SERVICE INSTRUCTION

SELECTION OF SUITABLE OPERATING FLUIDS FOR ROTAX® ENGINE TYPE 912 i, 912 AND 914 (SERIES)

SI-912 i-001R3
SI-912-016R8
SI-914-019R8

This SI revises SI-912 i-001R2, SI-912-016R7 and SI-914-019R7 dated 08 December 2014.

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 versions of the engine type:
- 912 i (Series)
- 912 (Series)
- 914 (Series)

1.2) Concurrent ASB/SB/SI and SL

none.

1.3) Reason

Introduction and release of AeroShell Oil Sport Plus 4 with new formulation in accordance to RON 424.

1.4) Subject

Selection of suitable operating fluids for ROTAX® engine type 912 i, 912 and 914 (Series)

1.5) Compliance

According Maintenance Manual of engine type ROTAX® 912 i, 912 and 914 (Series), current issue.

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

1.6) Approval

The technical content of this document is approved under the authority of DOA ref. 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.FLYROTAX.com. Updates and current revisions can be downloaded for free.

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2) Material Information

2.1) Material - cost and availability

None.

3) Lubricant

3.1) General

Foreign particles formed during combustion are suspended in the motor oil. Together with oil components that are not sufficiently resistant to heat, these foreign particles can cause parts such as pistons, piston rings, exhaust valves, etc., to seize and lead to problems.

On turbocharged engines, failing to ensure an adequate cool-down period prior to shut-off may lead to particle deposits and cause damage to bearings and seals. Hard oil residues can obstruct parts of the oil system and lead to damage.

- In addition to insufficient cool-down periods, the use of unsuitable oils and not obeying oil change intervals can especially cause such damage.
- Long-term operation with an engine that is too cold and/or operating too long with an overly rich fuel mixture can cause water and fuel contamination in the oil, reducing its lubrication capacity.
- Furthermore, long down times with oil that contains water and contaminants can cause corrosion damage, especially on the bearings, with serious consequential damage.

The criteria for correct motor oil selection are:

- Correct oil viscosity for cold starts and sufficient oil pressure at high temperatures.
- Good gear wear protection.
- Avoidance of clutch slipping due to use of additives.
- Insufficient oil flow capability causes too much volume remains in the engine, leading to low oil level in the external oil tank. This can only be detected during testing with an oil level indicator installed on the oil tank.
- Ability to withstand combustion products containing lead, which enter the oil during AVGAS operation.
- High oil temperature durability. This is especially important for the turbo engine due to the risk of oil carbon build-up on the bearing and sealing seats of the turbocharger. The oil carbon build-up (coking) can also flake off and block/restrict the oil return passage.

Conclusions

- If possible, operate the listed engine types using **unleaded** or low-lead fuel. (AVAGS 100 LL is not considered low leaded in this context.)
- Use the recommended motor oils tested and released by BRP-Powertrain according to section 3.2 of this SI.
- Use only oil which is classified by ROTAX standard (RON)!
- Due to high stresses in the reduction gears, oils with gear additives such as AeroShell Oil Sport Plus 4 are highly recommended.
- Because of the incorporated friction clutch, oils with friction modifier additives are unsuitable because this could result in clutch slipping during standard operation.
- Avoid oils strictly specified for use in Diesel engines. These may not be suitable due to insufficient high temperature properties and additives that may affect the operation of the slipper clutch in the gear box.
- On turbocharged engines, always conduct a cool-down run before shutting down in accordance with the relevant Operators Manual.
- Pay special attention to engine operation tips (see section 6).

3.2) Operation with unleaded and low-lead fuel (less than 0.1 g/liter lead content)

■ CAUTION: When operating primarily on unleaded fuels or MOGAS, the maintenance intervals remain unchanged in regard to the published maintenance schedule found in the currently valid Maintenance Manual for the engine type.

In case of severe operating conditions (operation in cold/hot wheather areas, interference by and and/or salt), the time between maintenance intervals must generally be shorter, and in particular, the frequency of oil changes must be increased regardless of the type of fuel mainly used (MOGAS or AVGAS).

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Motor oils tested and released from BRP-Powertrain (for use with unleaded fuel or MOGAS), which we recommend for use with our ROTAX® engine types 912 i, 912 and 914 Series:

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Marke / brand	Bezeichnung / description	Spezifikation / specification	Viskosität * / viscosity
SHELL®	AeroShell Oil Sport Plus 4 [1) 2) 3)]	RON 424	SAE 10 W-40

[1)] according to RON 424
[2)] with new formulation
[3)] in red bottle

◆ NOTE: The previous formulation of AeroShell Oil Sport Plus 4 can still be used until the expiration date.
◆ NOTE: The coefficient of viscosity indicates the tendency of oil to flow but it is not necessarily a quality code. Country specific deviations of the viscosity are possible.

3.3) Operation with leaded AVGAS fuels

Perform maintenance checks according to the latest Maintenance Manual.

◆ NOTE: If operating with leaded AVGAS fuel, we **recommend** a change of engine oil **every 25 operating hours**.

More frequent oil changes will assure timely removal of residues and oil sludge thus avoiding increased wear or operating troubles.

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4) Coolant

4.1) General

All engine types 912 i, 912 and 914 Series have liquid cooled cylinder heads and ram air cooled cylinders. The function of the coolant is to protect the cylinder heads from over-temperature by means of heat dissipation. Protection against corrosion of the engine components and freezing of the coolant is achieved with appropriate additives.

In principle, 2 different types of coolant are permitted:

- Conventional coolant based on ethylene glycol with 50% water content
- Waterless coolant based on propylene glycol (not allowed for 912 i Series)

4.2) Conventional coolant

Conventional coolant (with about 50% water content) has a specific thermal capacity that is higher than waterless coolant. It gives excellent corrosion protection, especially for aluminum, and protection against freezing.

◆ NOTE: For exact monitoring of the coolant temperature, a limit has been set. This is necessary because standard coolant based on ethylene glycol such as BASF Glysantin in a 50/50 proportion mixture can boil at a temperature as low as 120 °C (248 °F). Refer to the current Installation Manual for more information and instructions.

■ CAUTION: The certification and determination of the correct coolant type must be conducted by the aircraft manufacturer. As each aircraft type has different characteristics, testing must be done to determine the most suitable coolant and instrumentation for each aircraft type.

◆ NOTE: Coolant should be a low silicate and nitrite free formula. Follow coolant manufacturer directions regarding mixture percentages etc.

Coolants with a mixture of 50% antifreeze and 50% of distilled water recommended by the authorized distributors (not tested from BRP-Powertrain).

◆ NOTE: The following list is based on the experiences and local recommendation by the authorized distributors. Coolant brands, with same designation, may vary from one to the other region. Please contact the local distributor for a recommendation.

Marke / brand	Bezeichnung / description
BASF®	Glysantin Protect Plus/G48
CASTROL®	Antifreeze All-Climate
CASTROL®	Antifreeze Anti-Boil
OMV®	OMV Coolant Plus
PETROL®	Antifreeze Concentrate / Antifreeze G 11
PRESTONE®	DEX-COOL extended life
PRESTONE®	50/50 preluded DEX-COOL extended life
SHELL®	DEX-COOL
SHELL®	Antifreeze Concentrate
TEXACO®	Havoline Extended Life Antifreeze /
VELVANA®	FRIDEX G49
YACCO®	LR-35

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4.3) Waterless coolant for engine types 912/914 Series

■ CAUTION: Not released for engine types 912 i Series and 912/914 Series with cylinder head version Suffix - 01.

An advantage of waterless coolants is their high boiling point which prevents “boiling“ of the cooling system. However, its specific thermal capacity is lower than of conventional coolant which resulting in slightly higher running temperatures.

The cooling system of ROTAX® engine types 912/914 Series (without Suffix - 01) is designed for operation with waterless coolant and thus must not be modified, i.e. drainage or ventilation holes must not be closed.

■ CAUTION: The certification and determination of the correct coolant type must be conducted by the aircraft manufacturer. As each aircraft type has different characteristics, testing must be done to determine the most suitable coolant and instrumentation for each aircraft type.

Recommended coolant (100% concentrate)

◆ NOTE: NPG+/NGPR/NPG+C are not available anymore and are replaced by the successor product Aero Cool 180°.

■ CAUTION: Aero Cool 180° contraction point is approx. -23 °C (-10 °F) . It will not freeze and expand like conventional coolant. Do not use if conditions expose the engine to non-operational temperatures below -23 °C (-10 °F).

Marke/brand	Bezeichnung/description
EVANS®	Aero Cool 180

4.3.1) Warnings for operating with waterless coolant

- Water or coolant containing water must **never** be added to the cooling system!
- The max. water content must not exceed 3.6 %; it can be tested using a Brix refractometer.
- Any water present in the cooling system is separated out as vapor. This can cause the cooling system to fail due to insufficient coolant quantity.
- If Aero Cool 180° is not available locally for servicing the cooling system, a conventional coolant based on pure 100% ethylene glycol can be used temporarily. However, the coolant must be replaced again with Aero Cool 180° within the next 15 days.

■ CAUTION: As some conventional coolants are available in a pre-mixed formula (water added) be sure to add only 100% pure ethylene glycol if Aero Cool 180° is not available.

■ CAUTION: The above warnings are taken from the manufacturer’s users manual, however the original text and description in the users manual is binding.

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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.

◆ NOTE: If none of the fuels mentioned in chapter 5.3 is available, consult the corresponding European Standard EN228 as a reference. The fuel to be assessed, has to be equal or better at least in terms of the octane number and the maximum ethanol content.

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® 912/914 Series of engines are now approved for use with E10. Fuels that contain more than 10% ethanol blend have not been tested by BRP-Powertrain and are not permitted for use.

5.1.2) Suitability of fuel system components of airframe

BRP-Powertrain 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.

BRP-Powertrain recommends that aircraft manufacturer 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 also non-certified aircrafts conform to the information given in the above documents.

5.2) AVGAS fuel additives

Additives under the names of Decalin® and Alcor TCP®, which aid the scavenging of lead deposits have not been tested by BRP-Powertrain. Field experience shows that these products have no detrimental effect on the engine, when used in the recommended manner.

Always follow the additive manufacturers instructions especially with regard to health and safety precautions.

BRP-Powertrain only has field experience with Decalin Runup™ and Alcor TCP® brands. Other similar additives are not recommended as BRP-Powertrain cannot comment on their suitability for the 912 i, 912 and 914 Series engine types.

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5.3) Fuel according to local standards

The following fuels can be used.

	Usage / Description		
	912 A / F / UL Min. RON 90 (min. AKI* 87)	**912 S / ULS - 914 F / UL** Min. RON 95 (min. AKI 91)	**912 iSc / iS** Min. RON 95 (min. AKI 91)
MOGAS			
European standard	EN 228 Normal		
	EN 228 Super	EN 228 Super	EN 228 Super
	EN 228 Super plus	EN 228 Super plus	EN 228 Super plus
Canadian standard	CAN/CGSB-3.5 Qualität 1	CAN/CGSB-3.5 Qualität 3	
Russian standard	R 51105-97 / R 51866-2002	R 51105-97 / R 51866-2002	
	Regular-91/92 / Regular Euro-92		
	Premium-95 / Premium Euro-95	Premium-95 / Premium Euro-95	
	Super-98 / Super Euro-98	Super-98 / Super Euro-98	
South African standard	SANS 1598:2006	SANS 1598:2006	SANS 1598:2006
	Clean Fuels (CF2)	Clean Fuels (CF2)	Clean Fuels (CF2)
US standard	ASTM D4814	ASTM D4814	
Ukrainian standard	DSTU 4839-2007	DSTU 4839-2007	DSTU 4839-2007
	A-92-Euro		
	A-95-Euro	A-95-Euro	A-95-Euro
	A-98-Euro	A-98-Euro	A-98-Euro
Indian standard	IS 2796:2008	IS 2796:2008	IS 2796:2008
	MG 91		
	MG 95	MG 95	MG 95
AVGAS			
leaded	AVGAS 100 LL ASTM D910	AVGAS 100 LL ASTM D910	AVGAS 100 LL ASTM D910
unleaded	UL91 ASTM D7547	UL91 ASTM D7547	
released brand-name [1)]			
	HJELMCO AVGAS	HJELMCO AVGAS	
	HJELMCO AVGAS	HJELMCO AVGAS	

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[1)] unleaded, mainly available in the Scandinavian area

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

◆ NOTE: AVGAS 100LL places greater stress on the valve seats due to its high lead content and forms increased deposits in the combustion chamber and lead sediments in the oil system.

■ 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.

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6) General engine operation requirements and operating tips

1. Keep the motor oil temperature below 120 °C (250 °F) over most of the operating period.
2. Always insure that the oil type used is adequate for climatic conditions and peak engine operating temperatures. If operational oil temperatures exceed 120 °C (250 °F), use of a mineral or petroleum based oil is not recommended.
3. For turbocharged engines ensure an adequate running cool-down period to prevent deposits by coking of oil.
4. When operating with unleaded fuels or MOGAS and when engine oil temperatures often exceed 120 °C (250 °F) use of a high quality full synthetic oil is recommended.
5. To avoid formation of condensation water in the motor oil, the oil temperature must rise at least once every operational day to at least 100 °C (212 °F).
6. Avoid extended use of carburetor air pre-heating when safe and reasonable.
7. Depending on the type of fuel used, operating conditions, and the demands of the engine mission profile it may be necessary to increase the frequency of oil changes to avoid the excessive build up of lead and other residues in the engine oil. Always adjust the engine oil change intervals to avoid excessive build up of sludge in the engine oil.

■ CAUTION: Do not use oil additives and observe the operating limits as per the relevant Operators Manual.

Excessive engine vibration, particularly at low idle speeds, can impair the carburetor fuel metering system leading to a too rich mixture condition. This rich mixture condition can further lead to rough engine operation and excessive carbon and lead deposits.

7) Summary

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

Approval of translation to best knowledge and judgment - in any case the original text in the German language and the metric units (SI-system) are authoritative.

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