

Wichtiger Hinweis!

Der beiliegenden Tabelle können Sie entnehmen, für welche Kraftstoffsorten Ihr Lycoming-Motor zugelassen ist.

Ist Ihr Motor in der **Spalte ASTM D7547 / UL 91** aufgeführt, dürfen Sie den unverbleiten Total Kraftstoff AVGAS UL 91 **ohne weitere Zulassung für das Luftfahrzeug** verwenden. Dies ist in der beiliegenden SIB No.: 2011-01R2 der EASA geregelt.

Diese Erleichterung gilt nicht für die in Spalte 3 aufgeführten Lycoming Freigaben für Autokraftstoffe.

Autokraftstoffe dürfen nach wie vor nur verwendet werden, wenn zusätzlich zur Freigabe des Triebwerksherstellers eine ergänzende Musterzulassung (STC) zur Verwendung von MOGAS für das Luftfahrzeug vorliegt. Die ergänzende Musterzulassung erlischt, wenn Kraftstoffe mit einem Ethanol Anteil von mehr als 1 % verwendet werden, wie z.B. die heute handelsüblichen Kraftstoffe für Straßenfahrzeuge.



EASA Safety Information Bulletin

SIB No.: 2011-01R1
Issued: 19 April 2011

Subject: Unleaded Aviation Gasoline (Avgas) UL 91

Ref. Publication(s): Standards and Specifications:

ASTM D7547-09 "Standard Specification for Unleaded Aviation Gasoline".

ASTM D910-07 "Standard Specification for Aviation Gasoline".

Defence Standard 91-90 Issue 3.

Related Service Information of Engine Type Certificate Holders:

Rotax Service Instruction SI-912-016/SI-914-019 Revision 3.

Later revisions of these standards and service publications are acceptable.

Applicability: Aeroplanes powered by spark-ignited piston engines using Avgas or Motor Gasoline (Mogas).

Description: This SIB was initially published to inform all owners and operators of aeroplanes powered by spark-ignited piston engines about the use of unleaded Avgas UL 91.

Unleaded Avgas UL 91 meets the requirements of ASTM D7547-09. Unleaded Avgas UL 91 differs in parameters controlled by respective fuel standards from unleaded Hjelmsco Avgas 91/96 UL, unleaded Hjelmsco Avgas 91/98 UL and Avgas 100LL on certain properties, listed in Table 1.

Unleaded Avgas UL 91 may be used, if approved for the particular engine types. **No additional approval is required for the aeroplane, provided the aeroplane is already approved for operation with Avgas** (according to ASTM D910, Def Stan 91-90, Mil-G-5572, GOST1012-72 or equivalent) **or Mogas and the engine is already approved to use unleaded Avgas UL 91.**

This SIB is revised to mainly clarify that, if approved for the particular engine types, unleaded Avgas UL 91 may be used as well when the aeroplane is already approved for operation with Mogas as indicated above. It clarifies as well that additional differences in Property exist between the various gasoline as specified in Table 1 of this SIB.

Further additional changes have been incorporated in order to improve the quality of the document.

IMPORTANT:

Use of unleaded Avgas UL 91 in engines that have not been approved for the use of these fuels may cause extensive damage or lead to in flight failure, due to the lower Motor Octane Number (MON) of the fuel, compared to Avgas 100LL.

Note 1: The service information listed in "Ref. Publications" of this SIB identifies engines which, on the date of issue of this SIB, are known to be approved for use of unleaded Avgas UL 91. Approval of other engines is under review by the engine type certificate holders but has not yet been granted. This SIB might be revised again as soon as further information becomes available.

Note 2: Specifications Defence Standard 91-90 and ASTM D910 remain in force for traditional leaded Avgas Grades such as Avgas 100LL.

Table 1

Property**	Avgas 100LL	Unleaded Avgas UL 91	Hjelmco® 91/96 UL	Hjelmco® 91/98 UL
Knock value, lean mixture Motor Octane Number	min. 99.6	min. 91.0	min. 90.8	min. 90.8
Knock value, Research Octane Number		min. 96.0*		
Knock value, rich mixture Octane Number			min. 96.0	min. 98.0
Performance Number	min. 130.0			
Lead Content	max. 0.56 g/l	max 0.013 g/l*	max 0.013 g/l	max 0.013 g/l
Colour	blue	orange*	none	none

* Currently in ASTM approval process for implementation in next revision of D7547.

** Additional differences exist but these are currently not controlled in respective fuel standards. Fuel producers may choose to exceed stated minimum properties.

Recommendations: Before using unleaded Avgas UL91, it is recommended to take the following actions:

- (1) Check the latest instructions of the engine type certificate holders to verify if the engine installed on their aeroplane is approved for use of unleaded Avgas UL 91.
- (2) Verify that the engine has not been modified or altered and meets the specifications of the original engine type certificate.
- (3) Install on each fuel cap a label from the fuel supplier or make your own placard identifying that unleaded Avgas UL 91 is acceptable fuel for the aeroplane.

Contact: For further information contact the Airworthiness Directives, Safety Management & Research Section, Certification Directorate, EASA.
E-mail: ADs@easa.europa.eu.



Nr.	Anforderung (Requirements)	Grenzwert (Limit)		Maßeinheit (Dimension)	Prüfverfahren (Method)
		min.	max.		
1	Aussehen (Appearance)	klar, frei von sichtbaren festen Fremdstoffen und ungelöstem Wasser bei Umgebungstemperatur (clear, bright and visually free from solid matter and undissolved water at ambient temperature)			Visuell (visual)
2	Klopffestigkeit (knock rating) Motoroktanzahl (octane number / motor method) Researchoktanzahl (octane number / research method)	91,0 96,0		MOZ ROZ	ASTM D 2700 ASTM D 2699
3	Bleigehalt (tetraethyl lead content)		0,013	gPb/l	ASTM D 3237 ASTM D 5059
4	Benzolgehalt (benzene content)		<0,1	Ma.-%	DIN EN 12177
5	Dichte bei (density at) 15°C		ist anzugeben (to be reported)	kg/m³	ASTM D 1298
6	Siedeverlauf (distillation): Siedebeginn (initial boiling point) 10% Volumenanteil bei (vol. evaporated at) 40% Volumenanteil bei (vol. evaporated at) 50% Volumenanteil bei (vol. evaporated at) 90% Volumenanteil bei (vol. evaporated at) Siedeende (final boiling point) aufgefangene Destillationsmenge am Siedeende (recovery) Summe von 10% + 50% verdampfte Anteile bei (10% + 50% vol. evaporated at) Destillationsrückstand (residue) Destillationsverlust (loss)	 75 97 135	 ist anzugeben (to be reported) 75 105 135 170 1,5 1,5	 °C °C °C °C °C °C Vol.-% °C	ASTM D 86
7	Dampfdruck nach Reid bei (Reid vapour pressure at) 37,8°C	(38,0)	(49,0)	kPa	ASTM D 323 ASTM D 5190 ASTM D 5191
8	Schwefelgehalt (total sulfur)		0,05	Ma.-%	ASTM D 2622
9	Gefrierpunkt (freezing point)		-58	°C	ASTM D 2386
10	Heizwert (calorific value)	43,5		MJ/kg	ASTM D 3338
11	Abdampfdruckstand (existed gum)		3	mg/100 ml	ASTM D 381
12	Korrosionswirkung auf Kupfer (copper corrosion) [2h / 100°C]		1	Korrosionsgrad (degree of corrosion)	ASTM D 130
13	Oxidationsstabilität (oxidation stability), 16h Abdampfdruckstand (potential gum)		6	mg/100ml	ASTM D 873
14	Elektrische Leitfähigkeit (conductivity)	50	450	pS/m	ASTM D 2624
15	Wasserreaktion (water reaction) Volumenunterschied (volume change)		2	ml	ASTM D 1094

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SERVICE INSTRUCTION

DATE: April 24, 2013

Service Instruction No. 1070S
(Supersedes Service Instruction No. 1070R)
Engineering Aspects are
FAA Approved

SUBJECT: Specified Fuels for Spark Ignited Gasoline Aircraft Engine Models
MODELS AFFECTED: Lycoming engine models as detailed in Table 3
TIME OF COMPLIANCE: When refueling aircraft

NOTE

Incomplete review of all the information in this document can cause errors. Read the entire Service Instruction to make sure you have a complete understanding of the requirements.

This Service Instruction identifies approved fuels that can be used when refueling aircraft with Lycoming engines. Fuels no longer known to be in production and distribution have been removed from this Service Instruction. For historical information, refer to the engine model Type Certificate Data Sheet or previous revisions of this Service Instruction.

Fuels approved for use in Lycoming engines include the following types:

- Aviation Fuels (Table 1)
- Automotive Fuels (Table 2)

⚠ CAUTION

ANY MIXTURE OF UNAPPROVED FUELS AND ADDITIVE MATERIALS THAT MAKES A LOWER THAN SPECIFIED OCTANE RATING, CAN CAUSE ENGINE DAMAGE. USE OF LOWER-THAN-SPECIFIED OCTANE FUEL COULD CAUSE DETONATION AND MECHANICAL DAMAGE TO THE ENGINE.

⚠ CAUTION

IF INCORRECT FUEL OR ADDITIVES ARE USED, REFER TO THE LATEST REVISION OF SERVICE BULLETIN NO. 398 FOR INSTRUCTIONS TO CORRECT THE FUEL CONTAMINATION.



General Aviation
Manufacturers Association

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Fuel Specifications and Grades

Specifications that identify fuel types and grades approved for Lycoming engines are listed in Table 1: *Aviation Fuel Specifications and Fuel Grades* and Table 2: *Automotive Fuel Specifications and Fuel Grades*.

Engine Fuel Approvals

Table 3: *Fuels Approved for Use in Lycoming Engine Models* identify approved fuels for each Lycoming engine model.

Although the aviation and automotive fuels identified in Table 1 and Table 2 can be used as designated in Table 3, airframe approval is necessary. Refer to the Pilot Operating Handbook (POH), Type Certificate Data Sheet or Supplemental Type Certificated (STC) for aircraft approved fuels.

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Table 1
Aviation Fuel Specifications and Fuel Grades

Fuel Specification		Fuel Grades	Color
LEADED	<u>ASTM D910:</u> <i>Standard Specification for Aviation Gasolines</i>	100 100LL 100VLL	Green Blue Blue
	<u>TU 38.5901481-96:</u> <i>High-Octane Gasoline for Gasoline Engines</i> Ukrainian National Standard	91	Yellow
	<u>GOST 1012-72:</u> <i>Aviation petrol</i> Russian National Standard	B91/115 B95/130	Green Amber
	<u>ASTM D7547:</u> <i>Standard Specification for Unleaded Aviation Gasolines</i>	UL 91	Clear to Yellow (no dye)
UNLEADED	<u>HJELMCO Oil, INC.:</u> HJELMCO 91/96 UL is the registered trade name for colorless unleaded fuel made by HJELMCO Oil, Inc. of Sollentuna, Sweden	HJELMCO 91/96 UL	Clear to Yellow (no dye)



CAUTION

WHEN USING THE UNLEADED FUELS IDENTIFIED IN TABLE 1, LYCOMING OIL ADDITIVE P/N LW-16702, OR AN EQUIVALENT FINISHED PRODUCT SUCH AS AEROSHELL 15W-50, MUST BE USED.

NOTE

Isopropyl alcohol in amounts not to exceed 1% by volume can be added only to aviation fuel (not automotive 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 approved by the aircraft manufacturer.

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Table 2
Automotive Fuel Specifications and Fuel Grades

FUEL SPECIFICATION	FUEL GRADES*
<u>ASTM D4814-09b:</u> Standard Specification for Automotive Spark-Ignition Engine Fuel Ordering Requirements: Vapor Pressure: Class A-4 Oxygenate Content: For blends containing one or more oxygenates, oxygenate content shall not exceed 1.0 volume percent. Prohibited Oxygenates: Ethanol, Methanol	91 AKI 93 AKI
<u>EN 228:2008(E):</u> Automotive fuels - Unleaded petrol - Requirements and test methods Ordering Requirements: Vapor Pressure: Class A Oxygenate Content: For blends containing one or more oxygenates, oxygenate content shall not exceed 1.0 volume percent. Prohibited Oxygenates: Ethanol, Methanol	NB 3 93AKI



IN COMPLIANCE WITH THIS SERVICE INSTRUCTION, THE AUTOMOTIVE FUEL MUST AGREE WITH ALL SPECIFICATIONS IN TABLE 2. UNLEADED AUTOMOTIVE GASOLINE THAT IS NOT IN CONFORMANCE WITH THE SPECIFICATIONS IN TABLE 2 IS NOT TO BE USED.



WHEN USING THE UNLEADED AUTOMOTIVE FUELS IDENTIFIED IN TABLE 2, LYCOMING OIL ADDITIVE P/N LW-16702, OR AN EQUIVALENT FINISHED PRODUCT SUCH AS AEROSHELL 15W-50, MUST BE USED.

NOTE

Refer to the latest revision of Service Instruction No. 1534 for information on service recommendations for long-term storage of engines that use automotive fuel.

The clear to yellow (colorless) unleaded automotive fuels in Table 2 must be in conformance with ASTM D4814-09b or EN 228:2008:E. In these specifications, the automotive fuel is identified by an Anti-Knock Index (AKI) or in the case of EN 228 Super Premium, a grade designation. The AKI is an octane rating and is the arithmetic average of the Research Octane Number (RON) and Motor Octane Number (MON).

$$(RON + MON)/2 = AKI$$

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Automotive fuels usually have Reid Vapor Pressure (RVP) values between 7 and 9.3 psi (48 and 64 kPa) in summer seasons but specifications for the RVP can be as high as 15 psi (103 kPa) in the winter. In some geographic regions, there is no upper limit to RVP in the winter season. As vapor pressure increases, the tendency for vapor lock will increase as well as fuel "boil off" at altitude. It is also possible that ethanol-based fuels could not be compatible with some fuel system components. In cases of material incompatibility, deterioration of metallic and non-metallic components can occur. Therefore, fuels containing ethanol are not approved in this Service Instruction.

Automotive ground transportation fuels available direct to consumers (e.g. "pump gas") usually do not have labels with sufficient information to identify compliance with the requirements in Table 2. While indicated octane is generally necessary for display at retail points of sale, octane rating methods, fuel vapor pressure, oxygenate content and ethanol content can vary widely and are generally known only at the wholesale terminal.

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Table 3
Fuels Approved for Use in Lycoming Engine Models

Engine Models	Leaded Aviation Fuels (Table 1)				Unleaded Aviation Fuels (Table 1)		Unleaded Automotive Fuels (Table 2)		
	ASTM D910	TU 38	GOST 1012		ASTM D7547	HJELMCO	ASTM D4814		EN228
	100* 100LL 100VLL	91*	B91/115*	B95/130*	UL 91	91/96	91 AKI	93 AKI	NB.3
O-235									
-C, -E, -H	•	•	•	•	•	•		•	•
-F, -G, -J	•			•					
-K, -L, -N	•			•	•			•	•
-M, -P	•				•			•	•
O-290									
-D	•	•	•	•	•			•	•
O-320									
-A, -B, -C, -D, -E	•	•	•	•	•			•	•
-H	•								
IO-320									
-A, -B, -D, -E	•	•	•	•	•			•	•
-C, -F	•			•					
AIO-320									
-A, -B, -C	•	•	•	•	•			•	•
LIO-320									
-B	•	•	•	•	•			•	•
-C	•			•					
AEIO-320									
-D	•	•	•	•	•				
-E	•	•	•	•	•				
O-360									
-A, -B, -C, -D, -E, -G, -J	•	•	•	•	•			•	•
-E	•								

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Table 3 (Cont.)

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**Table 3 (Cont.)
Fuels Approved for Use in Lycoming Engine Models**

Engine Models	Leaded Aviation Fuels (Table 1)				Unleaded Aviation Fuels (Table 1)		Unleaded Automotive Fuels (Table 2)	
	ASTM D910	TU 38	GOST 1012		ASTM D7547	HJELMCO	ASTM D4814	EN228
	100* 100LL 100VLL	91*	B91/115* B95/130*		UL 91	91/96	91 AKI 93 AKI	NB.3
LTO-360								
-A, -E	•							
TIO-360								
-A, -C	•							
AEIO-360								
-A	•							
-B, -H	•	•	•	•				
LHIO-360								
-C, -F	•							
IO-390								
-A	•							
AEIO-390								
-A	•							
O-435								
-A, -C	•	•	•	•	•	•		
GO-435								
-C, -C2 (See note below for -C2)	•	•	•	•	•	•		
NOTE: GO-435-C2 engine models equipped with carburetor setting 10-3391 must use 91/96 HJELMCO grade or better fuel. Engines equipped with carburetor settings 10-3391-1 or PS-5BD can use fuels specified for GO-435-C model engines.								
VO-435								
-A, -6, -23	•	•	•	•				
-B	•							

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Table 3 (Cont.)

Fuels Approved for Use in Lycoming Engine Models										
Engine Models	Leaded Aviation Fuels (Table 1)				Unleaded Aviation Fuels (Table 1)		Unleaded Automotive Fuels (Table 2)			
	ASTM D910	TU 38	GOST 1012		ASTM D7547	HJELMCO	ASTM D4814			EN228
			91*	B91/115*			B95/130*	91 AKI	93 AKI	
TVO-435										
-A, -B, -C, -D, -E, -F, -G, -25	•									
O-480										
-I, -3	•									
-A	•	•	•	•		•				
GO-480										
-B, -D, -F	•	•	•	•	•					
-C, -G	•									
GSO-480										
-A, -B	•									
IGO-480										
-A	•			•						
IGSO-480										
-A	•									
O-540										
-A, -B, -E, -F, -G, -H, -J	•	•	•	•	•	•		•		•
-L	•									
-9, -9A	•									
IO-540										
-A, -B, -E, -G, -J, -K, -L, -M,	•			•						
-P, -R, -S, -U, -AA, -AC, -AE										
-C, -D, -N, -T, -V	•	•	•	•	•	•				•
-W, -AB, -AF	•				•	•		•	•	•

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**Table 3 (Cont.)
Fuels Approved for Use in Lycoming Engine Models**

Engine Models	Leaded Aviation Fuels (Table 1)				Unleaded Aviation Fuels (Table 1)		Unleaded Automotive Fuels (Table 2)	
	ASTM D910	TU 38	GOST 1012		ASTM D7547	HJELMCO	ASTM D4814	EN228
	100* 100LL 100VLL	91*	B91/115*	B95/130*	UL 91	91/96	91 AKI	93 AKI
VO-540								
-A, -B	•	•	•	•	•	•		
-C	•			•				
HIO-540								
-A	•			•				
IGO-540								
-A, -B	•			•				
IVO-540								
-A	•			•				
TIO-540								
-A, -C, -E, -F, -G, -H, -J, -N, -R, -S, -U, -V, -W, -AA, -AB, -AE, -AF, -AG -AH, -AJ, -AK	•							
TVO/TIVO-540								
-A	•							
AEIO-540								
-D	•	•	•	•		•		
-L	•							
IGSO-540								
-A, -B	•							
LTIO-540								
-F, -J, -N, -R, -U, -V	•							

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Fuels Approved for Use in Lycoming Engine Models**

Engine Models	Leaded Aviation Fuels (Table 1)				Unleaded Aviation Fuels (Table 1)		Unleaded Automotive Fuels (Table 2)	
	ASTM D910	TU 38	GOST 1012		ASTM D7547	HJELMCO	ASTM D4814	EN228
	100* 100LL 100VLL	91*	B91/115* B95/130*		UL 91	91/96	91 AKI 93 AKI	NB.3
TIO-541								
-A, -E	•							
TIGO-541								
-D, -E, -G	•							
IO-580								
-B	•			•				
AEIO-580								
-B	•			•				
IO-720								
-A, -B, -C, -D	•			•				

* - Continuous use of high lead fuels can cause increased lead deposits both in combustion chambers and spark plugs causing roughness in engine operation and scored cylinder walls. It is recommended that the use of this fuel be limited wherever possible. However, when high lead fuel is used, do periodic inspections of combustion chambers, valves, and valve ports more frequently and rotate or clean spark plugs whenever lead fouling is found. See the latest revision of Service Letter No. L192.

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