

MANDATORY
SERVICE BULLETIN

DATE: April 30, 1976

Service Bulletin No. 398
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Recommendation Regarding Use of Incorrect Fuel

MODELS AFFECTED: All Avco Lycoming aircraft engines.

TIME OF COMPLIANCE: Anytime engine has been operated with unspecified fuel.

The incidence of engine malfunction due to use of fuels that are not suitable has noticeably increased during the past two years. Usually, this happens without the pilots knowledge at the time the aircraft is refueled; and the degree of inefficiency of operation, or actual damage to the engine may range from un-noticeable to severe damage or failure. The extent of damage varies accordingly as the duration of run, engine power level and the type of unspecified fuel consumed; a blend of turbine fuel and Avgas can prove to be a particularly ruinous mixture in a very short time. Actually, any mixture of fuels and additive materials not approved for Avgas that result in a lower than specified octane rating are equally harmful. Consequently, because of the many variables that are a part of this problem; it is impossible to determine the airworthiness for any Avco Lycoming engine that has been operated with unspecified fuel - except by detailed inspection of the engine by qualified personnel. However, to help combat this problem we recommend the following:-

1. Know what aviation fuel grades are specified for your engine and their color code.

2. Do not accept any aviation fuel that has a lower octane rating than that fuel specified for your engine.

3. If it has been determined that the engine has been run on unspecified fuel; do not continue to operate it unless it has been inspected and certified to be airworthy by competent maintenance personnel.

Primary damage to the engine by the use of unspecified fuels occurs in the combustion chambers and is typically characterized by increased temperatures resulting in tuliped intake valves and burned pistons. If detonation has been severe enough further damage will occur to crank pins and main bearings, counterweights and valve train components. In view of the questionable possibilities, disassembly and inspection of the engine parts is the only safe recommendation that can be made after the engine has been operated with improper fuels.

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SERVICE LETTER

Service Letter No. L199
January 28, 1983

TO: Owners and Operators of Avco Lycoming Reciprocating Aircraft Engines.

SUBJECT: Recommendations Regarding USE OF FUEL

This Service Letter is to clarify Avco Lycoming's position on the fuel grades that are specified for use in our reciprocating engine models.

AVCO LYCOMING DOES NOT APPROVE the use of any fuel other than those aviation grades specified in our latest edition of Service Instruction No. 1070.

OUR POSITION IS CLEAR; do not operate your aircraft on any fuel which is not specified.

NOTE

Avco Lycoming Service Bulletin No. 398 is entitled "Recommendations Regarding Use of Incorrect Fuel". Please refer to this bulletin if your engine has been operated on any fuel that is not specified in Service Instruction No. 1070.

SERVICE INSTRUCTION

DATE: April 18, 2008 Service Instruction No. 1070P

SUBJECT: Specified Fuels Engineering Aspects are
FAA Approved

MODELS AFFECTED: Lycoming horizontally opposed series aircraft engines.

TIME OF COMPLIANCE: When refueling aircraft.

A low lead content fuel, currently designated “100LL” has been available since the discontinuance of leaded commercial grades 91/96 and 115/145 fuels and the limited availability of 80/87 grade in U.S. as well as overseas countries.

The colorless unleaded fuel, designated “AVGAS 91/96 UL” is a trade name fuel produced by Hjelmcö Oil Inc of Sollentuna, Sweden and stated by the company to conform to ASTM D910 specifications except for the lead content and colorant. Specification of Hjelmcö AVGAS 91/96UL (or any other brand / trade name) does not constitute a commercial endorsement by Lycoming.

Fuels currently designated B91/115 and B95/130 are available for use in the Commonwealth of Independent States (CIS). Fuel currently designated 91 is available for use in the Ukraine. A summary of current grades as well as the previous fuel designations is shown in the following list.

FUEL GRADE LIST

Original Fuel Grades (ASTM-D910)			Current Fuel Grades (ASTM-D910)			Foreign Fuel Grades		
Grade	Color	Max. TEL Ml/U.S. gal.	Grade	Color	Max. TEL Ml/U.S. gal.	Grade	Color	Max. TEL Ml/U.S. gal.
80/87	Red	0.5	80	Red	0.5	AVGAS 91/96UL	None	0
91/96	Blue	2.0	*100LL	Blue	2.0	φB91/115	Green	φ
100/130	Green	**3.0	100	Green	**3.0	φ91	Yellow	φ
115/145	Purple	4.6				φB95/130	Amber	φ

- * - Grade 100LL fuel in some overseas countries is colored green and designated as “100L”.
- ** - Commercial fuel grades 100 and 100/130 having Tetraethyl Lead (TEL) content of up to 4ml/U.S. gallons are approved for use in all engines certified for use with grade 100/130 fuel.
- φ - B91/115 and B95/130 are specified by GOST1012-72. Max. TEL content is 2.5g/kg (B91/115) and 3.1g/kg (B95/130). Ukrainian 91 is specified by TU38.5901481-96. Max. TEL content is 2.5g/kg.

The importance of using the fuel specified for a specific model Lycoming engine has always been stressed in Lycoming service publications. However, if the specified fuel is not available, a higher grade fuel may be used, subject in some instances to the restrictions described in the footnotes to the following Table of Specified Fuels. The chart showing specified and alternate fuels that can be safely used in no instance permits use of fuels of lower grade than that which is specified. Also, it is not permissible in any instance to use automotive fuel in aircraft engines, regardless of octane or advertised features because of the corrosive effect of its chlorine content and because of vapor lock that could result due to its high vapor pressure. Any fuel used in Lycoming engines must conform with Specifications ASTM-D910 or MIL-G-5572F.

NOTE

Isopropyl alcohol in amounts not to exceed 1% by volume may be added to the fuel to prevent ice formation in fuel lines and tanks. Although approved for use in Lycoming engines, do not use isopropyl alcohol in the aircraft fuel systems unless recommended by the aircraft manufacturer.

TABLE OF SPECIFIED FUELS

Engine Models	SPECIFIED FUELS ASTM D910		Alternate Military and Commercial Grades
	Certificated For Use With Grade	Commercial Grade Designation	
O-235-C, -E, -H; O-290-D; O-435-A,-C	80		AVGAS 91/96 UL B91/115 or 91 or 100LL or 100 or 100/130
O-290-D2; O-320-A, -C, -E; IO-320-A, -E; AEIO-320-E; O-340-B; O-360-B, -D; GO-435-C2*; VO-435-A; GO-480-B, -D, -F; O-540-B; VO-540-A, -B	80/87	80	AVGAS 91/96UL or B91/115 or 91 or 100/130 or 115/145
O-320-B, -D; IO-320-B, -D; LIO-320-B1A; AEIO-320-D; AIO-320-A, -B, -C; O-360-A, -C, -F, -G, -J; IO-360-B, -E, -L, -M; LO-360-A; AEIO-360-B, -H; VO-360-A, -B; IVO-360-A; HO-360-A, -B, -C; HIO-360-B; O-435-A2; GO-435-C2*; O-480-A; O-540-A, -D, -E, -F, -G, -H; IO-540-C, -D, -E, -N, -T; AEIO-540-D	91/96	100LL or 100	AVGAS 91/96UL or B91/115 or 91 or 100/130 or 115/145
O-235-F, -G, -J, -K, -L; IO-320-C, -F; LIO-320-C1A; IO-360-A, -C, -D, -F; LIO-360-C; AEIO-360-A; AIO-360-A, -B; HIO-360-A, -C, -D, -E; LIO-360-A; VO-435-A, -B; GO-480-C, -G; IGO-480-A; IO-540-A, -B, -E, -G, -J, -K, -L, -M, -P, -R, -S, -U, -V, -W, AB, -AC, -AE; HIO-540-A; VO-540-C; IVO-540-A; IGO-540-A, -B; IO-580-B; IO-720-A, -B, -C, -D; AEIO-580-B	100/130	100LL or 100	100/130 or B95/130 or 115/145

* - GO-435-C2 engines with Marvel-Schebler carburetor No. 10-3991 are certificated to use 91/96 fuel.

Engine Models	SPECIFIED FUELS ■ ASTM D910		Alternate Military and Commercial Grades
TO-360-A, -C; TIO-360-A; TVO-435-A, -B, -C, -D, -E, -F, -G; GSO-480-A, -B; IGSO-480-A; TIO-540-A, -C, -D, -E, -F, -G, -H, -J, -N, -R, -S, -U, -V, -W, -AA, -AB, -AE, -AF, -AG, -AH, -AJ, -AK; LTIO-540-F, -J, -N, -R, -U, -V; TIVO-540-A; IGSO-540-A, -B; TIO-541-A, -E; TIGO-541-B, -C, -D, -E, -G	100/130	100LL or 100	Ⓢ100/130 or Ⓢ115/145
O-320-H; O-360-E; LO-360-E; O-540-J, -L	100LL or 100	100LL or 100	Ⓢ100/130 or Ⓢ115/145

- ① - Grade 100LL or 100L in which the lead content is limited to 2 ml. of TEL per gallon are approved for continuous use in all Lycoming engines listed herein. Inspection procedures described in the following footnotes are not required for engines using this fuel.
- ② - O-235-C, O-290-D, -D2 and O-435-A2, -K1 (O-435-4) engines were built with solid stem exhaust valves. The use of fuels with higher lead content of more than 2 ml. of TEL per U.S. gallon must be limited to 25% of the operating time. If specified fuel is not available and usage with high leaded fuel exceeds 25% of the operating time, inspect the valve stems at every 150 hours of engine operation for erosion or “necking”. This inspection is accomplished by removing the exhaust manifold and visually inspecting the valves through exhaust ports. To determine if an engine has solid stem exhaust valves, remove the rocker cover and look for valve rotor caps which are used with sodium cooled valves but not with solid stem valves in these particular engines. O-235-C and O-290-D models can be converted to use sodium cooled exhaust valves.
- ③ - Early production O-320-A, -C, -D; GO-435; VO-435-A and GO-480-B, -D, -F were built with solid stem exhaust valves and their use with fuels having lead content of more than 2 ml. of TEL per U.S. gallon is limited to 25% of the operating time. If specified fuel is not available and usage with high leaded fuel exceeds 25% of the operating time, inspect the valve stems at 150 hours of engine operation for erosion or “necking”. This inspection is accomplished by removing the exhaust manifold and visually inspecting the valves through exhaust ports. To determine if an engine has solid stem exhaust valves, remove the rocker cover and look for valve rotor caps which are used with sodium cooled valves but not with solid stem valves in these particular engines.
- ④ - Continuous use of high lead fuels can result in increased lead deposits both in combustion chambers and spark plugs causing engine roughness and scored cylinder walls. It is recommended that the use of this fuel be limited wherever possible; however, when high lead fuel is used, conduct periodic inspections of combustion chambers, valves and valve ports more frequently and rotate or clean spark plugs whenever lead fouling is experienced.