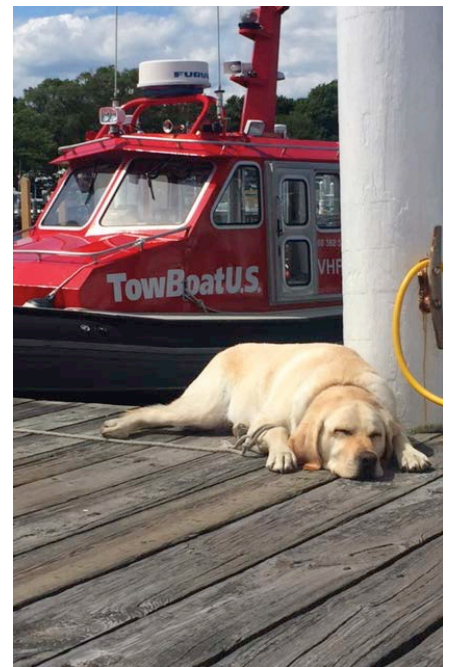
IN THE LAST issue of *Seaworthy*, a BoatU.S. member from Lorton, Virginia, sent us a picture of a powerboat blocked ashore with what looked like cinder blocks (which can be easily crushed). Member Neil Faucher sent us this picture. Apparently some marinas think cheap cinder blocks are too expensive and instead round up anything they can find, including rusted barrels. To be fair, the barrels probably weren't this bad when the boat was first blocked up. But south Florida, where this boat lives, is not friendly to old steel drums. It wouldn't take much more than a gust to crush this barrel – a tropical storm would certainly knock this boat over. Barrels, like cinder blocks, are not suitable for blocking anything heavier than a dinghy – and both are prohibited by the American Boat & Yacht Council (ABYC).

LOTS OF BOATERS have three-foot-itis – the need to get just a little bigger boat. Over time, that condition might cause you to get a

pretty sizable boat. If you happened to crack the 12-meter length (about 39 feet) there are suddenly some legal requirements that smaller boats don't have. One of them is the USCG requirement that you carry a copy of the Navigation Rules (also known as the COLREGS). The law actually says this: *the operator of each self-propelled vessel 12 meters or more in length shall carry on board and maintain for ready reference a copy of the Inland Navigation Rules.* Hopefully, the owners of boats 39 feet and over already know this. But what they might not know is that now, the USCG allows electronic copies to be carried if you don't want to have an actual hard copy aboard. But there are two caveats: A digital copy has to be corrected to the latest notice to mariners and it must be readily available. The unwritten rule of thumb for readily available is that you can get to the Rules within two minutes. You can find the newest electronic version at www.navcen.uscg.gov.



OVER THE YEARS, your *Seaworthy* editors have seen a lot of strange boats. Usually the strangest of them don't get more than a chuckle because they're often pretty useless as far as boats go. The picture above is no exception. Still, the builder gets an A for creativity and he can truly say his boat, uh, zips around. Or unzips. A YouTube video of the boat shows it making a wake that looks very much like the boat is unzipping the water. Google "zipper boat" to see it in action.



DAN CARPENTER OF TowBoat Nantucket Sound sent us this picture that just seems fitting for the dog days of summer.



FROM THE MYSTERY file. When marine surveyor Michael Hunter of Springfield, Missouri sent us this photo, we were puzzled. At first glance, it looked like an alien creature was attacking an inboard engine. Whatever it was, it sure didn't look like anything we'd expect see in a boat. But then we got a clue. Michael is the only marine surveyor we know who also happens to be a beekeeper. "When I arrived," he said, "I heard the boat buzzing and then observed bees entering and exiting through the gimbal bearing. I also saw them leaving and coming out of the engine compartment ventilation ducting." Turns out the alien creature is a beehive. He said the bees weren't just swarming, but had moved in. According to Michael, swarms are usually temporary, and they don't stay around long. "But this was an actual colony," he said. "Makes termites and worms seem easy and friendly!" But there was more. The boat had been sitting for seven or eight years, and nature, he said, was taking over. Michael also found raccoon scat, mice, and snake-skins in the boat. "Raccoons like the foam and the shelter. And mice, as you know, like to munch on the foam in the cushions, and the snakes like the mice."

CALIFORNIA, ALWAYS AT the forefront of trying to clean up the air, has new rules that manufacturers will have to follow to prevent evaporative emissions. Starting in model year 2018, if a manufacturer wants to sell boats that have built-in fuel tanks in the state, they have to be certified to do so. The new, stringent standards include such things as a low-permeation fuel line, low-permeation fuel tank, and a pressure-relief valve or canister to control diurnal vent emissions. For a little history, California started to require catalysts on most inboard and inboard/outboard engines under 500 horsepower in 2008, and now the EPA is doing the same for the rest of the country. A positive side-effect is that while meeting the emission requirements, the engines have become more efficient due to advanced electronic controls, and have even gotten a little quieter.

MORE ETHANOL HEADACHES. Say the word ethanol around most marinas, and you'll get a variety of responses from frowns to anger to eye-rolling. Its affinity for water can cause all kinds of problems in a boat engine. Ethanol's other "quirk" is that it's a strong solvent, which means that it "cleans out" fuel systems, often clogging filters and stalling engines. But the solvent property can cause even worse problems. Longtime BoatU.S. member Mike Berg from Long Island, New York, recently wrote to tell us that he found a leak in the Fuel Control Cell (FCC) on his boat's engine, where the control wires pass through into the fuel canister. "This is a dangerous condition," said Mike, who sent us to Pleasurecraft Engine Group (PEC), which makes gas engines for ski boats, among others. The FCC Pass-Thru wiring lead, the company says, was used on engine



models prior to model year 2007. Ethanol has the potential to degrade the sealant in the barrel of the FCC Pass-Thru wiring lead. This may cause fuel to seep or leak externally through this connection. The damage, says the company, is attributable to ethanol. Before 2007, many manufacturers, including PEC, used some fuel-system components that could be damaged by gas with more than 10 percent ethanol (E10), which is now available at some gas stations. PEC said they wanted let their customers know about the danger of using over 10 percent ethanol and that based on the age of these units, they should be replaced now. The company says that a new part is now available that can withstand E10. Contact Pleasurecraft Parts Department, and order FCC Pass-Thru part number RF121085. Note that using E15 or higher blends of ethanol gas are not approved for use in marine engines

