

SERVICE INSTRUCTION

SELECTION OF SUITABLE OPERATING FLUIDS

FOR ROTAX® 2-STROKE UL ENGINES

SI-2ST-008

Repeating symbols:

Please, pay attention to the following symbols throughout this document emphasizing particular information.

- ▲ **WARNING:** Identifies an instruction, which if not followed, may cause serious injury or even death.
- **CAUTION:** Denotes an instruction which if not followed, may severely damage the engine or could lead to suspension of warranty.
- ◆ **NOTE:** Information useful for better handling.

| || A revision bar outside of the page margin indicates a change to text or graphic.

1) Planning information

1.1) Engines affected

All 2 stroke UL engines

1.2) Concurrent ASB/SB/SI and SL

none

1.3) Reason

Field experience has shown that additional information about the choice of suitable operating fluids, such as 2-stroke oil, gearbox oil, coolant and fuel for ROTAX® 2-stroke engines is necessary.

1.4) Subject

Selection of suitable operating fluids for ROTAX® 2-stroke UL engines.

This information should help the aircraft manufacturer and operator to ensure that the operating conditions and installation are correct and thereby achieve optimum performance and reliability.

1.5) Compliance

According to the Maintenance Manual of 2-stroke engines current issue.

- ▲ **WARNING:** Non-compliance with these instructions could result in engine damages, personal injuries or death.

1.6) Approval

The technical content is approved under the authority of DOA No. EASA.21J.048.

1.7) References

In addition to this technical information refer to current issue of

- Operators Manual (OM)
- Maintenance Manual (MM)
- Installation Manual (IM)

- ◆ **NOTE:** The status of Manuals can be determined by checking the table of amendments of the Manual. The 1st column of this table is the revision status. Compare this number to that listed on the ROTAX® WebSite: www.rotax-aircraft-engines.com. Updates and current revisions can be downloaded for free.

1.8) Other publications affected

This Service Instruction (SI) will substitute the following:

- SI-13-1994 „Using auto fuel in ROTAX® two cycle aircraft engine“.

2) Material Information

2.1) Material - cost and availability

None

3) Lubricants

3.1) Engine lubrication

When the oil in 2-stroke engines is mixed into the fuel system, then the oil and its corrosion protective ingredients are continuously burned and then replaced by new fuel-oil-mixture. The oil is therefore exposed to the moving parts only for a short time before it is consumed up. Therefore it is important to use oils of high quality, to ensure that the engine gets the necessary corrosion protection and lubrication.

- ▲ **WARNING:** If the engine has no oil injection, then in accordance with the operators manual it is necessary to add to the fuel 2% Super 2-stroke oil (50:1).

Criteria for the selection of 2-stroke oil:

- Super 2-stroke engine oil ASTM/CEC standard classification API-TC
- The pour point of the oil must at least be 10 °C (18 °F) below the ambient temperature.

- ◆ **NOTE:** Oils that are intended for marine (watercooled) 2-stroke engines are not suitable for use in UL-engines due to their low operating temperatures. Oils formulated for air cooled engines are recommended due to their high temperature properties.

brand	description
CASTROL®	Active 2T
CASTROL®	Valvoline Syn Power 2T
SHELL®	AeroShell Sport Plus 2
SHELL®	Advance Ultra 2T
SHELL®	Advance S 2
SHELL®	Advance VSX 2
SHELL®	Advance Scooter 2
TEBOIL®	2T MIX
YACCO®	MVX 500 2T+MVX 1000 2T

3.2) Lubrication at the rotary valve drive

The lubricant for the rotary valve drive is the same as used for engine lubrication. See section 3.1. The oil should not be diluted.

3.3) Propeller Gearbox

Lubrication takes place with separate oil in the gearbox.

Special oils have to be used in the propeller gearbox. The main task of the gear box lubricating oil is the transmission of force and pressure, the diminishing of friction and abraision, the transfer of lost heat, protection from corrosion and absorbing particles from wear.

Criteria for the selection:

- Oil for gearbox according to API-GL5 or GL6
- Viscosity SAE 140EP or 85W-140EP

brand	description
CASTROL®	EPX 85W/140 Manual
GEARTEX®	EP-C 85W/140
SHELL®	SPIRAX A 85W/140

4) Coolant

4.1) General

The 2-stroke engines of the type 462 UL, 532 UL, 582 UL and 618 UL have liquid cooled cylinder heads and cylinders. The coolant transfers away heat from cylinder heads and cylinder to avoid overheating. Using the correct coolant can avoid corrosion of parts and freezing of the coolant.

4.2) Mixing ratio antifreeze / water

50% antifreeze with anticorrosive and 50% pure (distilled) water, or an equivalent premixed coolant.

■ CAUTION: The coolant has to be used as stated in the manufacturers description.

The ratio antifreeze/water should not exceed any constraints given by the coolant manufacturer. Mixing ratio exceeding the limits stated by the manufacturer may result in thixotropy (jelling) of the antifreeze which seriously lowers the coolant systems efficiency.

■ CAUTION: Thixotropy of the coolant can be harmful for components of the cooling system and can influence the cooling circuit to and from the expansion tank.

◆ NOTE: Coolant should be a low silicate or silicate free formular. Follow coolant manufacturer directions regarding mixture percentages etc.

brand	description
BASF®	Glysantin Protect Plus/G48
CASTROL®	Antifreeze All-Climate
CASTROL®	Antifreeze Anti-Boil
PETROL®	Antifreeze Concentrate / Antifreeze G 11
SHELL®	Antifreeze Concentrate
SHELL®	DEX-COOL
TEXACO®	Havoline Extended Life Antifreeze / Coolant DEX-COOL
VELVANA®	FRIDEX G48
YACCO®	LR-35

5) Fuel

For ROTAX[®] aircraft engines different fuel types are available. See Operators Manual of the relevant engine type and/or the table in chapter 5.3.

5.1) Automotive fuels

In addition to AVGAS various automotive fuel types with different quality are available. Due to various environmental, economic and political reasons a number of fuel types with different amount of ethanol blend is available. Therefore the maximum amount of ethanol blend is defined as follows:

5.1.1) E10 (Unleaded gasoline blended with 10% ethanol)

In addition to AVGAS and unleaded automotive fuel (Mogas) the ROTAX[®] engine type 503 UL and 582 UL are now approved for use with E10. At an ethanol amount of maximum 10%, higher exhaust gas temperatures (EGT) may be possible. If the maximum allowable EGT is exceeded, consult an authorized maintenance facility for relevant checks and for further corrective actions (e.g. other carburetor jetting).

- ◆ **NOTE:** All other ROTAX 2-stroke UL aircraft engines as e.g. 447 UL, 618 UL etc. were not tested for E10 and are not approved for it. Even if there is no negative feedback from field information, these engine types should only be operated with fuels with max. 5% alcohol.

Fuels that contain more than 10% ethanol blend have not been tested nor are they permitted for use.

5.1.2) Suitability of fuel system components of airframe

ROTAX[®] urges owners to confirm with their airframe manufacturer that ethanol blended fuels of up to 10% (E10) are compatible with all fuel system components.

It is the responsibility of the aircraft manufacturer to test their fuel system components and supply any further information on techniques, procedures and limitations of using ethanol blended fuel.

ROTAX[®] recommends that aircraft manufacturers and owner/operators read the following:

- FAA Advisory Circular Letter AC 23.1521-2
- FAA Special Airworthiness Information Bulletin CE-07-06
- EASA Safety Information Bulletin - SIB 2009-02

These contain details regarding the use of ethanol (alcohol) blended fuels and the type certificate requirements.

It is strongly recommended that non certified aircraft also conform to the information given in the above documents.

5.2) Fuel according to local standards

The following fuels can be used.

MOGAS	description
European norm	EN 228 Normal ¹⁾
	EN 228 Super ²⁾
	EN 228 Super plus ²⁾
Canadian norm	CAN/CGSB-3.5 quality 1 ³⁾
US norm	ASTM D4814 ³⁾

AVGAS	description
Aviation standard	AVGAS 100 LL (ASTM D910)

■ CAUTION: Engines of type 618 UL require at least RON 95 (AKI 91)

¹⁾ at least RON 90

²⁾ at least RON 95

³⁾ at least AKI* 87

* Anti Knock Index, $(RON+MON)/2$

■ CAUTION: Use only the correct fuel for the specific climate zones.

◆ NOTE: There is a risk of vapor lock formation if winter fuel is used for summer operation.

6) General engine operation requirements and operating limits

1. Regular synchronization of bowden cable for throttle and choke adjustment can greatly improve the smoothness of engine operation.
2. Proper adjustment of the engine idle speed and maintenance of the air induction system can support smooth engine operation and helps to maintain the correct air / fuel mixture. Proper air / fuel mixture will reduce the separation of the non - volatile components e.g. in leaded AVGAS, and helps to minimize the rate of deposits in the engine.
3. Avoid rapid changes in engine RPM immediately after start up (not more than 3000 rpm).
4. Rapid engine cooling down resulting from rapid altitude changes, landing manouvers flown at low power settings, or rapid shut down after landing or ground operations should be avoided.
5. Correct balancing of the propeller to a tolerated value can greatly reduce vibration, decrease wear of engine and gear reduction unit components, improve engine performance, and add to engine life. Modern electronic propeller balancing equipment allows quick dynamic balancing of propellers without removing the propeller from the aircraft. Other benefits of correct propeller balance include the reduction of cockpit noise and vibration levels, and a reduction in fatigue of exhaust components, air boxes, sheet metal components, cowlings, engine linkages and aircraft sections.

7) Summary

- ▲ **WARNING:** Non-compliance with these recommendations could result in engine damage, personal injury or death !