Is Vapor Lock a Problem with Unleaded Auto Gasoline?

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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 likelihood 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 US 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 practical 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 Methyl Tertiary Butyl Ether (MTBE) and ethanol alcohol. Alcohol additives, other than some de-icing fluids, are not approved by the FAA.