This SL revises SL-912-016/SL-914-014 initial issue dated 28 July 2009

SERVICE LETTER

Essential information regarding engine behavior, performance and manifold pressure data for ROTAX® Engine Type 912 and 914 (Series)

ATA System: 72-00-00 Engine

1) Planning information

To obtain satisfactory results, procedures specified in this publication must be accomplished with accepted methods and prevailing legal regulations.

BRP-Rotax GmbH & Co KG. cannot accept any responsibility for the quality of work performed in accomplishing the requirements of this publication.

1.1) Applicability

All engines of type:

Engine type	Serial number
912 (Series)	all
914 (Series)	all

1.2) Concurrent ASB/SB/SI and SL

none

1.3) Reason

Field experience has shown that additional information is necessary on the handling (Aircraft Operators) and the installation (Aircraft Manufacturer OEM's) of ROTAX® aircraft engines type 912 and 914.
The areas of special importance are:

- Engine load (power setting) and its effect on the possibility of detonation and/or pre-ignition
- Idle speed setting
- Carburetor synchronization
- Using high fuel quality
- Balancing of the propeller
- Compliance with installation specification to the exhaust back pressure
- Compliance with the required airbox temperature

NOTICE

Compliance with these given instructions can help reduce the risk of engine overload but will not protect against incorrect operation and engine installation where limits of operation are exceeded. In addition the applicable limits in the Operators and Installation Manual have to be respected.

1.4) Subject

Essential information regarding engine behavior, performance and manifold pressure data for ROTAX® Engine Type 912 and 914 (Series).

1.5) Compliance

RECOMMENDED

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1.6) Approval

The technical content of this document is approved under the authority of DOA ref. EASA.21J.048.

1.7) Labor time

none

1.8) Mass data

change of weight - - - none.

moment of inertia - - - unaffected.

1.9) Electrical load data

no change

1.10) Software modifications

no change

1.11) References

In addition to this technical information refer to current issue of

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

NOTE: The status of the Manuals can be determined by checking the table of amendments. The 1st column of this table shows 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.

1.12) Other Publications affected

- not affected

1.13) Interchangeability

2) Material Information

none.

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3) Accomplishment/Instructions

NOTE: Before maintenance, review the entire documentation to make sure you have a complete understanding of the procedure and requirements.

Accomplishment

All measures must be implemented and confirmed by at least one of the following persons or organizations:

- Operators of ROTAX® Aircraft engines
- Aircraft Manufacturer (OEM)

NOTE: All work has to be performed in accordance with the relevant Maintenance Manual.

Safety notice

⚠WARNING **Identifies an instruction which, if not followed, may cause serious injury or even fatal injury.**

⚠CAUTION **Identifies an instruction which, if not followed, may cause minor or moderate injury.**

NOTICE **Denotes an instruction which if not followed, may severely damage the engine or could lead to suspension of warranty.**

ENVIRONMENTAL NOTE

Environmental notes gives you tips on environmental protection.

3.1) Operational data (e.g. for the aircraft operator)

3.1.1) Engine load (Power setting)

Background information

In isolated cases there have been situations of overloading the engine, leading to possible detonation (uncontrolled ignition of fuel/air mix) and/or pre-ignition (fuel/air mixed at incorrect time).

Investigation showed if one or more parameter is exceeded and/or a combination at or near the limit can result in a higher risk of engine damage.

Parameters that have an effect detonation/pre-ignition	
Deviation/effect	**Possible cause**
Excessively high cylinder head temperature/ Excessively high coolant temperature.	Insufficient cooling capacity (e.g. low coolant level, semi blocked radiator for winter, coolant pressure loss, poor engine installation).
Excessively high intake air temperature.	Fresh air intake receiving hot air (e.g. carburetor heat on, engine installation). Incorrect use of carburetor heat.
Ignition timing incorrect.	Incorrect spark plug grade/ heat range.

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Parameters that have an effect detonation/pre-ignition	
Deviation/effect	**Possible cause**
Poor fuel quality.	to low octane, contaminated fuel, excessive water, excessive alcohol, oil or diesel mixed. Use of non approved fuel additives.
Lean fuel/air mixture.	Non standard air filter, incorrect jetting, poorly maintained carburetors, inadequate fuel delivery.
Excessively high engine load with low RPM.	Fixed pitch propellers manufactured with too much pitch, ground adjustable propellers configured with too much pitch and incorrectly controlled in-flight adjustable propellers. Refer to 3.1.2.

3.1.2) Performance recommendations

Step	Procedure
1	Engine speed over 5500 rpm is restricted to 5 min maximum (As detailed in the Operators Manual 912/914 Series).
2	Take off RPM at WOT (wide open throttle) should not be below 5200 rpm to avoid over loading the engine.
3	Continuous use of engine speed below 5200 rpm with WOT should be avoided.

NOTE: These recommendations are especially valid when coolant temperature higher than 120 °C (248 °F) and pressure altitude below approximately 1000 meters (3500 ft.).

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3.1.3) Performance and manifold pressure data (MAP)

See Fig. 1.

- Engine operation above 5200 rpm is not limited by manifold pressure
- Engine speed over 5500 rpm is restricted to 5 min maximum
- Continuous use of engine speed below 5200 rpm must follow manifold pressure graph below

NOTE: The manifold pressure graph is not relevant for ROTAX engine type 912 A, 912 F, 912 UL, 914 UL and 914 F.

NOTE: Only applicable on pressure altitude below 3500 ft.

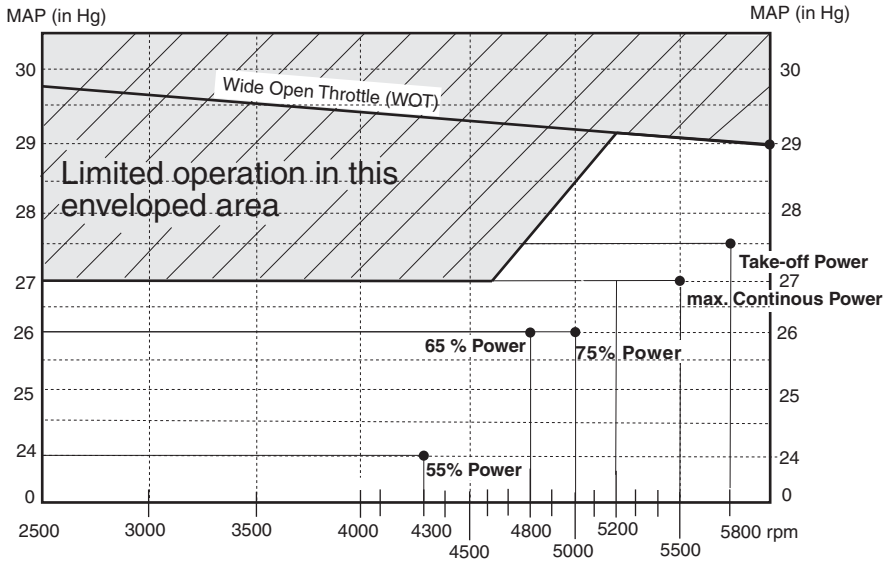

Fig 1 *Performance and manifold data for ROTAX® 912 ULS/S* *08447*

NOTE: Take off speed at WOT (wide open throttle) should not be below 5200 rpm to avoid over loading the engine. Continuous use of engine speed below 5200 rpm must follow manifold pressure graph. Applicable with pressure altitude less than 3500 feet.

NOTE: Procedures for aircraft **not** fitted with a MAP (Manifold Pressure) gauge e.g. fixed pitch propeller: It is strongly recommended to reduce the WOT position by approx. 100 rpm (after reaching safe altitude) - if the maximum achieved rpm is only 5200 rpm.

NOTE: Correct procedure for in-flight variable pitch and constant speed propellers to avoid unnecessary load on the engine:

- To increase power, first increase rpm by advancing the prop control, then increase MAP with the throttle.
- To decrease power, first reduce MAP with the throttle, then decrease rpm with the prop control. In flight variable pitch and constant speed propellers:

NOTE: Manifold pressure gauge must be fitted to aircraft with variable pitch and constant speed propeller!

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3.2) Maintenance relevant information (e.g. for maintenance organizations)

3.2.1) Idle speed setting

NOTICE

It is strongly recommended that there is a mechanical “stop“-position on the throttle control inside the cockpit. This is to ensure that the throttles cannot be forced so as to bend the “stops“ on the carburetors and inadvertently stop the engine.
Ensure the engine is at its lowest possible idle speed (minimum of 1400 rpm) before selecting ignition off

Step	Procedure
1	To reach a smooth engine run the engine idle speed must be maintained as high as practical.
2	The idle speed has to be set about 1400 to 1800 rpm. The engine start and stop behavior should be most efficient in this rpm-range.
3	After engine start or after landing it is recommended to advance the throttle so that the engine runs smooth. Ground idle should be between 1400 and 2200 rpm.

NOTE: There is no recommended idle speed in that relevant range that will suit all installations to the wide variation in propeller weights/moments of inertia, engine mount design etc.

3.2.2) Carburetor synchronization and maintenance

Regular pneumatic synchronizing of the carburetors and mechanical synchronization of the Bowden cables for the throttles and chokes can greatly improve smoothness of engine operation

Step	Procedure
1	At unusual vibration, it would be constructive to synchronize the carburetors.
2	Adjust the idle mixture screw after synchronizing to smooth engine run.
3	Confirm that any electric boost pumps do not exceed the maximum fuel pressure of 0.5 bar (7.25 psi) to the carburetors when run in conjunction with the mechanical pump.
4	Check that the float valve is not leaking. Verify the float height is correct.

3.2.3) Balancing of the propeller assembly

The correct balancing of the propeller assembly according to the manufacturer´s instructions will reduce engine vibration and decrease wear of gear reduction unit components.

Modern dynamic balancing is performed with the propeller on the aircraft.

3.2.4) Starting procedure and tips

Field experience has shown that starting the 912 and 914 (Series) of engine type can be difficult when using traditional aircraft engines techniques.

Cold engines	
Step	**Procedure**
1	Due to a feature of the carburetor design the throttle must be at idle (fully closed) when starting a cold engine. This allows for more effective fuel enrichment.
2	The choke must be fully opened.
3	Soon after starting advance the throttle to around 2000 rpm and slowly close the choke.
4	Keep engine at around 2200 rpm for warm up period.

NOTE: Engine type 914 Series - engine start at cold temperatures: Compared to 912 Series the choke must be kept open a bit longer and the throttle closed for some time while the engine gains heat. If the choke is removed too early the engine could stop.

Hot engines	
Step	**Procedure**
1	It is always prudent to park the aircraft with the nose pointing into wind to aid the cooling after shut down and prevent excessive heat soak under the engine cowling.
2	Open the throttle a small amount slowly while cranking (choke closed). Once the engine fires, advance throttle to 1800 / 2000 rpm.

Engines which have not started due to wrong procedure and are “flooded”	
Step	**Procedure**
1	Open throttle fully (choke closed).
2	Ignition ON and start the engine.

NOTICE As ignition ON and starter may be on the same switch, pay attention for sudden start of engine at high rpm.

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3.2.5) Engine shut down tips

Step	Procedure
1	Reduce loading on the propeller and gearbox by adjusting the propeller to fine pitch (in-flight variable pitch propellers) and move throttle to idle position.
2	After cooling down run, throttle must be at idle so engine at its minimum speed, switch ignition off on one circuit for a short time (2-3 seconds) then switch off the second circuit.
3	914 Series: Always pay attention to cool down period to protect the turbocharger.

3.3) Installation relevant information (e.g. for aircraft manufacturer OEM)

3.3.1) Engine load (Power settings)

Background information

In isolated cases there have been situations of overloading the engine, leading to possible detonation (uncontrolled ignition of fuel/air mix) and/or pre-ignition (fuel/air mixed at incorrect time).

Investigation showed if one or more parameter is exceeded and/or a combination at or near the operation limit can result in a higher risk of engine damage.

Parameters that have an effect detonation/pre-ignition	
Deviation/effect	**Possible cause**
Excessively high cylinder head temperature/ Excessively high coolant temperature	poor engine installation
Excessively high intake air temperature	poor engine installation
Lean fuel/ air mixture	- Non standard air box - Use of non approved mixture leaning devices.
Excessively high engine load with low RPM.	Non suitable propeller (e.g. over pitched)
Excessively high exhaust gas back pressure	Exceeding the installation specific requirements of the exhaust gas back pressure.

NOTICE The execution of the engine installation will greatly affect certain aspects such as, intake air temperature, fuel mixture and running temperatures.

Examples:

- Due to poor engine installation an increased intake air temperature under the cowling (often not measured in flight) is possible. This could cause exceedance of the limits of operation (e.g. CHT and EGT). This could lead to a higher possibility of engine damage.
- An airbox other than a ROTAX® genuine item could considerably affect mixture. This is also relevant for cowling design that supplies hot air to the engine and/or does restrict airflow for adequate cooling.
- Poor engine installation design which does not respect maximum allowable temperatures of the engine components in normal operating conditions of flight leads to operational problems. Always design engine installations to respect all parameters and limitations.

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3.3.2) Fixed pitch and ground adjustable propellers

NOTICE

ROTAX® strongly recommends the installation of a manifold absolute pressure gauge. Fixed pitched propellers should be set so that the take off rpm is above 5200 rpm (WOT).

3.3.3) In-flight variable pitch and constant speed propellers

NOTICE

Manifold absolute pressure gauge must be fitted to aircraft with variable or constant speed propellers!

Correct procedure for in - flight variable pitch and constant speed propellers to avoid unnecessary load on the engine:

Step	Procedure
1	To increase power, put the prop governor lever to maximum rpm speed, then increase MAP with the throttle lever. Refer also to the pilot operating handbook of the aircraft manufacturer for relevant power setting.
2	To decrease power, first reduce MAP with the throttle, and then decrease rpm with the propeller control.

3.3.4) Exhaust gas CO testing/HC testing

- All ROTAX® aircraft engine are bench tested and have a relevant carburetion calibration set at the factory.

NOTE: At factory calibration (standard day condition) only genuine ROTAX® spare parts and/or accessories were used. Non- genuine ROTAX® parts have to be tested accordingly.

- As mentioned in the Installation Manual, it is the responsibility of the aircraft manufacturer to carry out exhaust gas CO measurement to confirm that their installation and/ or use of non ROTAX® parts does not have a detrimental effect on carburetor calibration and is within ROTAX® stated limits.

NOTE: The test should be performed as a ground run with full load (WOT, at no less than 5200 rpm, minimum of 26.5 InHg manifold pressure) with the engine cowl fixed in flight position and engine at full operating temperature.

- In order to obtain further information for mixture distribution or to make statements, a HC measurement at the individual cylinders would be useful.

3.4) Summary

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

Translation to other languages might be performed in course of localisation. In any case the original text in English language and the metric units are authoritative.

3.5) Enquiries

Enquiries regarding this Service Letter should be sent to the ROTAX® authorized distributor or independent Service Center of your area.

A list of all distributors is provided on www.FLYROTAX.com.

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