TOTAL PERFORMANCE
VAN'S AIRCRAFT
14401 Keil Road NE, Aurora, Oregon, USA 97002
PHONE 503-678-6545 • FAX 503-678-6560 • www.vansaircraft.com • info@vansaircraft.com
Service Letters and Bulletins: www.vansaircraft.com/public/service.htm

SERVICE BULLETIN 13-3-21

Date Released: **March 21, 2013**

Date Effective: **March 21, 2013**

Subject: **Ethanol in gasoline**

Affected Models: **All flying RV-12 aircraft**

Required Action: **See Synopsis**

Time of Compliance: At or before the next Annual Condition Inspection.

Synopsis: The Rotax engine used in the RV-12 is approved by Rotax for use with 10% ethanol. Van's has used 10% ethanol in our factory demo airplane for over 4 years, with no apparent problems. However, certain precautions should be taken if the engine is run on gasoline with ethanol added.

Ethanol is a highly aggressive solvent. The aluminum used in the tubing and fuel tank should be impervious to it. But there are other components such as the O rings in the gascolator and fuel pump, the nylon seal a in the fuel valve, and the tank sealant which may all be harmed by long term exposure. Periodic replacement or inspection of these items is a good idea. Rotax has recommended a 5 year replacement schedule for rubber hoses and fittings on their engine.

http://www.rotax-owner.com/rotax-blog/item/20-the-task-at-hand-rotax-5-year-rubber-replacement

Phase separation is also a concern with ethanol in gas. Frequent flyers who fill up regularly (as we do at the factory) should have no trouble. Beware if the airplane sits for extended periods (more than 30 days) with fuel in the tank that may contain ethanol. Drain the tank prior to any extended period of inactivity. You can read more here:

http://www.eaa.org/lightplaneworld/articles/1106_ethanol.asp

http://fuelschool.blogspot.com/2009/02/phase-separation-in-ethanol-blended.html

Text versions of these web pages are attached to this SB.

If deterioration of the tank sealant occurs, it may be necessary to remove it from the affected area and apply new sealant, or in extreme cases the tank may need to be rebuilt. We have not yet seen any effect of E10 ethanol on the RV-12 tanks in service. But it is mentioned here so RV-12 owners pay attention to the tank sealant during inspections, especially if ethanol separation is likely to have occurred.

We recommend that RV-12 owners use premium auto gasoline without ethanol if practical, per the Rotax operating instructions. 100LL is approved, but requires a different and more laborious maintenance schedule for the Rotax. Given the lack of issues with our company airplanes, and in the current fleet, we believe that 10% ethanol premium car gas is preferable to the use of 100LL, provided appropriate precautions are taken and the operator is aware of the potential issues.

Flying With Ethanol
By Terri Sipantzi, for Light Plane World

Terri Sipantzi -- There has been a lot of discussion going around the light-sport and ultralight community about alcohol in the fuel. Can we use it? Is it a good idea? What is legal? It's probably one of the questions I'm most asked. Let me start by addressing this question from a legal point of view, and then I'll work to the practical side. If you're flying a special light-sport aircraft (S-LSA), then you must use the fuel specified by the aircraft (not engine) manufacturer.

That's right – the aircraft manufacturer is the one that makes the authoritative determination. In making the determination whether to allow alcohol (ethanol is what we're talking about here, not methanol), manufacturers will typically wait until the engine manufacturer determines the use of ethanol is safe and at what levels. In the case of Rotax engines, the engine manufacturer has stipulated that up to 10 percent ethanol is safe in their engines. (See Rotax service bulletins to determine if your engine has been determined ethanol safe. It will be based on engine serial numbers.)

Once the engine manufacturer has determined the engine is safe for a specified percentage of ethanol, the aircraft manufacturer must then ensure that the fuel system installed in the aircraft is also ethanol safe. If the manufacturer is using fuel lines, a fuel tank, or any other components that haven't been tested for ethanol, then the manufacturer can't issue approval to use ethanol until those components are changed out or tested. So check with your manufacturer to determine if your S-LSA is approved for ethanol use.

By the way, the "approval" can be in one of a few forms. It can either be no specific ethanol restriction or it can be a statement specifically authorizing the use of ethanol. It can even be a deferral to the engine manufacturer (a statement that the aircraft manufacturer authorizes whatever the engine manufacturer authorizes). If you're flying an experimental light-sport aircraft or ultralight, you can do whatever you want from a legal point of view, but you would be wise to follow the same path the aircraft manufacturers follow in determining whether it is a good idea. Is it a good idea?

I've been using ethanol in my plane, off and on, for some time now. However, I always default to ethanol free when I can get it. Why's that? Last spring, after I had been using ethanol-based gas for several months, I was trying to start my trike. It would start, run, and then die. After three of these false starts, I suspected I was having a fuel problem, and the first thing I checked was the fuel itself by draining a sample. The entire fuel sample cup looked like a filmy, almost jellylike substance. The alcohol in the fuel was completely saturated with moisture and had settled to the bottom. My engine was sucking this filmy, jellified mess into itself. Even if I'd drained the saturated content out, the fuel was still no good because fuel treated with ethanol derives part of its octane rating from the ethanol. Since all the ethanol had separated out with the water, my octane rating was below the safe level. I had to completely drain the tank.

Since then I try to use ethanol-free gas whenever I can find it. It's more stable, and if moisture gets into the fuel, I can drain it out just as I would if I were using 100LL (the fuel GA aircraft use). With ethanol fuel I have to be much more concerned about how long any of it is sitting around.

Another thing you have to watch for with ethanol-based fuels is corrosion. If I'm going to be storing a plane for more than 30 days, I'll drain the fuel from the tank and I'll pop the carb bowls off and drain the fuel out of them. If you store your plane over the winter without emptying the carb bowls, then there's a good chance that the ethanol will cause some corrosion. If any of the corrosion breaks free, it can foul one of the carb jets causing problems. Corrosion is an even bigger concern with two-stroke engines since the crankcase is open to the environment when the engine is stopped. There are a number of good articles out about protecting your two-stroke from corrosion during the winter storage season, so if

you're using ethanol-based fuel you'll want to get one of these articles and make sure you protect your engine from the extra risk ethanol poses.

Something else to pay attention to is your fuel filter. This is particularly true if you have bought a used plane that has had one or more fuel lines changed out. If the fuel line going into the fuel filter is being degraded by the ethanol, little bits of that line are going to start clogging the fuel filter. The same thing will happen if the gas tank is being dissolved. A trike pilot here in Virginia had to make an emergency landing a couple of years ago when his engine died. During the subsequent investigation it was determined his fuel filter had clogged up over a period of time, with deteriorating fuel line bits, and finally choked the engine to death.

These are things I don't have to worry about if I'm using fuel without ethanol. But if ethanol-based fuel is all I can get, then I'll fly with it – I'm just going to be watching the fuel system a lot more closely.

One of my readers just sent me this cool link for finding ethanol-free gas. Check it out at Pure-Gas.org.

Terri Sipantzi is the owner/operator of Precision Windsports Inc., a full-service weight-shift light-sport aircraft dealer based in Lynchburg, Virginia, and specializing in Airborne trikes. He's a regular contributor to EAASport Aviation and Light Plane World.

This article was originally published in the Precision Windsports monthly newsletter. You can subscribe to the newsletter, read back issues, and access archives of his published articles at www.PrecisionWindsports.com.

http://fuelschool.blogspot.com/2009/02/phase-separation-in-ethanol-blended.html

Phase Separation in Gasoline's containing Ethanol is now a major problem for all users of gasoline.

Whether you use gasoline as a fleet operator or for your family car, classic car, boat, personal water-craft, motorcycle, snowmobile, ATV, RV, lawnmower, weed-whacker, generator, or any of the thousands of other types of equipment that use gasoline engines; you are being affected by Ethanol in your fuel.

Phase Separation describes what happens to gasoline containing Ethanol when water is present. When gasoline containing even small amounts of Ethanol comes in contact with water, either liquid or in the form of humidity; the Ethanol will pick-up and absorb some or all of that water. When it reaches a saturation point the Ethanol and water will Phase Separate, actually coming out of solution and forming two or three distinct layers in the tank.

Phase Separation is also temperature dependent. For example, E-10 can hold approximately .05% water at 60°F. To better understand the amount of water that we are talking about, picture 1 gallon of E-10 at 60°F. This gallon will hold approximately 3.8 teaspoons of water. However if the temperature drops to 20°F it can only hold about 2.8 teaspoons of water.

We recently were called to consult for a fleet where a fairly large number of vehicles were being regularly fueled from a single tank and about one-half the vehicles were stored inside and the other half were stored outside. After a night with a 30°F+ temperature drop, several of the vehicles stored outside developed problems with significant amounts of water found in the vehicle tanks. After checking the storage tank and finding no measurable water, they looked for other possible causes including sabotage. After looking at many possible causes this customer consulted with us and we were able to describe the Phase Separation through temperature change scenario and determine that this was the most likely cause of the problems.

Phase Separation can happen in an underground or an aboveground storage tank, a vehicle tank, a boat tank, in any type of equipment tank, and even in the gas can in your garage.

When this happens, you can have serious and even catastrophic engine problems, without warning.

When this Phase Separation occurs you will have an upper layer of gasoline with a milky layer of Ethanol and Water below it, and then in many cases a third layer of just water at the bottom.

If this happens and you try to start the engine you can have one or more of the following problems. If your fuel tank pick-up tube is in the water layer, most likely the engine will fail to start. If the engine is running and suddenly draws water you can have damage from thermal shock or hydro-lock. If the pick-up tube draws the Ethanol-Water mixture or just Ethanol you can have problems where the engine will operate in an extreme lean condition, which can cause significant damage or even catastrophic failure. If the pick-up tube draws the gasoline, it will operate very poorly due to lower octane that is the result of no longer having the Ethanol in the fuel.

Gasoline containing Ethanol provides further challenges and dangers for marine operators (Boaters) and other users of seasonal equipment such as motorcycles, personal water-craft, snowmobiles, ATV's, RV's, yard maintenance, generators, and other equipment.

Ethanol is a strong, aggressive solvent and will cause problems with rubber hoses, o-rings, seals, and gaskets. These problems are worse during extended storage when significant deterioration will take place. Hoses will delaminate, o-rings will soften and break down, and fuel system components made

from certain types of plastics will either soften or become hard and brittle, eventually failing. Fuel system components made from brass, copper, and aluminum will oxidize to the point of failure.

Operators of boats with fiberglass fuel tanks built before 1993 can have actual structural failure as Ethanol will break down and pick-up some of the materials the tanks are made from. This causes two separate but equally serious problems. First the tanks can become so weakened that they can fail. In cases where the tank is part of the boats structure we have seen tanks become so weak that it is possible to collapse part of the deck just by walking on it. The second problem is that this material when dissolved from the fiberglass tank is carried through the fuel system and can cause damage to carburetors and fuel injectors and can actually get into the combustion chambers causing damaging deposits on valves and pistons. This material can be nearly impossible to remove without destroying the affected parts.

Two-Cycle engines have a special problem with Ethanol blended fuels. Two-Cycle engines function because the oil added to the fuel bonds to the engines metal surfaces and provides barrier lubrication to all the parts requiring lubrication. When Ethanol is added to the gasoline, it displaces the oil and forms a primary bond with the metal surfaces. This bond provides virtually no lubrication and can result in significantly increased wear and even catastrophic failure in a very short amount of time.

Until now the only preventative measures available to tank operators and end users was to try and make sure there was no water in the tank and that vents allowed a minimum amount of airborne water (humidity) into the tank.

Gasohol, E-10, E-20, and E-85 are the terms that refer to gasoline containing Ethanol. For example the most common fuel available today is E10. E-10 is 10% Ethanol and 90% gasoline, while E-85 is 85% Ethanol and 15% gasoline (Note: E-85 is actually E-70 in the winter in cold weather (Northern Tier) states.

Ethanol has less energy (as measure in Btu's – British Thermal Units) per gallon than does regular unleaded gasoline. This means that the more Ethanol found in fuel the worse your fuel economy will be. You use more gallons of fuel containing Ethanol to go fewer miles.

This poor fuel economy is made worse by other EPA and State requirements for fuels to change seasonally. Until very recently we have used what is known as "Conventional" gasoline (CVG) in the winter and "Reformulated gasoline (RFG) in the summer. The theory is that the lower volatility of RFG will reduce the formation of green house gases. However RFG has lower Btu's per gallon. RFG together with Ethanol results in a significant mileage penalty. My own vehicle drops about 2 miles per gallon or about 9% when using RFG with Ethanol.

For many years the refining industry used a chemical called MTBE to meet the oxygenate requirements set forth by the EPA. Generally refiners used 15% MTBE and 85% gasoline. However MTBE has now been virtually eliminated in the US due to its carcinogenic compounds and the huge potential problems caused by its pollution of as much as 75% of the ground water in the US and Canada.

This has left Ethanol as the primary additive to meet Federal and State oxygenate mandates.

Further the federal government currently subsidizes Ethanol with a $.51 per gallon tax credit that goes to the refiners or blenders. With E-10 this provides those refiners and or blenders with a $.051 per gallon subsidy on every gallon of gasoline that they sell.

In many cases we have seen gasoline containing more than 10% Ethanol. We test regularly and have seen fuel containing 12%, 13%, and even 14% Ethanol while the pump shows only 10%. Increasing the amount of Ethanol increases the refiner/blenders subsidy and profit while further lowering your fuel economy.

One more concern with Ethanol and RFG or Ethanol and CVG is that Ethanol when mixed with water; they readily form Gums in the fuel system much quicker than gasoline without Ethanol. These Gums coat fuel system components including filters, carburetors, injectors, throttle plates; and will then form varnish and carbon deposits in the intake, on valves, and in the combustion chamber. These deposits can coat sensors and plug catalytic converters.

The good news is that we now have products available to prevent and control Phase Separation and that we can dramatically reduce or eliminate most of the problems caused by Ethanol in Gasoline.

Because of all the problems with Ethanol Blended gasoline's we will list some specific suggestions and recommendations on how to deal with and resolve many of these problems.

When Phase Separation occurs in fuel tank on a vehicle, boat or other piece of equipment, the tank should be completely drained. The tank should be refilled with good fuel and the fuel line purged prior to restarting the engine.

For Seasonal vehicles and equipment, e.g. boats, personal water-craft, motorcycles, classic cars, ATV's, RV's, lawn and garden equipment, gasoline powered generators, and so on, we recommend that you try to use conventional gasoline without Ethanol whenever possible and particularly prior to storage.

In ALL Two-Cycle gasoline engines where there is any possibility that you are using gasoline containing Ethanol we strongly suggest using a full synthetic two-cycle oil in the gas.

In bulk storage tanks where you believe phase separation may have occurred or where you are concerned it may happen. We suggest the use of a modified water finding paste such is made by the Kolor Kut Company. This paste starts out brown, if you dip the tank with a measuring stick with the paste and it turns yellow (even light or spotty yellow), you have significant water dissolved in the fuel, if the paste turns red you have free water.

If you have fuel that has Phase Separated and you have either two or three layers you should arrange to have the tank pumped from the bottom to remove the one or two bottom layers containing the water and or the Ethanol/Water mix. (Note: you should check again with the paste before the technician leaves to be certain that all the Water and Water/Ethanol has been completely removed). You do not need to remove the gasoline. Check with water finding paste after 24 hours. If no red or yellow present then add clean fuel to the tank to working capacity.

If you have specific questions, please contact me here or at: fuelschool (at) roadrunner.com