EAA

The Leader In Recreational Aviation

Dear STC Recipient:

Thank you for your application for the two Supplemental Type Certificates for your aircraft.

The Experimental Aircraft Association is very pleased to be able to provide you with these STCs. Enclosed you will find your supplement to your flight manual, supplemental type certificates, and placards.

It is our hope that our efforts have helped you. If you have further questions, please do not hesitate to contact the STC Department at (920) 426-4843.

Sincerely,

EXPERIMENTAL AIRCRAFT ASSOCIATION, INC.

EAA
The Leader in
Recreational Aviation

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FAA - GREAT LAKES FORM
GL 8000-3.6 (1-77)

AN ACCIDENT PREVENTION PROGRAM SAFETY SUGGESTION

DEPARTMENT OF TRANSPORTATION

FUEL CONTAMINATION

WATER IS THE PRINCIPAL CONTAMINANT OF AVIATION FUEL. THE ACTUAL CONTAMINATION OCCURS THROUGH:

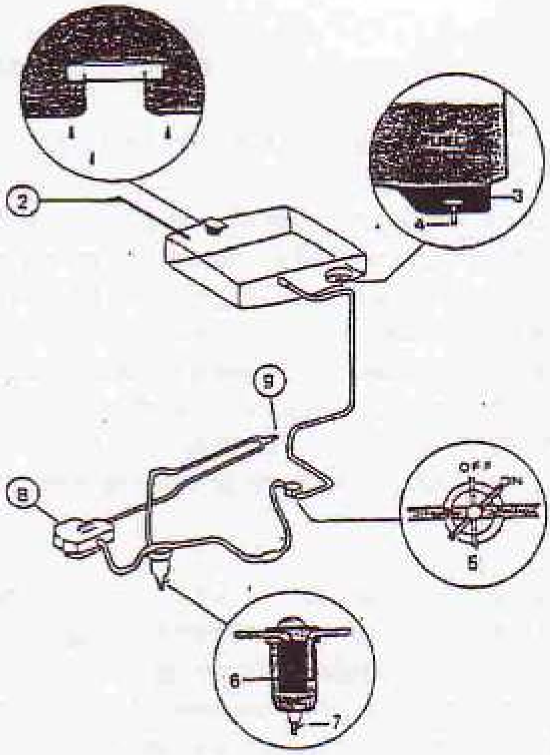
1. CONDENSATION. Occurring in partially filled aircraft fuel tanks and in storage and dispensing facilities such as underground tanks and fuel truck tanks.

2. ENTRY OF OUTSIDE MOISTURE. Such as rain or snow entering through the aircraft tank gauge or vent system.

REMEMBER

For a safe flight, drain fuel sumps at each preflight (and drain fuel screens as recommended by aircraft manufacturer) to prevent water contamination.

After refueling it is wise to wait about 20 minutes because it may take that long for water to settle low enough to show up at the sumps. If this is not feasible, make takeoff on a tank that has not been added to.



1. Fuel Filler Cap
2. Fuel Vent
3. Sump
4. Sump Drain (Use Of Quick Drain Recommended
5. Fuel Selector
6. Fuel Screen
7. Fuel Drain Valve (Usually Quick Drain Valve)
8. Carburetor
9. Primer

Simplified gravity feed high wing fuel system. Low wing fuel systems require engine driven fuel pump and an auxiliary fuel pump. (Usually electrically operated).

GPO 819-963

FIELD INFORMATION NO. 301

AUTOMOBILE GASOLINE FOR AIRCRAFT

More than 65 percent of the privately owned, single-engine, piston fleet of aircraft in the United States still utilize 80 octane rated gasoline. There are several incentives for investigating the use of automobile gasoline rather than 100 low lead (100LL) aviation gasoline. The first is simply availability. Finding 80 octane is getting more and more difficult. When it is unavailable, then 100LL aviation gasoline must be used. When 100LL is used in place of 80 octane or automobile gasoline in engines rated for 80 octane fuel, there is a considerable increase in the cost of operation as outlined in FAA Advisory Circular AC 91-33. Field experience has substantiated that there is improved reliability when using automobile gasoline as opposed to 100LL as reported in the ASTM Report No. STP 1048.

When using unleaded regular automobile gasoline instead of 100LL aviation gasoline, the savings are made up of two parts: first, the lower price of the gasoline itself, which can be as much as $1.00 per gallon less; second, but even more significant is the savings from the reduced cost of maintenance. Test work done years ago by Embry-Riddle Aeronautical University indicated that today the added maintenance cost of using 100LL aviation gasoline would be approximately $10.00 an hour for a Cessna 150. With an airplane having a 230 hp engine, however, the savings when using automobile gasoline, considering maintenance, cost reduction, and direct operating cost reduction, could easily amount to more than $35.00 per hour of operation.

As more and more aircraft become approved to use automobile gasoline, it is anticipated that the incentive will increase for additional fixed base operators to provide it at the airport. Obviously, we cannot expect them to compete with high volume cut rate automobile gasoline retailers on the street; and we should expect to pay some additional cost for the convenience of having automobile gasoline available at the airport.

The best source from a reliability, safety and convenience standpoint is the fixed-base operator on your airport. Unfortunately, in the past, FBO insurance companies were reluctant to extend coverage because of the temporary restriction the FAA had placed on the use of automobile gasoline in air taxi operations (FAR Part 121). This restriction was removed in 1992 and the use of automobile gasoline in STCed aircraft is completely approved for ALL flight operations. With this clarification, we expect to see an increase in the number of FBOs offering automobile gasoline on the airport. The FAA publication, *Airport Facility Directory*, provides information on airports having automobile gasoline available.

STC COMPLIANCE

EAA STC approvals are for the use of unleaded regular automobile gasoline, **excluding gasoline containing alcohol**, manufactured to the ASTM Specification D-4814 (American Society of Testing Materials, 1916 Race St., Philadelphia, PA 19103). Specification D-4814 superseded Specification D-439.

According to FAA Advisory Circular 23.1521-1b, "Automobile gasoline not containing alcohol or other oxygenates, conforming to D-439 and D-4814 are essentially identical and may be used interchangeably." (Most STCs still read "D-439.") Specification D-4814 added the definitions and requirements for the use of alcohol and ether additives.

In most states, the law requires compliance with D-4814 or its equivalent. Major fuel suppliers, those who generally have their name on the product from well head to retailer, can be expected to comply since this is a rather broad specification and in wide use. The Department of Energy Reports, which are issued twice a year, show that most fuel in the United States conforms completely to the specification requirement, and in those cases where there is some excursion, it is in non-critical areas. For example, the octane requirement for most regular automobile gasoline is 82; however, even though some automobile gasoline has tested lower than 82 octane, no automobile gasoline has tested lower than 80 octane.

If further reassurance in necessary, a sample of gasoline to be used can be taken to a state testing lab, or a state university to obtain a chemical breakdown to confirm compliance with the specification. There is usually a nominal fee. The American Petroleum Institute publishes a survey of state laws indicating which states require compliance by law. In 1993, 42 states and the District of Columbia required compliance with D-4814, and/or have written their own requirements similar to Specification D-4814.

Product exchange arrangements among oil companies require conformance to at least D-4814 specification requirements. It simply is not practical for oil companies to market nonconforming fuels in a limited market area.

Gasoline manufacturers have internal specifications, which are more restrictive than ASTM specifications, to ensure meeting these requirements which represent minimum characteristics of automobile gasoline. The following is a list of states in 1993 requiring compliance with ASTM D-439/D-4814 in whole or in part for the sale of automobile gasoline within the states, and also states that require critical specification values. The source of this information is "The Impact of U. S. Environment Regulations on Fuel Quality," issued by ASTM. For the most current information, contact ASTM. Your library will have the address of the closest office.

Alabama	Arizona	Arkansas	California
Colorado	Connecticut	Delaware	District of Columbia

Florida	Georgia	Hawaii	Idaho
Illinois	Indiana	Iowa	Kansas
Louisiana	Maine	Maryland	Massachusetts
Michigan	Minnesota	Mississippi	Missouri
Montana	Nevada	New Jersey	New Mexico
New York	North Carolina	North Dakota	Oklahoma
Rhode Island	South Carolina	South Dakota	Tennessee
Texas	Utah	Vermont	Virginia
Washington	Wisconsin	Wyoming	

As with any Supplemental Type Certificate, there is a requirement for an aircraft mechanic to inspect the aircraft to ensure compliance with the terms of the STC, and an IA mechanic must execute FAA Form 337 for both the airframe and engine and forward this to the FAA. At the present time, there are no requirements for mechanical changes in either the airframe or the engine, to use automobile gasoline. However, changes are required for modifying the Lycoming 0-235-L2C and -K2C to lower the compression ratio and reduce the 100 octane rating to 80, thus permitting the use of automobile gasoline. This must be done under a separate STC, which is included with the STC for this engine installation.

The EAA's type certification test program has resulted in FAA approval for nearly all 80 octane Teledyne Continental Motors engines, from the A-40 up through the 0-470, and most Lycoming engines from the 0-235C series through the 0-540B series. It should be recognized that in some aircraft where fuel systems are complex and have characteristics which may lead to vapor formation with higher volatility automobile gasoline, there may have to be changes made in the fuel delivery system to permit safe operation with this fuel. Engineering flight tests are needed to determine what changes, if any, are required for specific aircraft applications.

FUELING SAFETY

A question frequently asked is, "Is it all right to fuel my airplane using five gallon cans?" The answer is "yes," but you must know it is risky business to handle gasoline in this manner. There is an added risk of contamination when putting gasoline into your aircraft. Fuel contamination with aviation gasoline or automobile gasoline, or any fuel is a significant safety problem in aircraft. Using five-gallon cans exposes you to the possibility of contaminating with rust or perhaps solder droplets from brand new cans and, in particular, from water formed by condensation or water otherwise entering the fuel system. Our recommendation, when this method of fueling must be done, is to take extreme care in making sure no water or other contaminant is put in your airplane fuel tank. Farm stores sell large funnels with flanges that will screw on your gasoline tank inlet to support the funnel and at the same time provide a 100-mesh stainless steel screen. This should help ensure the absence of water in the fuel tank. The problem still remains, as with all aircraft and fuel systems, of possible condensation forming enough water in the fuel tank to cause a problem.

The recommended practice has been to leave the fuel tanks full whenever possible in the small aircraft we fly. We highly recommend reading FAA Advisory Circular AC 20-43 regarding the contamination of aviation fuel.

Caution: Do not use fuel which contains alcohol. It is not compatible with all materials in your fuel system and will cause malfunction of the fuel delivery system, reduce your aircraft range and aggravate the contamination problems and vapor lock potential.

For further information please contact:

EAA - Automobile Gasoline STC
EAA Flight Research Center
P.O. Box 3065
Oshkosh, WI 54903-3065
Phone: (414) 426-4843
Fax: (414) 426-4881

FIELD INFORMATION NO. 302

WHY ARE TWO STCs NECESSARY FOR MY AIRCRAFT?

Two STCs are needed because there are two main parts to your airplane - the engine and the airframe. The engine must be able to use the fuel with no problems. The airframe must be able to deliver the fuel to the engine with no problems. Modified aircraft and engines must at least duplicate original testing applicable to each to achieve FAA certification. "STC" stands for FAA Supplemental Type Certificate.

EAA chose to do more than required in the Federal Air Regulations and also selected the longer 500-hour flight test for approval rather than the 150-hour engine block testing. The Cessna 150 program extended over 24 months and included periods of hot weather and cold weather testing, with seasonal variation in automobile gasoline volatility. The Cessna 172 program included about 750 hours of FAA supervised pipeline patrol operation.

The FAA defined the change in fuel from aviation gasoline to automotive gasoline as a major change. Therefore, under present Federal Air Regulation, supplemental type certification is required for the engine itself and for the airframe. Part of the responsibility of the IA mechanic completing the FAA "337 Form" is to ensure that the aircraft and engine conform to the original FAA Type Certificate and no changes have been made which would be unsuitable for incorporating the automobile gasoline STCs.

When you sell an airplane with an EAA STC, please be sure to convey all STC documentation to the new owner(s) and ask that individual to notify EAA of the new ownership.

If you have purchased an airplane that already has an EAA STC, check for the log book entry, the FAA 337 Form, the appropriate placards, and a full set of information sheets from EAA. Advise EAA of the new ownership. EAA maintains an N-number record so that you can be kept up-to-date on new developments. Contact EAA if your information package did not come with your airplane. We will be glad to provide another copy at a nominal cost.

FIELD INFORMATION NO. 303

DETONATION, AKI AND OCTANE NUMBER

The number which is posted on automobile service station pump is not a true octane number. It is what is called an "antiknock index" number (AKI). This number is the average of two octane numbers arrived at by two different kinds of tests. One is called ASTM Research Method and is often abbreviated R or RON. The other is the ASTM Motor Method, M or MON. The antiknock index number on the pump is then this average, or R + M divided by 2 = AKI. A rule of thumb is that the Motor Method octane number (MON) is approximately five points less than the AKI. The significance of the MON is that this is identical to the octane number for aviation gasoline.

Specification D-4814 (previously D-439) for automobile gasoline requires a minimum of 82 MON when the posted number is 87 AKI or more. When the EAA requested approval from the FAA, the request was for an AKI number or 87 to insure a safety margin of 2 octane numbers over the approved rating for aviation gasoline for these 80 octane engines.

DETONATION

Denotation will not be a problem when using any grade of automobile gasoline with an aircraft engine approved for use of 80 octane fuel.

The Department of Energy's (DOE) semi-annual report giving data on gasolines selected at random throughout the United States shows that for more than 20 years, the lowest octane number measured for automobile gasoline in the U.S. has been more than 80 octane by the Motor Method, which is the same as the aviation method. So for 80 octane aircraft engines, the octane rating of even the lowest octane automobile gasoline is more than adequate.

THE AKI IS ONLY 85 IN SOME STATES. IS THAT A LEGAL FUEL?

No. The octane number requirement for any engine is reduced with reduced ambient temperatures and increased altitude. Therefore, mountain states are permitted to market fuel at lower octane numbers than others. In terms of the STC, the approved fuel must have an 87 antiknock index rating. This may mean that sometimes in mountainous states premium fuel should be used. In this case, the minimum octane number, according to DOE surveys will be at least 84 MON (equivalent to aviation gasoline octane number). Using regular automotive gasoline with an 85 AKI could possibly result in a minimum octane number of 79.1 MON. This difference is probably not significant, but in order to maintain a larger conservative margin, EAA requested approval for automobile gasoline with a minimum 87 AKI to insure 82 MON.

FIELD INFORMATION NO. 304

IS VAPOR LOCK A PROBLEM WITH UNLEADED AUTOGASOLINE?

Vapor lock is always a problem to consider regardless of what kind of fuel is being used. Vapor lock has occurred under some conditions while aircraft were using aviation gasoline.

When using automobile gasoline, vapor lock is an important consideration because automobile gasoline has been designed to facilitate engines starting in the winter time and thus has a higher volatility. In the test work done by the EAA, this winter fuel of higher volatility was used in the high summer ambient temperatures. This combination represents the most adverse conditions for the formation of vapor lock.

There are other important considerations such as the effect of high ambient temperatures, very high engine operating temperatures under conditions of takeoff with high volatility fuel, and the complexity of the fuel system (many bends and fittings). All of these factors and many more effect the liklihood for vapor lock.

When a fuel is heated, vapor is driven off, which in turn reduces the volatility of the remaining fuel. As an aircraft sits on the ramp, the fuel tanks are heated and vapor is vented out reducing the vapor pressure. In EAA's test work, it was necessary to refrigerate fuel before loading the aircraft fuel tank to ensure a high volatility for the test. Then while attempting to keep the fuel cool and the airplane hot, flight tests demonstrated satisfactory performance of the fuel system during the critical takeoff period. Tests were also satisfactorily completed using the same high volatility fuel heated to 110 degrees Fahrenheit.

Another area of concern is high altitude vapor lock. All EAA flight test programs have included an evaluation of the adverse combination of volatility and temperatures, plus demonstrated climbs to the service ceiling of the aircraft, (which in the case of the Cessna 182 was 21,034 feet density altitude), and to also include some periods of cruise at altitudes above 7000 feet. Each airplane that we have flown in our 500-hour flight test program successfully completed these tests.

ASTM specification defines gasoline RVP (reid vapor pressure) for classes of A through E in areas of the country for various seasons. Any class gasoline, A through E, is approved for any season anywhere in the United States.

Automobile gasoline volatility has been generally higher than aviation gasoline volatility. If critical operating conditions, as mentioned, reach extremes vapor lock can occur earlier with automobile gasoline than with aviation gasoline. Operation conditions that encourage the formation of vapor in aviation or automobile gasoline are those which raise the under-cowl temperatures to extremes and provide a source for the transfer of excessive heat into the fuel lines.

After any prolonged period of heat soak (e.g., hot day ground idling or engine restart a short time after a long period of engine operation), perform full power check before taking off. Ensure recommended fuel pressure is indicated on aircraft so equipped. Follow this precaution also with aviation gasoline.

At the present time in most U.S. metropolitan regions, the EPA limits the volatility of automobile gasoline to about the same as 100LL aviation gasoline. In California as of June 1, 1996, regular automobile gasoline, with the exception of gasoline that has alcohol, is for all practicle purposes identical to 80 Grade aviation gasoline. Future automobile gasoline changes to meet EPA requirements find both aviation gasoline and automobile gasoline approaching identical characteristics with the exception of meeting the 100 octane rating. Oxygenates required in these urban areas are primarily Methly Tertiary Butyl Ether (MTBE) and ethonal alcohol. Alcohol additives, other than some de-icing fluids, are not approved by the FAA.

FIELD INFORMATION NO. 305

OXYGENATED GASOLINE

The following are a series of questions being asked by automobile gasoline STC users because of the confusion caused by the introduction of oxygenated gasoline in some major cities.

WHAT IS OXYGENATED GASOLINE?

Oxygenates include a broad range of alcohols and ethers. While there are several alcohols and ethers that are being used in unleaded gasoline, two such components, Methyl Tertiary Butyl Ether (MTBE) and ethanol have seen significant level of commercial use. Another ether used is Ethyl Tertiary Butyl Ether (ETBE) and it to has been tested by EAA and approved by the FAA. All alcohols and ethers add oxygen to the gasoline.

WHY ARE THEY OXYGENATING OUR GASOLINE?

EPA has required the use of oxygenates because it reduces exhaust emissions of carbon monoxide.

WHAT IS MTBE?

MTBE is manufactured by the chemical reaction of methanol and isobutylene. It has been a blending agent in gasoline to raise the octane number for over 20 years. The conversion of methanol to MTBE eliminates the unfavorable characteristics associated with alcohols, such as materials compatibility problems, water tolerance and corrosive action. More recently, MTBE has been classified as an oxygenate by the EPA.

IS IT SAFE TO USE GASOLINE WITH MTBE?

Yes, all industry and FAA testing to date indicate no safety problem. EAA believes, but cannot prove, that MTBE was in the automobile gasoline in our initial STC testing in the early 1980s. MTBE was not an issue at that time, so its presence was not determined. You might notice a slight leaning of the mixture when using gasoline with MTBE.

IS GASOLINE WITH MTBE OR ETBE OKAY UNDER THE EAA STC?

Yes! On December 14, 1992, EAA received clarification from FAA that: "Automobile gasoline blended with MTBE is approved for use in aircraft that are approved for use of automobile gasoline STCs." EAA, Petersen Aviation and others have worked with the FAA to have MTBE "approved" based on the common industry knowledge that it has been in automobile gasoline for years. FAA's determination that gasoline blended with MTBE can be used safely in aircraft (that are STC approved) was based, in part, on FAA tests, research and review of service difficulty reports. No material compatibility or performance problems were found. The FAA also approved the use of automobile gasoline that contains ETBE on December 1, 1995. This approval was based on flight test, ground tests and material compatibility test performed by EAA, FAA and Petersen aviation.

WHAT IS ETHANOL AND CAN I USE IT IN MY AIRCRAFT?

Ethanol is often confused with methanol. These two alcohols have distinctly different characteristics; however, **all STCs prohibit the use of gasoline containing alcohol** - either methanol or ethanol.

ARE ALL PARTS OF THE COUNTRY BEING AFFECTED OR IS THIS AN ISOLATED SITUATION?

Most highly populated areas of the country are affected by oxygenates, because they have not yet achieved the required standards for air quality. Because of production volumes and distribution systems, the use of oxygenated fuels sometimes spreads beyond these specific areas.

HOW DO I FIND OUT IF MTBE, ETHANOL AND OTHER ADDITIVES HAVE BEEN ADDED TO MY FUEL IF MY STATION ATTENDANT DOES NOT HAVE THE INFORMATION?

Only with laboratory testing can you tell the make up of your fuel. However, currently the only additives that is not approved is alcohol. EAA has published a simple procedure to test for alcohol, which is practical to use at your airplane and includes this instruction sheet with every STC. These instructions are in EAA Field Information No. 306.

SO IS MY AUTOMOBILE FUEL STC WORTHLESS?

No, it's just limited to gasoline that does not contain alcohol. If you live where state law requires the addition of ethanol (alcohol) to gasoline for political reasons (ethanol is made from corn), either a source of alcohol-free fuel must be found, or aviation gasoline must be used. All STC information clearly spells this out.

WHAT IS EAA DOING ON THE WHOLE QUESTION OF GASOLINE ADDITIVES?

EAA is continualy testing new fuels and fuel additives to ensure that STC owners will continue to be able to use automobile fuel. However, based on earlier testing by EAA and the FAA, we believe that extensive modifications would be necessary to use gasolines that have alcohol as an additive; therfore, we are no longer testing for the approval of any alcohol additives.

FIELD INFORMATION NO. 306

FIELD TEST FOR DETERMINING PRESENCE AND AMOUNT OF ALCOHOL IN GASOLINE

EXPERIMENTAL AIRCRAFT ASSOCIATION, INC. (EAA) appreciates the permission of Conoco, Inc. to base this field test procedure on one developed by the company.

SCOPE

This method determines the amount, if any, of alcohol present in gasoline. This test is designed specifically for field-testing where time and simplicity are important factors.

SUMMARY OF METHOD

A sample of gasoline is shaken at room temperature with an amount of added water. The volume increase of water is proportional to the amount of alcohol initially in the fuel sample. Nine (9) parts of the gasoline sample are combined with one (1) part water.

APPARATUS REQUIRED FOR EITHER OF THE METHODS BELOW

GRADUATED CYLINDER METHOD

One (1) each one thousand milliliter (1000 ml) clear Pyrex or shatter-resistant glass graduated cylinder OR transparent chemical-resistant plastic (such as TPX) graduated cylinder. (These can be purchased from laboratory or chemical equipment suppliers.)

MEASURING CUP METHOD

One (1) each 2-quart clear pyrex, glass, or chemical resistant plastic container. One (1) each 4-fluid-ounce measuring up (1/2 cup). One (1) each 32-fluid-ounce measuring cup (1 quart).

PREPARATION

Clean Containers.
On the 2-quart container, mark the level of exactly four (4) fluid ounces (1/2 cup) permanently on the side (a piece of masking tape can be used).

PROCEDURE

GRADUATED CYLINDER METHOD
To 9 parts of gasoline (900 ml), add 100 ml of water for a total of 1000 ml in the graduated cylinder. Shake thoroughly, let stand for 10 minutes or until gasoline is again bright and clear. Record the apparent level of the line between the gasoline and water. This "Final Volume" is used in the calculation below.

MEASURING CUP METHOD

To nine (9) parts of the gasoline sample (36 ounces or 1 quart plus ½ cup), add 4 fluid ounces (1/2 cup) of water for a total of 40 fluid ounces in the 2-quart container. Shake thoroughly, let stand for 10 minutes or until gasoline is again bright and clear. Record the apparent level of the line between the gasoline and water.

The Measuring Cup Method is intended to indicate the presence of alcohol and is not practical to evaluate the amount of alcohol. If the final line between gasoline and water is measurably higher than the ½ cup mark, the presence of alcohol is indicated.

NOTE: Erroneous results are probable if sample and water are not thoroughly shaken and mixed.

CALCULATION

GRADUATED CYLINDER METHOD

Note the final volume and calculate the percentage of alcohol in the sample using the following calculation: Percentage of Alcohol in Gasoline = (Volume – 100 divided by 900) X 100.

Where: V = "Final Volume" of water as determined in procedure above (read at separation line between water and gasoline).

PRECISION

Within +/- 1% alcohol if you measured and recorded accurately.

ACTION TO BE TAKEN

In the opinion of EAA, and in the interest of most conservative operations, the following observations are offered:

If alcohol content is less than 1%, fuel will probably have no effect on aircraft.

If fuel contains up to 5% alcohol, caution must be exercised. Do not permit it to remain in tanks or fuel system for more than 24 hours, then drain and refill with alcohol-free fuel, ensuring that no alcohol concentration remains in fuel lines or sump. Vapor lock may be a problem. DO NOT FLY.

If alcohol content is more than 5%, DO NOT FLY. Drain the fuel system, flush all parts, replace with clean alcohol-free fuel and run up engine long enough to exchange fuel in carburetor bowl.

KNOWN PROBLEMS

Alcohol attacks some seal materials and varnishes on cork floats of fuel level indicators. This could cause leakage of seals and release particles of varnish from floats, causing blocked screens in fuel lines or blocked carburetor jets. Excessive entrained water carried by alcohol could lead to fuel line blockage or blockage at screens or values when operating at low ambient temperatures at ground level or at high altitude. Fuel volatility is also increased with the addition of alcohol in a manner that is not detected by the Reid Vapor Pressure test, which is used to determine if a fuel meets the automotive specification. For example, a gasoline with alcohol will meet the Reid Vapor Pressure limit of 13.5 psi but it will behave as though it has a volatility of roughly 20 psi. Gasolines with alcohol will also phase separate. Phase separation occurs as the gasoline/alcohol blend cools, such as when a plane climbs to a higher altitude. When water that is absorbed in the fuel by alcohol comes out of solution, it takes most of the alcohol with it. The quantity that comes out of solution cannot be handled by the sediment bowl and tank sumps. Furthermore, if the alcohol is used to raise the octane of the base gasoline, the gasoline that remains will not have sufficient octane to prevent detonation. A good reference for this phase separation problem is: Paul Corp., Laboratory Investigations into the Effects of Adding Alcohol to Turbine Fuel, DOT/FAA/CT-TN88/25 July 1988, FAA Technical Center, Atlantic City International Airport, NJ 08405.

PRECAUTIONARY

Gasoline is volatile, extremely flammable and harmful, or fatal if swallowed. Avoid prolonged or repeated breathing of vapor or contact with skin or eyes. If swallowed, do not induce vomiting, get medical care immediately.

FIELD INFORMATION NO. 307

MATERIALS AND COMPABILITY ISSUES

SWELLING OF BENDIX CARBURETOR FLOAT NEEDLE VALVES IN CONTINENTAL A-65 SERIES THROUGH C-90 SERIES ENGINES

Some neoprene tipped float needle valves with either automobile gasoline or 100LL aviation gasoline may cause continual leaning unknown to the pilot, contributing to possible engine damage. This unapproved needle valve may be labeled with Bendix P/N 390077 either engraved or stamped. If the unapproved part is suspected, refer to Bendix Service Bulletin ACSB-84.

POTENTIAL DETERIORATION OF MARVEL-SCHEBLER CARBURETOR FLOATS

Any aviation or automobile gasoline may cause deterioration of the cellular plastic floats in Marvel-Schebler carburetors resulting in any of the following: flooding of the carburetor, rough engine at low power settings, inconsistent engine shutdown, and fuel dripping from the carburetor after shutdown. If symptoms occur, contact an A&P mechanic. Regardless of the fuel used, these floats should not be reused and should be replaced.

POSSIBLE SEPARATION OF GASOLINECOLATOR RUBBER PLUNGER

The rubber plunger in the gasolinecolator drain assembly in some Cessna models may separate from the metal shaft, causing a potential leak. This problem caused by either aviation or automobile gasoline has been reviewed by the manufacturer. Inspect for proper fit and check for new parts availability.

POTENTIAL ATTACK OF VARNISH ON OLD CORK FUEL TANK FLOATS

Cork floats in older aircraft were coated with a varnish sealant. One hundred low lead (100LL) aviation gasoline and automotive gasoline may have higher aromatics than 80 octane aviation gasoline and may attack old varnish. This leads to problems of gasoline absorption by the cork, and particles of varnish getting into the fuel system and possibly plugging metering jets in the carburetor.

If your fuel system has been performing satisfactorily with long-term use of 100LL aviation gasoline, then it should be satisfactory with no changes using automotive gasoline. Inspect floats and, if indicated, recoat with polyurethane-type varnish (Use 2-part urethane varnish such as Stits UV-550).

FIELD INFORMATION NO. 308

ENGINE OVERHAUL - MAJOR OR "TOP ": USE OF UNLEADED AUTOMOBILE GASOLINE IN FRESHLY OVERHAULED ENGINES

The purpose of this bulletin is to explain the procedure for the use of unleaded automobile gasoline in new or freshly overhauled engines where the valves have been refaced. There have been reports from the field of valve sticking or actual valve/valve seat damage when unleaded automobile gasoline was used in some freshly overhauled engines that have previously used automobile gasoline successfully for long periods. Subsequent valve problems occurred in as little as 10 hours of engine operation.

Small engines from the 1940s were designed for fuels with octane ratings of 63 to 73 octane. These fuels contained no lead at that time. There were valve sticking problems in some engines which were resolved by the manufacturer issuing service instructions to change the valve seat angle and to replace soft valve seats with hard seats. This had been done so many years ago that there is little likelihood of an engine still in existence which has the original soft seats and old valve seat angles. Thus aviation gasoline, with its very high lead content (approximately 2.0 grams/gallon) compared to the need for these engines, had caused many problems as outlined in AC 91.33. Note that grade 80 aviation gasoline for which these engines were initially approved, has a **maximum** allowable lead content of approximately 0.5 grams/gallon and may be supplied with zero lead content.

Engine manufacturers, in order to minimize valve problems caused by the excessive lead content of 100 low lead aviation gasoline, have increased valve stem diameters and added hardened inserts for the valve seats. Both of these changes favored the use of a gasoline with a very low lead content also, and as pointed out above, showed normal wear characteristics in the EAA's 500-hour flight test program.

As indicated in June 1985 issue of SPORT AVIATION, a Continental Motors Special Service Bulletin M46-2, dated November 25, 1946, addressed this situation. An investigation by Continental Motors revealed that the "absence of lead from the fuel has resulted in the 'picking up' or 'welding' of the valve seat to the valve." (Remember, at that time, high quality gasoline was "white gasoline" - with no lead content.)

The special bulletin goes on to say that "there is nothing wrong with either the gasoline or valve materials, but that the two will not work together except after a protective coating is deposited on the valve and seat contact surfaces by use of leaded fuel for the first two or three hours of life of the new engine or an engine in which the valves have been refaced, after the initial 'lead treatment,' however, no valve trouble should be encountered and operation should be better with the 73 or 80 octane clear gasoline than with the war and prewar leaded fuels." Since that time, TCM has changed valve and seat angles for further improvement.

Although this procedure was not used during our flight test program and none of the above mentioned valve problems were experienced, we recommend operating on leaded fuel immediately after engine service involving the valves.

EAA members report that their experience indicates that 10 hours of operation on leaded fuel (100LL aviation gasoline, not "leaded" regular automobile gasoline, which now has no lead content) is a more conservative program.

Experience has shown greater extended life and more time between overhauls with the use of unleaded automobile gasoline. EAA had more than 500 hours of flight test time on each of the following aircraft when EAA's STCs were issued: Cessna 150 with a Continental engine, Cessna 182 with a Continental engine, Piper Cherokee PA-28-140 with a Lycoming engine, and a Cessna 172 with a Lycoming engine. A Cessna 172 in pipeline patrol satisfactorily flew a supervised 1,200 hours observed by FAA. All aircraft performed very satisfactorily in actual flight tests for EAA and FAA. Engine teardown inspection by an independent engine shop and witnessed by FAA representatives indicated no adverse wear problems with the use of unleaded automobile gasoline.

FIELD INFORMATION NO. 309

REFORMULATED GASOLINE IN THE FUTURE

The performance of automobile gasoline today reflects the EPA's goals for the environment and the Federal Government's goal for reducing our dependency on petroleum imports.

The resulting developments are leading to a gasoline that is increasingly even more favorable for use in aircraft.

Planned changes will enhance octane levels, reduce volatility and the potential for vapor lock, and improve and monitor overall quality. We can expect improved power plant reliability and durability. We can also expect more reasonable costs and availability afforded by a motor gasoline pool used by tens of millions of vehicles - compared to today's aviation market, costs and supply lines for the less than 250,000 gasoline engine powered aircraft.

While all of us would like to see the unrestricted use of any gasoline, the Supplemental Type Certificate will be with us for the foreseeable future. There is an extreme age span in our airplanes which leads to a range of materials used. Most materials, however, are at least post - World War II, and for general aviation aircraft, follow automobile practice. In order to keep up, we must be sure of continued materials compatibility - and that usually means recertification, or STCs from the FAA.

Changes already mandated by the EPA require the addition of "oxygenates" to gasoline to provide reduced harmful emissions from all piston engines. The most widely used oxygenates today are MTBE (an ether compound) and ethanol (an alcohol). The amount used is limited by the EPA to that which adds approximately three percent oxygen content to the gasoline, which is equivalent to about 15 percent MTBE or 10 percent alcohol by volume.

MTBE as well as another ether, ETBE, have been the subject of satisfactory performance testing by the FAA. We believe that MTBE was a blending agent in some of EAA's flight testing in the early 1980s. At that time, the test fuels were analyzed only for conformance to the ASTM specifications D-439 and octane quality, and not for the presence or content of MTBE. The FAA considers the addition of MTBE or ETBE to automobile gasoline to be acceptable for use by aircraft having an STC for the use of automobile gasoline.

EAA continues to represent general and sport aviation on the ASTM subcommittees responsible for the automobile gasoline specifications (D-4814) and the aviation gasoline specifications (D-910) and monitors proposed changes to ensure as prompt as possible action to permit the continued use of existing STCs.

In the future, we believe that the complete elimination of lead in gasoline will lead to a high-octane aviation fuel derived from an automobile gasoline base and containing higher percentages of MTBE or an equivalent blending agent. Any overseeing, which is now lacking in aviation gasoline, is provided today by the EPA in automobile gasoline and will ensure quality and consistency in the future.

FIELD INFORMATION NO. 310

IS IT ALL RIGHT TO MIX AVIATION GASOLINE AND AUTOMOBILE GASOLINE?

Aviation gasoline and unleaded automotive gasoline may be mixed in any proportion. Any mixture containing unleaded automotive gasoline in the aircraft must be handled in accordance with the placards or precautions established for unleaded automotive gasoline.

CAN AN AIRPORT STOP ME FROM FUELING MY OWN AIRCRAFT?

An airport cannot stop you from fueling your aircraft and continue to be eligible for Federal aid. It may however, require that you conform to its safety regulations.

In accordance with guidelines per FAA AC 150/5190-2A, section 4.d, "Any unreasonable restriction imposed on the owners and operators of aircraft regarding the servicing of their own aircraft and equipment may be considered as a violation of agency policy. The owner of an aircraft should be permitted to **fuel**, wash, repair, paint, and otherwise take care of his or her own aircraft, provided there is no attempt to perform such services for others. Restrictions, which have the effect of diverting activity of this type to a commercial enterprise, amount to an exclusion right contrary to law. Local airport regulations, however, may and should impose restrictions on these activities necessary for safety, preservation of airport facilities and protection of public interest. These might cover, for example, restrictions on the handling practices for aviation fuel and other flammable products, such as aircraft paint and thinners, requirements to keep fire lanes open, weight limitations on vehicles, and aircraft to protect pavement from over stress, etc."

CAN ALCOHOL, METHANOL AND ETHANOL BE USED?

Do not use fuel which contains methanol or ethanol. They are not compatible with materials in your fuel system and will cause malfunction of the fuel delivery system. There is a simple test to determine significant alcohol content in fuel. EAA Field Information No. 306 provides details on how to do it yourself.

The FAA has tested Methyl Tertiary Butyl Ether (MTBE) and found no harmful effects in aircraft engines and typical fuel systems at various concentrations up to 100 percent MTBE. (Reference: Report DOT/faa/CT88/05 "Alternate fuels for General Aviation Aircraft with Spark Ignition Engines."). As of late 1992, FAA clarified the policy allowing the use of MTBE for STC-approved installations. As of December 1995, the FAA has also tested and approved Ethyle Tertiary Butyl Ether (ETBE). See EAA Field Information No. 305.

WHY IN THE EXHAUST STACK OF MY ENGINE BLACK WITH SOOT AFTER USING AUTOGASOLINE?

A black soot is the natural by-product of burning unleaded gasoline and is to be expected. This is not an indication of a rich mixture, nor an indication of internal build-up or potential for spark plug fouling. The black soot is graphite-type deposit. The gray deposit we usually see when using 100LL aviation gasoline is a lead-type deposit.

ENGINE MODELS APPROVED

Engine models approved for the use of Autofuel in airframes listed on the reverse side of this page. The cost of the STC package (airframe, engine, and placards) is based on the engine models as follows:

TELEDYNE CONTINENTAL ENGINES	
A-40, -2, -3, -4, -5	$60.00
A-50-1, -2, -3, -4, -5, -6, -7, -8, -9	$75.00
A-65-1, -3, -6, -7, -8, -9, -12, -14 (O-170-3, -5, -7)	$97.50
A-75-3, -6, -8, -9	$112.50
C-75-8, -12, -15	$112.50
C-85-8, -12, -14, -15	$127.50
C-90-8, -12, -14, -16	$135.00
C-125-1, -2	$187.50
E-165-2, -3, -4	$247.50
E-185-2, -5	$277.50
E-185-1, -3, -8, -9, -10, -11	$307.50
C-145-2, -2H, -2HP	$217.50
O-200-A, -B, -C	$150.00
O-300-A, -B, -C, -D, -E	$217.50
E-225-2, -4, -8, -9	$337.50
O-470-A, -E, -J	$337.50
O-470-K, -L, -R, -S	$345.00
O-470-11, -11B, -15	$319.50
0-470-4, -13, -13B	$337.50

AVCO LYCOMING ENGINES	
O-235-C	$165.00
O-235-C1B	$162.00
O-235-C1, -C2, -E1, -E2	$172.50
O-235-H2	$162.00
O-290, 0-290-A, -AP, -B, -C, -CP, -D	$187.50
O-290-D2, -D2A, -D2B, -D2C	$202.50
O-320-A, -C, -E	$225.00
0-540-B1A5, -B1B5, -B1D5, -B2A5, -B2B5, -B2C5, -B4A5, -B4B5	$325.50

*Engine Modification Required.

AIRFRAME MODELS APPROVED

AERO COMMANDER, INC. S.L. Industries
100

AERONCA, INC. Bellanca, Champion, Trytek, Wagner, B&B Aviation, Citabria
Most Models, 7 series & 11 series, *7KCAB

ARCTIC AIRCRAFT CO. INC.
Interstate S-1A, *S-1B1, S-1B2

BEECHCRAFT, INC. Bonanza
35, A-35, B-35, C-35, D-35, E-35, F-35, G-35, 35R

CESSNA
120, 140, 140A
150, 150A-H, 150J-M, A-150K-M
170, 170A, 170B
172, 172A-E, 172F (T-41A), 172G,H
P172, 172I, K, L, M
175, 175A, B, C
177
180, 180A-H, 180J
182, 182A-P
305A (O-1A), 305B, 305E (TO-1D, I-1D, O-1F)
305C (O-1E), 305D (O-1G), 305F

COMMONWEALTH, INC.
Skyranger and Rearwin 175, 180, 185

ERCOUPE, INC. Airco, Skyranger and Rearwin
415-C, -D, -E, -G, 415-CD, F-1, F-1A, A-2, A-2A, M10

FUNK
B-85C

GRUMMAN, INC. Gulfstream American
AA-1, -1A, -1B, -1C, AA-5, -5A

LUSCOMBE, INC. Temco
8 Series, 11A

MAULE
M-4, Most Models

MOONEY
M-18C, -18C55, -18L, -18LA

PIPER
E-2
J-2
J-3, Most Models
J-4, Most Models
J-5, Most Models
PA-11, Most Models
PA-12, Most Models
PA-14
PA-15*
PA-16
PA-17
PA-18, Most Models
PA-19, Most Models
PA-20, Most Models
PA-22, Most Models
PA-28-140, -150, -151

PORTERFIELD, INC. Rankin & Northwest CP-55, CP-65, CS-65

STINSON
(Univair) 108 series*, HW-75, 10

SUPERIOR AIRCRAFT CO, INC
LCA, LFA* Culver, Cadet

TAYLORCRAFT
A, BC Most Models

VARGA
2000C, 2150, 2150A, 2180

NOTE:
* Airframe Approvals Only
** Requires engine modification

EXPERIMENTAL AIRCRAFT ASSOCIATION STC APPLICATION

PLEASE PRODUCE STCs FOR THE FOLLOWING AIRCRAFT:

"N" Number	Acft Make & Model #	Acft Serial Number	Engine Make & Model #	Engine Serial Number	Price

Number of fuel tank inlets/gas caps 1 2 3 4 5 (Circle one) Total Enclosed $______________

Owner's Name ____ Check #______________

Owner's Address ____ EAA #______________

City__________________ STATE____________ ZIP_______-______ Country ___________

Phone Number (___) _____-_______ Credit Card #________________________ Exp. Date____/____

CELL PHONE NUMBER WHILE AT AIRVENTURE: (_____)_______-__________

If you want your STC sent to your mechanic or A&P, please supply their mailing information;

For this STC to be valid, we must have complete airframe and engine model numbers, serial numbers, letter and dashes. Please PRINT all information.

After AirVenture you can mail or fax to: EAA Flight Center, Attn: STC, 1145 W. 20th Ave., Oshkosh, WI 54902 (920) 426-4843 or (920) 426-4881 (fax)

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