

Ethanol Gas Safety Directive
Possible Change to New Gas Tank
Apollo Delta Jet AS-III912S
Apollo North America, Inc.
Aug 24, 2008
Requirement: Mandatory

Introduction:

Due to the passage of [Energy Independence and Security Act of 2007](#) in the US, and due to recent state mandates in various states, 10% Ethanol gas (also called E10) is becoming more and more common place in the United States, despite its ill effects on boating and aviation. This has affected many aircraft operations especially light aircraft which utilize auto gas generally. The following components may be affected by using 10% Ethanol gas:

- Fuel Tank
- Fuel lines and gaskets
- Engine gaskets and engine internal systems

Effect on each of these components is discussed and remedies and strategies recommended. It's required that owners of Apollo brand of aircraft read, understand and fulfill these requirements for continued safe operations of their aircraft.

Scope:

- All Apollo aircraft (general advise regarding E10 auto gas)
- Fuel tank should be changed on Delta Jet AS-III912 model in the United States if they are equipped with fiberglass fuel tanks. These tanks were used when E10 gas was not a factor; however, it has since become more and more common place.
- **The following serial numbered Delta Jets are required to change fuel tanks OR to stop using auto gas with Ethanol completely:**
USA0001
USA111106
USA101106
USA270306
USA200207

WARNING: Non-compliance with this directive may cause in-flight engine failure, destruction of aircraft and serious injury or even death

How to Comply:

Read this safety directive and become familiar with effects of E10 gas on the fuel system.

- Find out using your Rotax operator's manual or from an authorized Rotax service station in your area what percentage of ethanol is allowed by Rotax officially in the fuel being used and follow those guidelines. **Service Instruction from Rotax SI-912-016** talks specifically about fluids allowed to be used in Rotax engines and effects of alcohol in fuel on the engine in section 5 of the service instruction. This Service Instruction must be read by all users. It can be found here: <http://www.rotax-aircraft-engines.com/pdf/dokus/d03830.pdf>
- By September 30, 2008 for the above mentioned serial numbers (see scope) of Delta Jet model, change the fuel tanks and fuel lines by ordering the safety directive fuel tank and fuel line kit from the factory (e-mail apollonorthamerica@yahoo.com or call 813-786-8290, price is \$600 per kit) **OR**

- Immediately check via thorough visual inspection the condition of the fiberglass gas tank and fuel lines and filter and switch to using 100LL Avgas which requires shorter time periods (25 hours) for oil change and require that fully synthetic oil not be used. No use of auto gas will be allowed unless the fuel system is brought in compliance with 10% Ethanol use by changing it using new components from the factory.

Discussion:

There are a few points to keep in mind:

1. **Ethanol can affect fiberglass fuel tanks** if a certain Ethanol resistant resin is not used in making the fuel tanks. Fiberglass tanks can start dissolving in the presence of Ethanol, causing a dangerous situation and the dissolved resin can go right through fuel filters and over long use cause possible damage to engine internals. As such on the older Delta Jet trikes, the fiberglass fuel tank is questionable to use with auto gas that contains 10% Ethanol. A new fuel tank replacement kit is available for the listed serial numbers and the best thing for users of these aircraft is to utilize this replacement kit and replace the fuel tank and fuel lines which is all included in the kit and has been tested to be ethanol resistant.
2. **Rotax does not** currently allow use of 10% ethanol in fuel in their engines. Testing is underway at Rotax to determine what percentage will be allowed but currently 10% ethanol gas usage is against Rotax engine guidance. Refer to your Rotax engine manuals or Rotax service stations to determine the most current recommendation for percentage of Ethanol allowed in fuel.
3. Not only the engine but **also the whole fuel system**, including fuel tank, fuel lines and fuel filter should be compatible with 10% ethanol
4. Ethanol is an alcohol and **an excellent solvent and cleaner**. Thus at first when switching to ethanol based gas we have noticed a few observations. Auto gas generally builds a leftover layer of varnish in the tank and fuel lines; however, ethanol starts to dissolve this not only in the gas station underground tank where you get your gas but also in your own aircraft tank. As this layer dissolves, it can start to clog your fuel filter causing a fuel supply problem. This will last till the varnish is completely gone. Hence if you are just starting to use fuel with Ethanol in it, keep especially a close eye on your fuel filter. Change it after the first few tank fills of Ethanol based fuel are utilized just to be on the safe side. This is cheap insurance.
5. **Ethanol attracts water and keeps water suspended**. Water may not be able to be sumped during a preflight inspection because the water will blend with the ethanol. This water can separate from the fuel at higher altitudes and lower temperatures causing engine stoppage and fuel line freezing. It will not be guaranteed that water will make its way down to the bottom of the fuel system where it can be checked by draining (sump) from the quick drain fuel valve located in the belly of the aircraft in the pre-flight.
6. **Check for water by sumping in pre-flight**. This step is very important to get water accumulated at the bottom out in pre-flight and should be performed every time. If you find water when draining your aircraft drain, phase separation has

- probably occurred, and there is likely to be a significant amount of water/alcohol mix somewhere in your fuel system. Your engine will not run on this separated mix, so it shouldn't be allowed to make its way to the engine. In this case it's best to simply drain all the fuel if fuel blended with alcohol was being used and re-fill with fresh fuel before a take-off is attempted.
7. **What is phase separation?** The water molecules form an electro-chemical bond with the ethanol that is stronger than the fuel's original bond with the ethanol. Water is heavier than gas so the water/ethanol molecule is dragged to the bottom of the tank and separates from the more buoyant fuel molecules. This is referred to as phase separation and occurs when the water content in the fuel reaches roughly .5%. Ethanol provides a significant boost to the octane rating of the fuel, so when phase separation occurs you end up with a corrosive water/ethanol layer on the bottom of the tank, under what is now substandard fuel
 8. **Always use fresh gas.** This is most likely the best thing you can do to avoid many of the pitfalls of using E10. Use fresh gas and do not store E10 for more than two weeks. Buy when you fly.
 9. **Fuel filter.** We recommend a metal filter element of around 60 microns to allow suspended water to pass through the filter media and not get blocked by the filter causing a fuel starvation scenario after some time. Contact your local Rotax service station to obtain such a fuel filter recommended by them or you can get it from Apollo.
 10. **Corrosion and Rust.** Since Ethanol can attract water and hold it, it can cause corrosion or rust in the fuel system from the tank to the fuel fittings onwards into the engine, electric fuel pumps and inaccuracies in fuel level senders. This corrosion or rust should be prevented through use of good common sense practices. Thus we recommend that you use fresh gas as much as possible. Get the gas, use it and do not store it for long periods of time. We suggest no more than two weeks of gas storage as a general recommendation if using fuel with 10% Ethanol. Vented fuel tanks in humid conditions can easily allow moisture attracted to Ethanol into the tank causing problems.
 11. **Medium term storage.** We define this non use of aircraft for over a month, up to 3 months. In this case, try and use up or drain 10% Ethanol auto fuel, fill with 2 gallons of 100LL avgas and run the engine for about 15 to 20 minutes before you go away. You want to use up all auto fuel from the system and replace it with 100LL Avgas which has no Ethanol. Upon return simply use fresh gas of your choice to fill to desired quantity before flight.
 12. **For longer storage** please refer to Rotax engine manuals and your maintenance manuals.
 13. Fuel with higher percentage of Ethanol is also more prone to **vapor lock** compared to fuel without Ethanol as the aircraft climbs which occurs when fuel vaporizes in the fuel lines because of higher temperatures and/or reduced ambient pressure at higher altitudes. This is more important for completely covered engines where fuel line temperatures can get significant. Pilots operating in such hot conditions regularly should keep this fact about fuel with ethanol in mind and fly accordingly.

14. In most cases you will find that the **range and endurance of the aircraft will decrease** with use of higher percentage of Ethanol in your fuel.
15. In most cases you will find that your **exhaust gas temperatures (EGT)** will be higher as fuel with alcohol burns leaner than regular fuel.

Changing to new fuel tanks recommended for aircraft serial numbers listed in scope:

These new Aluminum welded fuel tanks are now standard and in fact increase the capacity of the fuel system by approximately 1 US gallon.

The fuel tank and fuel line change kit can be ordered by e-mailing contact info including phone number to call to apollonorthamerica@yahoo.com or by calling 813-786-8290

The price of this kit is \$600 plus shipping and has to be paid at the time of placing the order via a credit card. The kit will come with instructions on how the fuel tank can be changed. The change of the fuel tank should be accomplished on all S-LSA or production-LSA aircraft by a licensed mechanic or by someone with written authorization from the manufacturer. Experimental aircraft can be maintained by the owner and do not require licensed mechanics. However, common sense would dictate to only attempt this if you are confident that you are capable of doing this yourself. This is not a warranty item and as such the parts and labor are not provided for free. The serial numbers in questions were manufactured at a time when ethanol is fuel in the United States was not such a big problem but in the recent years many states have started to mandate that fuel suppliers start utilizing up to 10% Ethanol in the fuel supplied at auto fuel stations which unfortunately effects some aviation as well as boat users.