

SPECIAL REPORT

How to Solve Alcohol Fuel Problems:

Running a Boat, a GenSet or a Personal WaterCraft on Alcohol Fuel Isn't a Problem When You Know the Secret . . .



What E-10 is and what it does . . .

By now you already know that Ethanol-laced gasoline is notorious for causing big problems with outboard motors, stern drives and inboard engines. Whether or not it should ever put to sea is a moot point. That's what's on the fuel docks whether we like it or not. But the fact of the matter is that boat owners need not suffer. In fact, millions of boaters burn E-10 without problems. Here's how to make this biofuel work for you.

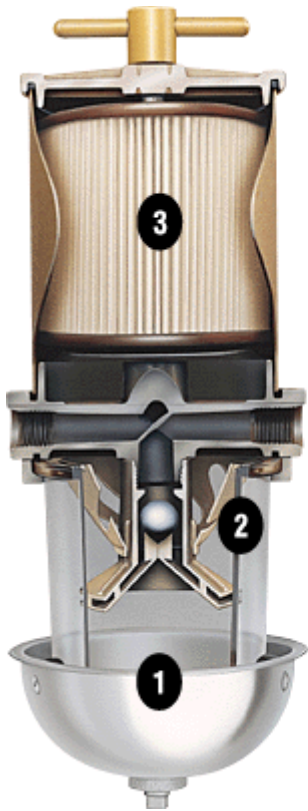
E-10 is a U.S. government-mandated blend of 10 percent alcohol and 90 percent gasoline. While E85 (sometimes also called E-15) is a blend of 15 percent alcohol and 85 percent gasoline. We won't delve into the politics here. Suffice it to say that on the highway this renewable fuel works well enough. But the problem on a boat is the simple fact that ethanol, or grain alcohol, is both a solvent and hygroscopic.

As a solvent, it readily dissolves gum, varnish and rust that's built up on the bottom of the fuel tank. The engine's fuel pump sucks it out of the tank and deposits it in the fuel filter. Soon the filter is plugged and the engine starves for fuel. That's why it's all too common to go through multiple fuel filter changes until the day when the fuel system has finally been scrubbed squeaky clean. The obvious solution is to change fuel filters often and have plenty of spares on board.

What's more, ethanol leeches resin and plasticizers from fiberglass, plastic and rubber. So the inside walls of fiberglass fuel tanks, like those installed in Bertram, Chris Craft and Hatteras boats built back in the 60's and 70's go soft. The resin turns into jelly. The jelly flows downstream to the filters with predictable results. Some of the dissolved resin flows past the fuel filters deposits itself as a black sludge on the intake valve stems causing them to stick in their guides. Also, fuel injectors and carburetor jets clog. It isn't pretty. In time the softened tanks begin to weep fuel into the bilge. That erodes mileage and is a fire and explosion hazard. **Vinylester resins are impervious to ethanol**, though epoxy and polyester resins are not.



Another tantalizing tidbit of information is that newer boats without fiberglass tanks and without years worth of gum build-up tend to be more trouble free when fuel is filtered through a 10-micron element, as opposed to sister ships with the more typical 30-micron filtration. Both **Yamaha Marine** and **Racor** offer 10 micron fuel filters with specific model appropriate for boats as small as dingy tenders up to big block V-8s.



How it works

- 1** As fuel enters, it moves around and through a turbine centrifuge, spinning off large solids and water droplets. Being heavier than fuel, they fall to the bottom of the collection bowl.
- 2** Smaller water droplets bead-up along the sides of the chamber and on the element. When heavy enough, they too fall into the high capacity bowl.
- 3** Besides repelling water and tiny solids, asphaltenes, algae and rust are filtered from fuel by the Aquabloc element. Because Aquabloc elements are waterproof, they remain effective longer.

Racor's Aquabloc filter media forces water to the bottom of the drain bowl where it can be drained off. Racor claims nearly 100 percent removal of water and solid contaminants.

On larger craft we find the more expensive three-stage filter system. The primary stage literally centrifuges the gasoline, causing large particulate matter and water droplets to fall down into the sediment bowl. The second stage coalescing ring causes remaining water to form into droplets and also fall into the sediment bowl. All at the same time, dry fuel flows to the engine.

Remember in the beginning when we said ethanol is hygroscopic? That means it pulls water out of the atmosphere. Alcohol loves water. The higher the humidity, the

greater the volume of water drawn into the fuel. So how much water does gas need to absorb before it becomes a problem?

When just four teaspoons of water per gallon (0.5%) contaminate the gasoline, the solution separates into two distinct layers: Gasoline floats on the top and water saturated alcohol sinks to the bottom.

Experts assert that in 70 percent humidity it only takes about three months to reach phase separation. Though you could have problems sooner, which usually happens as the result of a contaminated fuel supply. Know that the hottest sparkplug in the world can't ignite water. So naturally it follows, the engine sputters, stalls, and eventually dies. There is a very simple solution: Plumb a fuel/water separator in the fuel delivery line. More about that idea later on in this story.

So how can you be sure gasoline is water-contained and not some other malady? Again, there's a simple answer. E-10 gasoline contaminated by water turns white. The emulsion readily passes through filters. But when it hits .5 percent water, and phase separation occurs, the layer of gasoline reverts to clear and bright, but is octane compromised.

At the refinery adding ethanol to base gasoline raised its octane by a couple of numbers, say from 87 to 89. So naturally it follows, subtracting alcohol (and water) from the blend lowers the octane to its original rating. As a result horsepower fades, acceleration

weakens and mileage worsens. Even without phase separation E-10 delivers lower mileage per gallon (about 1.5 percent) for the simple reason that ten percent of the blend is ethanol, with inherently fewer inherent BTUs than gasoline. BTUs burned equal work done.

There's yet another problem with E-10. Its shelf life runs from about six weeks to 90 days before it begins to decompose. That means that even in a perfect water world where there is no water contamination, the solution it's wise to stabilize fuel with an E-10 specific stabilizer. Three good brands worthy of consideration are Marine Formula Sta-Bil specially formulated for E10, Starbrite's StarTron and PRI-G. Keep in mind these additives help to prevent phase separation, but once it has occurred you are on your own.



The first line of defense is prevention, minimize the volume of water going into your tanks at the fuel dock. When topping off the tanks, scrupulously pre-filter every gallon pumped. It is a wise man who invests in a funnel that incorporates a water separator. The **Racor Filter Funnel** incorporates a reservoir in the bottom that captures water.

The multi-stage **Baja Fuel Filter** features a series of mesh screens, coarse and fine, that stop particulate matter and water at the point of entry. There are three stages of filtration. The first coarse mesh traps sand and grit. Next the fine mesh removes, well, finger grain matter. The third and final stage is a specially treated mesh that removes all remaining debris and traps any water. If you see lots of water in the filter after topping off, it's time to try a new fuel dock with cleaner product.



The next line of defense is to keep the fuel tank 80- to 95- percent full in order to prevent condensation from forming on the inside walls at night, yet still leave room for thermal expansion during the heat of the day.

When non-ethanol fuel is available, even at a higher price, consider spending the extra money at the pump instead of having to invest in a case of fuel filters.



If you should ever want to test for water in the fuel, Marine Development Research offers a **Water Probe Indicator** kit that detects water in your gas or diesel fuel tank. If there is any, dose the fuel with an appropriate additive. Drying fuel with an additive eliminates the hassle of disposing fuel at a recycling center.

Effective water-in-the-fuel additives include MDR's E-ZORB Water Remover and Star Tron by Starbrite.

StarTron is the blue stuff that looks like windshield washer solution. Its enzymes prevent ethanol and water from chemically bonding. There is no phase separation. Instead, the water unceremoniously falls to the bottom of the tank, leaving the ethanol is suspension retaining the gasoline's rated octane. StarTron also breaks down the gum and varnish so it does no damage. A powerful stabilizer, it maintains gasoline for up to a year. It can also rejuvenate old fuel.



MDR Gasoline Water Zorb does not contain alcohol. It works its magic by emulsifying water and allows fuel contaminated with water to burn through the engine, eliminating the need to drain the tank. Important note: The tried and true Gasoline WATER ZORB is not intended for Ethanol gasoline. Instead, use the new E-Zorb water remover specifically formulated for E-10 gas.

E-Zorb was formulated to totally emulsify phased-separated water and ethanol at the bottom of a fuel tank introduce it back into the E-10 gasoline. The water passes through the finest filters, encapsulated in the gasoline, burn off as steam. Octane that was lost when the ethanol separated out with the water goes back into the fuel. For alcohol free gasoline use the previously mentioned MDR WATER ZORB.

PRI is a noteworthy fuel stabilizer that prevents fuel rot in an industrial strength solution, and in nearly the same formula used in ocean going vessels that burn heavy fuel oil. Another benefit, **PRI** freshens old fuel that has gone bad. In addition to protecting gasoline from the ravages of time, **PRI-G** also minimizes carbon



deposits in the combustion chamber. While this carbon scrubbing characteristic is most appreciated on the old two-stroke outboards, the carbon-busting also helps direct-injected two-stroke outboard motors and four-stroke outboards, inboards and stern drives.



STA-BIL is a venerable fuel stabilizer renowned for keeping gasoline from turning sour. It is Americas #1 selling fuel additive brand. The new Marine Formula STA-BIL, specifically formulated for ethanol fuel, boasts four times the fuel system cleaner of Regular STA-BIL and double the corrosion preventer. Naturally the additive prevents corrosion from moisture and ethanol-induced water attraction. It improves marine engine performance all year long and not just during seasonal storage

Product	Prices (may vary)
STA-BIL Marine Formula	\$13.99 - 8 - ounces
PRI-G	\$20.95 - 16 ounces
MDR E-Zorb	\$17.00 - 16 ounces
StarTron	\$11.00 - 8 ounces
Water Probe Indicator	\$7 to \$10.00
Yamaha Marine Filter	\$35 to \$50 w/aluminum head
Racor Filter Funnel (3.9 gpm)	\$30.00
Baja Filter	\$99.50