ROTAX
AIRCRAFT ENGINES

OPERATORS MANUAL

FOR ROTAX® ENGINE TYPE 914 SERIES

Ref. No.: OM-914

ROTAX® **914 UL 3** WITH OPTIONS

part no.: 899645

⚠ WARNING

Before starting the engine, read the Operator´s Manual, as it contains important safety relevant onformation. Failure to do so may result in personal injuries including death. Consult the original equipment manufacturer´s handbook for additional instructions!

Approval of translation has been done to best knowledge and judgement - in any case the original text in german language is authoritative.

Introduction

Foreword

BRP-Powertrain provides “Instructions for Continued Airworthiness”, which are based on the design, the tests and certification of the engine and its components.
These instructions apply only to engines and components supplied by BRP-Powertrain.
This Operators Manual contains important information about safe operation of the engine, together with descriptions of the system and its layout, technical data, operating media and the operational limits of the engine.
The specified data apply only to the engine and not to specific applications in particular aircraft. The aircraft manufacturer’s Operators Manual is therefore definitive in terms of the operation of the engine, as it contains all of the aircraft-specific instructions.

Chapter structure

The structure of the Manual follows whenever it is applicable the structure of the „GAMA Specification #1 for Pilot’s Operating Handbook“. The Operators Manual is subdivided into following chapters:

Subject	Chapter
Introduction	Chapter INTRO
List of effective pages	Chapter LEP)
Table of amendments	Chapter TOA)
General note	Chapter 1)
Operating instructions	Chapter 2)
Standard operation	Chapter 3)
Abnormal operation	Chapter 4)
Performance data	Chapter 5)
Weights	Chapter 6)
Description of systems	Chapter 7)
Checks	Chapter 8)
Supplements	Chapter 9)

NOTES

LEP) List of effective pages

Chapter	Page	Date
	cover page	
INTRO	INTRO-1	04 01 2010
	INTRO-2	04 01 2010
LEP	LEP-1	04 01 2011
	LEP-2	04 01 2010
TOA	TOA-1	04 01 2011
	TOA-2	04 01 2010
	TOA-3	04 01 2011
	TOA-4	04 01 2011
1	1-1	04 01 2010
	1-2	04 01 2010
	1-3	04 01 2010
	1-4	04 01 2010
	1-5	04 01 2010
	1-6	04 01 2010
	1-7	04 01 2010
	1-8	04 01 2010
	1-9	04 01 2010
	1-10	04 01 2010
	1-11	04 01 2010
	1-12	04 01 2010
	1-13	04 01 2010
	1-14	04 01 2010
2	2-1	04 01 2010
	2-2	04 01 2010
	2-3	04 01 2011
	2-4	04 01 2011
	2-5	04 01 2010
	2-6	04 01 2010
	2-7	04 01 2011
	2-8	04 01 2010
	2-9	04 01 2010
	2-10	04 01 2010
3	3-1	04 01 2010
	3-2	04 01 2010
	3-3	04 01 2010
	3-4	04 01 2010
	3-5	04 01 2010
	3-6	04 01 2010
	3-7	04 01 2010
	3-8	04 01 2010
	3-9	04 01 2010
	3-10	04 01 2010
	3-11	04 01 2010
	3-12	04 01 2010
	3-13	04 01 2010
	3-14	04 01 2010

Chapter	Page	Date
4	4-1	04 01 2010
	4-2	04 01 2010
	4-3	04 01 2010
	4-4	04 01 2010
	4-5	04 01 2010
	4-6	04 01 2010
	4-7	04 01 2010
	4-8	04 01 2010
	4-9	04 01 2010
	4-10	04 01 2011
5	5-1	04 01 2010
	5-2	04 01 2010
	5-3	04 01 2010
	5-4	04 01 2010
	5-5	04 01 2010
	5-6	04 01 2010
6	6-1	04 01 2010
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7	7-1	04 01 2010
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8	8-1	04 01 2010
	8-2	04 01 2010
9	9-1	04 01 2010
	9-2	04 01 2010
	9-3	04 01 2010
	9-4	04 01 2010
	9-5	04 01 2010
	9-6	04 01 2011
	9-7	04 01 2011
	9-8	04 01 2011
	rear page	

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TOA) Table of amendments

Approval*

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

Current no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of issue	signature
0	1 to 9	all	04 01 2010	DOA*			
1	LEP	LEP-1	04 01 2011	DOA*			
1	TOA	TOA-1	04 01 2011	DOA*			
		TOA-3	04 01 2011	DOA*			
		TOA-4	04 01 2011	DOA*			
1	2	2-3	04 01 2011	DOA*			
		2-4	04 01 2011	DOA*			
		2-7	04 01 2011	DOA*			
1	4	4-10	04 01 2011	DOA*			
1	9	9-6	04 01 2011	DOA*			
		9-7	04 01 2011	DOA*			
		9-8	04 01 2011	DOA*			

NOTES

TOA) Summary of changes

Content

Summary of the relevant amendments in this context, but makes no claim to completeness.

current no.	chapter	page	date of change	comment
0	1 up to 9	all	04 01 2010	New layout
1	2	2-4 2-7	04 01 2011 04 01 2011	Engine start operating temperature description Operating fluids - definition
1	9	9-6,7,8	04 01 2011	Overview of authorized distributor

NOTES

1) General note

Foreword

Before operating the engine, carefully read this Operators Manual. The Manual provides you with basic information on the safe operation of the engine.

If any passages of the Manual are not clearly understood or in case of any questions, please, contact an authorized Distribution- or Service Center for ROTAX aircraft engines.

We wish you much pleasure and satisfaction flying your aircraft with this ROTAX engines.

Table of contents

This chapter of the Operators Manual contains general and safety information concerning the operation of the aircraft engine.

1.1) General note

Purpose

The purpose of this Operators Manual is provided to familiarize the owner/user of this aircraft engine with basic operating instructions and safety information.

Documentation

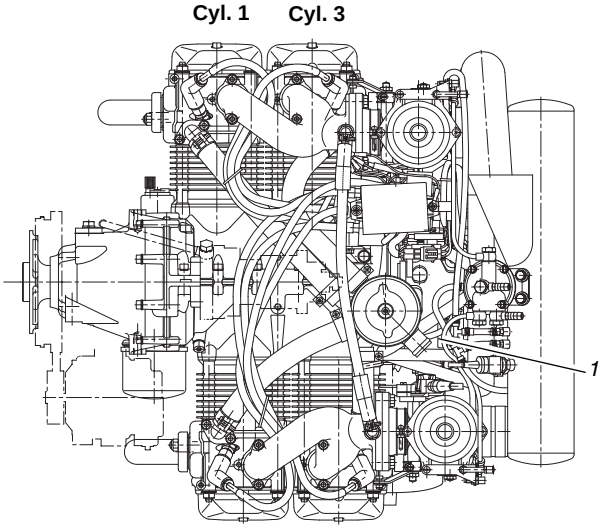
For more detailed information regarding, maintenance, safety- or flight operation, consult the documentation provided by the aircraft manufacturer and/or dealer.

For additional information on engines, maintenance or parts, you can also contact your nearest authorized ROTAX-aircraft engine distributor (Chapter 9.2).

Engine serial number

When making inquiries or ordering parts, always indicate the engine serial number, as the manufacturer makes modifications to the engine for product improvement.

The engine serial number is located on the top of the crankcase, magneto side. See Fig. 1.



Part	Function
1	engine serial number

Fig. 1 *03645*

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1.2) Abbreviations and terms used in this Manual

Abbreviations

Abbreviation	Description
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
A	Ampere
ACG	Austro Control GmbH
API	American Petrol Institute
ASTM	American Society for Testing and Materials
AKI	Anti Knock Index
CAN/CGSB	Canadian General Standards Board
CW	Clockwise
CCW	Counter-clockwise
DOA	Design Organization Approval
EASA	European Aviation Safety Agency
EN	European Standard
FAR	Federal Aviation Regulations
h	hours
IFR	Instrument Flight Rules
INTRO	Introduction
ISA	International Standard Atmosphere
kW	Kilowatt
LEP	List of effective pages
Nm	Newton meter
OM	Operators Manual
part no.	Part number
RON	Research Octane Number
ROTAX	is a trade mark of BRP-Powertrain GmbH & Co KG
rpm	Revolutions per minute
SAE	Society of Automotive Engineers
SI	Service Instruction
SB	Service Bulletin
SL	Service Letter
TC	Type certificate
TOA	Table of amendments
VFR	Visual Flight Rules

1.3) Safety

General note

Although the reading of such information does not eliminate the hazard, understanding the information will promote its correct use. Always use common workshop safety practice.
The information and components-/system descriptions contained in this Manual are correct at the time of publication.
BRP-Powertrain, however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on its products previously manufactured.

Revision

BRP-Powertrain reserves the right at any time, and without incurring obligation, to remove, replace or discontinue any design, specification, feature or otherwise.

Measuring units

Specifications are given in the SI metric system with the USA equivalent in parenthesis. Where precise accuracy is not required, some conversions are rounded off for easier use.

Translation

This document has been translated from German language and the original German text shall be deemed authoritative.

Symbols used

This Manual uses the following symbols to emphasize particular information. This information is important and must be observed.

⚠ WARNING — **Identifies an instruction which, if not followed, may cause serious injury including the possibility of death.**

⚠ 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 other component.**

NOTES: **Indicates supplementary information which may be needed to fully complete or understand an instruction.**

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

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1.4) Safety notice

Normal use

⚠ WARNING

Non-compliance can result in serious injuries or death!
Never fly the aircraft equipped with this engine at locations, airspeeds, altitudes, or other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage.

- This engine is not suitable for acrobatics (inverted flight etc.).
- This engine shall not be used on rotorcrafts with an in-flight driven rotor (e.g. helicopters).
- It should be clearly understood that the choice, selection and use of this particular engine on any aircraft is at the sole discretion and responsibility of the aircraft manufacturer, assembler and owner/user.
- Due to the varying designs, equipment and types of aircraft, BRP-Powertrain grants no warranty or representation on the suitability of its engine's use on any particular aircraft. Further, BRP-Powertrain grants no warranty or representation of this engine's suitability with any other part, components or system which may be selected by the aircraft manufacturer, assembler or user for aircraft application.

⚠ WARNING

Non-compliance can result in serious injuries or death!
Unless correctly equipped to provide enough electrical power for night VFR (according latest requirement as ASTM), the ROTAX 914 UL is restricted to DAY VFR only.

- Certain areas, altitudes and conditions present greater risk than others. The engine may require humidity or dust/sand preventative equipment, or additional maintenance may be required.
- You should be aware that any engine may seize or stall at any time. This could lead to a crash landing and possible severe injury or death. For this reason, we recommend strict compliance with the maintenance and operation and any additional information which may be given to you by your distributor.

Training	- Whether you are a qualified pilot or a novice, complete knowledge of the aircraft, its controls and operation is mandatory before venturing solo. Flying any type of aircraft involves a certain amount of risk. Be informed and prepared for any situation or hazard associated with flying. - A recognized training program and continued education for piloting an aircraft is absolutely necessary for all aircraft pilots. Make sure you also obtain as much information as possible about your aircraft, its maintenance and operation from your dealer.
Regulation	- Respect all government or local rules pertaining to flight operation in your flying area. Fly only when and where conditions, topography, and airspeeds are safest. - Consult your aircraft dealer or manufacturer and obtain the necessary information, especially before flying in new areas.
Instrumentation	- Select and use proper aircraft instrumentation. This instrumentation is not included with the ROTAX engine package. Only approved instrumentation may be installed.
Engine log book	- Keep an engine log book and respect engine and aircraft maintenance schedules. Keep the engine in top operating condition at all times. Do not operate any aircraft which is not properly maintained or has engine operating irregularities which have not been corrected.
Maintenance	- Before flight, ensure that all engine controls are operative. Make sure all controls can be easily reached in case of an emergency. - Since special tools and equipment may be required, engine servicing should only be performed by an authorized ROTAX engine distributor or a qualified trained mechanic approved by the local airworthiness authority. - When in storage protect the engine and fuel system from contamination and exposure.

Engine run

- Never operate the engine without sufficient quantities of operating fluids (oil, coolant, fuel).
- Never exceed the maximum permitted operational limits.
- In the interst of safety, the aircraft must not be left unattended while the engine is running.
- To eliminate possible injury or damage, ensure any loose equipment or tools are properly secured before starting the engine.
- Allow the engine to cool at idle for several minutes before turning off the engine.

Vacuum pump

- This engine may be equipped with a vacuum pump. The safety warning accompanying the vacuum pump must be given to the owner/operator of the aircraft into which the vacuum pump is installed.

1.5) Technical documentation

General note

These documents form the instructions for continued airworthiness of ROTAX aircraft engines.
The information given is based on data and experience that are considered applicable for professionals under normal conditions. The fast technical progress and variations of installation might render present laws and regulations inapplicable or inadequate.

Documentation

- Installation Manual
- Operators Manual
- Maintenance Manual (Line and Heavy Maintenance)
- Overhaul Manual
- Illustrated Parts Catalog
- Alert Service Bulletins
- Service Bulletins
- Service Instructions
- Service Letters

Status

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.

Revision pages

Further the Manual is in such a way developed that revision pages are offered and the entire document does not have to be exchanged. The overview of the valid pages are in the Chapter LEP. The current edition and revision is shown in the foot note.

Reference

Any reference to a document refers to the latest edition issued by BRP-Powertrain if not stated otherwise.

Illustrations

The illustrations in this Manual are mere sketches and show a typical arrangement. They may not represent the actual part in all its details but depict parts of the same or similar function. Therefore deduction of dimensions or other details from illustrations is not permitted.

NOTE: The illustrations in this Operators Manual are stored in a graphic data file and are provided with a consecutive irrelevant number.

This number (e.g. *00277*) is of no significance for the content.

1.6) Standard version

Serial production

- 4-stroke, 4 cylinder horizontally opposed, spark ignition engine with turbocharger and electronic control of boost pressure (TCU = turbocharge control unit), one central cam-shaft - push-rods - OHV
- Liquid cooled cylinder heads
- Ram air cooled cylinders
- Dry sump forced lubrication
- Dual breakerless capacitor discharge ignition
- 2 constant depression carburetors
- 2 electric fuel pumps (12 V DC)
- Electric starter (12 V 0.7 kW)
- Integrated AC generator with external rectifier-regulator (12 V 20 A DC)
- Prop drive via reduction gear with integrated shock absorber and overload clutch

NOTE: The overload clutch is installed on all **serial production** aircraft engines which are certified and on non-certified aircraft engines of the configuration 3.

- Stainless steel exhaust system
- Engine suspension frame

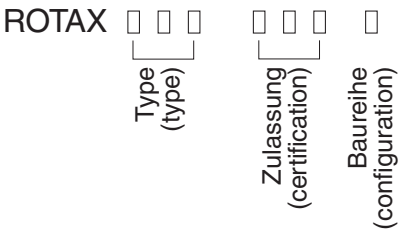
Optional

- Electric starter (12 V 0.9 kW)
- External alternator (12 V 40 A DC)
- Vacuum pump: (only for configuration 2 and 4 possible)
- Hydraulic constant speed propeller governor: (for configuration 3 only)

1.7) Type description

e.g. 914 F 2

The type designation is of the following composition.



Description

Description		Configuration
Type:	**914**	4-cyl. horizontally opposed, turbo-charged engine
Certification:	**F**	certified to FAR 33 (TC No. E00058 NE) JAR-E (TC No. EASA.E.122)
	UL	non-certified aircraft engines
Configuration:	**2**	Prop shaft with flange for fixed pitch propeller.
	3	Prop shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller.
	4	Prop flange for fixed pitch propeller and prepared for retrofit of a hydraulic governor for constant speed propeller.

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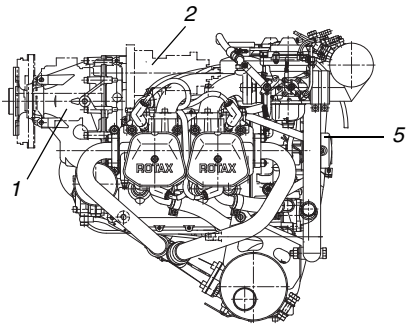
1.8) Denomination of cylinders, Engine views, components

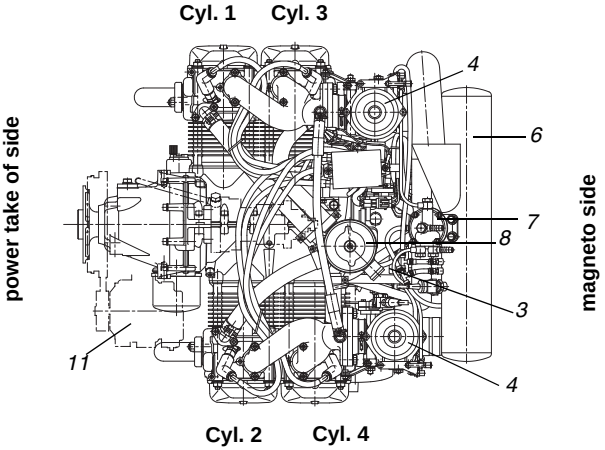
Lateral view



Part	Function
1	propeller gear box
2	vacuum pump or hydraulic governor for constant speed propeller

Fig. 2 *03644*

Top view



Part	Function
3	engine serial number
4	CD carburetor
5	electric starter
6	intake air distributor “Airbox“
7	fuel pressure control
8	expansion tank with excess pressure valve

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Part	Function
9	turbocharger
10	exhaust system
11	external generator

Fig. 3 *03645*

Front view

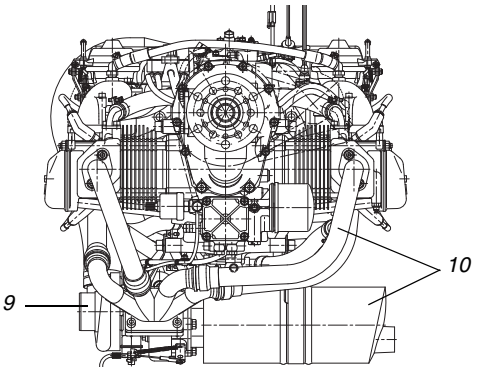

Fig. 4 *03646*

1.9) Technical data

See table

Description	914 F/UL
Bore	79.5 mm (3.13 in)
Stroke	61 mm (2.40 in)
Displacement	1211 cm^3 (73.9 in^3)
Compression ratio.	9.0 : 1

1.10) Fuel consumption

See table

Fuel consumption in l/h (US gal/h)	914 F/UL
at take-off performance	33.0 l/h (8.7 gal/h)
at max. continuous performance	27.2 l/h (7.2 gal/h)
at 75 % continuous performance	20.4 l/h (5.4 gal/h)
specific consumption at max. continuous performance	276 g/kWh (0.458 lb/hph)

1.11) Direction of rotation

Direction of rotation on propeller shaft

Direction of rotation on propeller shaft: counter clockwise, looking at p.t.o side of engine.

normal direction of propeller rotation (engine)

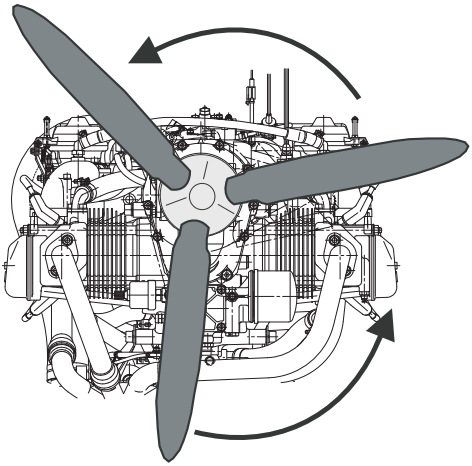

Fig. 5 *08629*

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2) Operating instructions

Introduction

The data of the certified engines are based on type certificate of type 914 F FAR 33 (TC No. E00058NE), JAR-E (TC No. EASA.E.122).

Table of contents

This chapter of the Operators Manual contains the operating limits that must be observed to ensure the ROTAX aircraft engine and standard systems operate safely.

2.1) Operating limits

Performance

Performance data relate to ISA (**I**nternational **S**tandard **A**tmosphere).

Take-off performance	84.5 kW at 5800 rpm
Max. continuous performance	73.5 kW at 5500 rpm

Manifold pressure

Take-off performance	1300 hPa (38.4 in.HG)
	*1320 hPa (39.0 in.HG)
Max. continuous performance	1150 hPa (34.0 in.HG)
	*1180 hPa (34.9 in.HG)
*914 F starting with engine S/N 4,420.200 (TCU part no. 966741)	
*914 UL starting with engine S/N 4,417.598 (TCU part no. 966471)	

NOTE: The stated pressure in the suction tube is always lower by the pressure loss in the carburetors than the TCU controlled airbox pressure and may be therefore subject bigger deviations.

Speed

Take-off speed	5800 rpm (max. 5 min)
Max. continuous speed	5500 rpm
Idle speed	min. 1400 rpm

Manifold pressure

NOTICE Due to the control behavior an overshooting of the manifold pressure is possible. But within 2 seconds this pressure has to stabilize within the allowance.

Take-off performance	max. 1350 hPa (39.9 in.HG)
Max. continuous performance	max. 1200 hPa (35.4 in.HG)

Acceleration

Limit of engine operation at zero gravity and in **negative** "**g**" condition.

Max.	5 seconds at max. -0.5 g

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Critical flying altitude

available boost pressure

NOTICE Up to the stated critical flight altitude the respective manifold pressure is available.

Take-off performance	up to max. 2450 m (8000 ft.) above sea level
Continuous performance	up to max. 4875 m (16000 ft.) above sea level

Airbox temperature

Intervention temperature	72 °C (160 °F)
Intervention temperature	* 88 °C (190 °F) * 914 F starting with S/N 4,420.200 (TCU TNr. 966741) * 914 UL starting with S/N 4,417.598 (TCU TNr. 966471)

Oil pressure

Max.	7 bar (102 psi)
NOTICE	For a short period admissible at cold start.
Min.	0.8 bar (12 psi) (below 3500 rpm) * 1.5 bar (22 psi)
Normal	2.0 to 5.0 bar (29 to 73 psi) (above 3500 rpm) * 1.5 to 5.0 bar (22 to 73 psi) * 914 F up to S/N 4,420.085 * 914 UL up to S/N 4,417.665

Oil temperature

Max.	130 °C (266 °F)
Min.	50 °C (120 °F)
normal operating temperature	approx. 90 to 110 °C (190 - 230 °F)

EGT

exhaust gas temperature

Max.	950 °C (1742 °F)

Conventional coolant

See also Chapter 2.2).

Coolant temperature: (coolant exit temperature)	
Max.	120 °C (248 °F)

Cylinder head temperature:	
Max.	135 °C (275 °F)
Permanent monitoring of coolant temperature and cylinder head temperature is necessary.	

Waterless coolant

See also Chapter 2.2).

Cylinder head temperature:	
Max.	135 °C (275 °F)
Permanent monitoring of cylinder head temperature is necessary.	

Engine start, operating temperature

Max.	50 °C (120 °F) (ambient temperature)
Min.	-25 °C (-13 °F) (oil temperature)

Fuel pressure

⚠ WARNING

Non-compliance can result in serious injuries or death!
Exceeding the max. admissible fuel pressure will override the float valve of the carburetor and to engine failure.

Max.	Airbox pressure + 0.35 bar (5.08 psi)
Min.	Airbox pressure + 0.15 bar (2.18 psi)
Normal	Airbox pressure + 0.25 bar (3.63 psi)

Propeller governor

Power consumption of the hydraulic propeller governor:	
Max.	600 W

Vacuum pump

Power consumption of the vacuum pump:	
Max.	300 W

External alternator

Power consumption of the external alternator:	
Max.	1200 W

Bank angle

Deviation from bank angle:	
Max.	40°

NOTE: Up to this value the dry sump lubrication system warrants lubrication in every flight situation.

2.2) Operating media-Coolant

General note

NOTICE Obey the latest edition of Service Instruction SI-914-019 for the selection of the correct coolant.

Conventional coolant

Conventional coolant mixed with water has the advantage of a higher specific thermal capacity than waterless coolant.

Application

When correctly applied, there is sufficient protection against vapor bubble formation, freezing or thickening of the coolant within the operating limits.

Use the coolant specified in the manufacturers documentation.

Mixture

NOTICE Obey the manufacturers instructions about the coolant.

	mixture ratio %	
designation	**concentrate**	**water**
conventional e.g. BASF Glysantine anticorrosion	50*	50
waterless e.g. EVANS NPG+	100	0

* coolant component can be increased up to max. 65 %.

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2.3) Operating media-Fuel

General note

NOTICE Obey the local codes and the latest edition of Service Instruction SI-914-019 for the selection of the correct fuel.

NOTICE Use only fuel suitable for the respective climatic zone.

NOTE: Risk of vapour formation if using winter fuel for summer operation.

Knock resistance

The fuels with following specifications can be used:

	Usage/Description
Knock resistance	**914 F/UL**
	Min. RON 95 (min. AKI* 91)

* Anti Knock Index (RON+MON)/2

Mogas

	Usage/Description
Mogas	**914 F/UL**
European standard	EN 228 Super EN 228 Super plus

AVGAS

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. Thus it should only be used in case of problems with vapor lock or when other types of gasoline are unavailable.

	Usage/Description
AVGAS	**914 F/UL**
Aviation Standard	AVGAS 100 LL (ASTM D910)

2.4) Operating media-Lubricants

General note

NOTICE

Obey the manufacturers instructions about the lubricants.
If the engine is mainly run on AVGAS more frequent oil changes will be required. See Service Instruction SI-914-019, latest edition.

Oil type

Motorcycle oil of a registered brand with gear additives. Do not use aircraft engine oil for direct driven engines.

NOTICE

At the selection of suitable lubricants refer to the additional information in the Service Instruction SI-914-019, latest edition.

Oil consumption

Max. 0.06 l/h (0.13 liq pt/h).

Oil specification

- Use only oil with API classification **"SG"** or higher!
- Due to the high stresses in the reduction gears, oils with gear additives such as high performance motor cycle oils are recommended.
- Because of the incorporated overload clutch, oils with friction modifier additives are unsuitable as this could result in a slipping clutch during normal operation.
- Heavy duty 4-stroke motor cycle oils meet all the requirements. These oils are normally not mineral oils but semi- or full synthetic oils.
- Oils primarity for Diesel engines have **insufficient high temperature properties and additives which favour clutch slipping, and are generally unsuitable.**

Oil viscosity

Use of multi-grade oils is recommended.

NOTE: Multi-viscosity grade oils are less sensitive to temperature variations than single grade oils.

They are suitable for use throughout the seasons, ensure rapid lubrication of all engine components at cold start and get less fluid at higher temperatures.

Table of lubricants See Fig. 1

Since the temperature range of neighbouring SAE grades overlap, there is no need for change of oil viscosity at short duration of ambient temperature fluctuations.

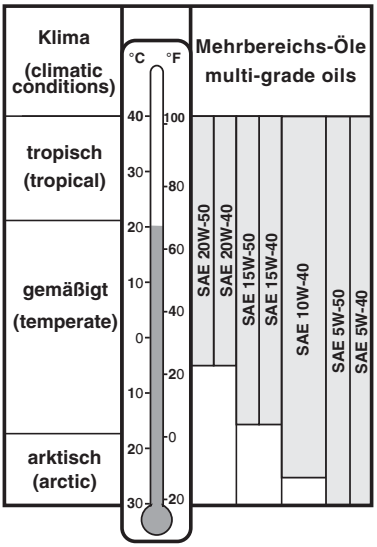

Fig. 1 *01176*

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NOTES

3) Standard operation

Introduction

To warrant reliability and efficiency of the engine, meet and carefully observe all the operating and maintenance instructions.

Table of content

This chapter of the Operators Manual contains expanded operating and maintenance instructions.

3.1) Daily checks

General note

To warrant reliability and efficiency of the engine, meet and carefully observe all the operating and maintenance instructions.

⚠ WARNING

Risk of burnings and scalds!
Hot engine parts!
Conduct checks on the cold engine only!

⚠ WARNING

Non-compliance can result in serious injuries or death!
Ignition “OFF”
Before moving the propeller switch off both ignition circuits and secure the aircraft. Have the cockpit occupied by a competent person.

NOTICE

If established abnormalities (e.g. excessive resistance of the engine, noise etc.) inspection in accordance with the relevant Maintenance Manual is necessary. Do not release the engine into service before rectification.

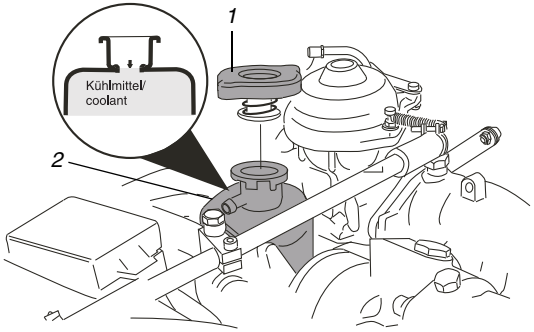
Coolant level

NOTICE The coolant specifications of the section Chapter 2.2) Operating media are to be observed!

Step	Procedure
1	Verify coolant level in the **expansion tank**, replenish as required up to top. The max. coolant level must be filled up to the top (see Fig.1).
2	Verify coolant level in the **overflow bottle**, replenish as required. The coolant level must be between max. and min. mark.

Graphic

Expansion tank



Part	Function
1	radiator cap
2	expansion tank

Fig. 1 *08523*

Check of mechanical components

Check of mechanical components

Step	Procedure
1	Turn propeller by hand in direction of engine rotation several times and observe engine for odd noises or excessive resistance and normal compression.

NOTICE

At excessive resistance of the engine perform the relevant unscheduled maintenance check according to Maintenance Manual (Line), chapter “Hard to turn over“.

Gear box

Version without overload clutch:
No further checks are necessary.

Version with overload clutch:

Step	Procedure
1	Turn the propeller by hand to and fro, feeling the free rotation of 30° before the crankshaft starts to rotate. If the propeller can be turned between the dogs with practically **no friction** at all (less than 25 Nm = 19 ft.lb) further investigation is necessary.

Carburetor

Step	Procedure
1	Verify free movement of throttle cable and starting carburetor over the complete range. Check from the cockpit.

Exhaust system and turbocharger

Step	Procedure
1	Inspect for damages, leakage and general condition.

3.2) Before engine start

Carry out pre-flight checks.

3.3) Pre-flight checks

Safety

⚠ WARNING

Non-compliance can result in serious injuries or death!
Ignition "OFF". Before moving the propeller. Switch off both ignition circuits and anchor the aircraft. Have the cockpit occupied by a competent person.

⚠ WARNING

Risk of burnings and scalds!
Hot engine parts!
Carry out pre-flight checks on the cold or luke warm engine only!

Operating media

Step	Procedure
1	Check for any oil-, coolant- and fuel leaks. If leaks are evident, rectify and repair them before next flight.

Coolant

NOTICE

The coolant specifications of the section Chapter 2.2) Operating media are to be observed!

Step	Procedure
1	Verify coolant level in the **overflow bottle**, replenish as required up to top. The coolant level must be between min. and max. mark.

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NOTICE The oil specifications of the section Chapter 2.4) Operating media are to be observed!

Step	Procedure
1	Check oil level and replenish as required.
2	NOTE: Propeller shouldn't be turned excessively reverse the normal direction of engine rotation. Remove oil tank cap. Prior to oil check, turn the propeller by hand in direction of engine rotation several times to pump oil from the engine into the oil tank.
3	It is essential to build up compression in the combustion chamber. Maintain the pressure for a few seconds to let the pressure flow around the piston rings into the crankcase. The speed of rotation is not important for the pressure transfer into the crankcase.
4	This process is finished when air is returning back to the oil tank and can be noticed by a murmur from the open oil tank.
5	Install oil tank cap.

Oil level (oil dipstick)

NOTE: The oil level should be in the upper half (between the “50%“ and the “max“ mark) and should never fall below the “min“ mark. Prior to long flights oil should be added so that the oil level reaches the “max“ mark.

Avoid oil levels exceeding the “max“ mark, since excess oil could be poured out through the venting system.

Difference between max.- and min.- mark = 0.45 litre (0.95 liq pt)

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3.4) Engine start

Safety

⚠ WARNING Non-compliance can result in serious injuries or death!
Do not take the engine into operation if any person is near the aircraft.

Engine start

Step	Designation	Procedure
1	Fuel valve	open
2	Starting carb	activated
	If engine in operating temperature	**Then** start the engine without choke
3	Throttle lever	set to idle position
4	Master switch	on

TCU

Function test of TCU

NOTE: When switching on the voltage supply, both lamps are automatically subject to a function test.

⚠ WARNING Non-compliance can result in serious injuries or death!
Do not take the engine into operation before having rectified the cause od deficiency.

Lamps

For approx. 1-2 seconds both lamps illuminate and then extinguish. If not, a check as per Maintenance Manual is necessary.

Step	Designation	Procedure
5	Electric fuel pump	on
6	Ignition	both circuits switched on
	NOTICE Do not actuate starter button (switch) if the engine is running. Wait until complete stop of engine!	
7	Starter button	actuate
	NOTICE Activate starter for max. 10 sec. only (without interruption), followed by a cooling period of 2 minutes!	
8	As soon as engine runs	adjust throttle to achieve smooth running at approx. 2500 r.p.m.

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Step	Designation	Procedure
9	Oil pressure	Check if oil pressure has risen within 10 seconds and monitor oil pressure. Increase of engine speed is only permitted at steady oil pressure readings above 2 bar (30 psi).
10	**NOTICE** At an engine start with low oil temperature, continue to observe the oil pressure as it could drop again due to the increased flow resistance in the suction line. The engine speed rpm may be only so far increased that the oil pressure remains steady.	
11	Staring carb	De-activate.

To observe!

Reduction gear with shock absorber

NOTICE Since the engine comprises a reduction gear with shock absorber, take special care of the following:

Step	Procedure
1	To prevent impact load, start with throttle lever in idle position or at the most up to 10% open.
2	For the same reason, wait for around 3 sec. after throttling back to partial load to reach constant speed before re-acceleration.
3	For checking the two ignition circuits, only one circuit may be switched off and on at a time.

3.5) Prior to take-off

Safety

⚠ WARNING Non-compliance can result in serious injuries or death!
Do not take the engine into operation if any person is near the aircraft.

Warming up period

Step	Procedure
1	Start warming up period at approx. 2000 rpm for approx. 2 minutes.
2	Continue at 2500 rpm, duration depending on ambient temperature, until oil temperature reaches 50 °C (120 °F).
3	Check temperatures and pressures.

Throttle response

NOTICE After a full-load ground test allow a short cooling run to prevent vapour formation in the cylinder head.

Step	Procedure
1	**Short** full throttle ground test (consult Aircraft Operators Manual since engine speed depends on the propeller used).

Ignition check

Check the two ignition circuits at **4000 rpm** (approx. 1700 rpm propeller).

Step	Procedure
1	Speed drop with only one ignition circuit must not exceed **300 rpm** (approx. 130 rpm propeller).
2	**115 rpm** (approx. 50 rpm propeller) max. difference of speed by use of either circuit, A or B.
	NOTE: The propeller speed depends on the actual reduction ratio.

Propeller governor

Check of hydraulic propeller governor:
Check control of the hydraulic propeller governor to specifications of the manufacturer.

NOTE: Cycling the propeller governor puts a relatively high load on the engine. Unnecessary cycling or additional checks should be avoided.

3.6) Take-off

Safety

⚠ WARNING Non-compliance can result in serious injuries or death!

- Monitor oil temperature, cylinder head temperature and oil pressure. Limits must not be exceeded! See Chapter 2.1) Operating limits.
- Respect “cold weather operation” recommendations, see Chapter 3.9).

NOTICE If the national Aviation Authority demands the software classification “D“ according to RTCA DO 178 B for the TCU software a special starting procedure is laid down which renders any influence of the TCU ineffective during the take-off, see Chapter 3.6.2).

Climb

Climbing with engine running at take-off performance is permissible (max. 5 minutes) (see Chapter 2.1).

3.6.1) Take-off (standard - with active TCU)

Step	Procedure
1	Switch on the auxiliary fuel pump at take-off.
2	Move throttle lever to 115 % (take-off performance).
3	The auxiliary fuel pump should be switched off after the take-off.

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3.6.2) Take-off (as per RTCA DO 178 B - with inactive TCU)

NOTICE

Any improper use of the TCU-switch will be recorded by the TCU. At exceeding of the limits of operation will render any claims on ROTAX null and void.

Step	Procedure
1	Switch on the auxiliary fuel pump.
2	Move throttle lever to 115 % (take-off performance).
3	Set take-off power until the boost pressure stabilizes within the limits of operation.
4	TCU-switch in “OFF“ position.
5	After reaching the critical altitude switch on the TCU.
6	The auxiliary fuel pump should be switched off after the take-off.

3.7) Cruising

Performance

Step	Procedure
1	Set performance as per performance specifications Chapter 5) and respect operating limits as per Chapter 2.1).

Oil temperature

Step	Procedure
1	Avoid operation below normal operation oil temperature (90 to 110 °C / 194 to 230 °F), as possible formation of condensation water in the lubrication system badly influences the oil quality. To evaporate accumulated condensation operate engine at over 100 °C (212 °F) oil temperature for a minimum of 10 min. every flight day.

3.8) Engine shut-off

General note

Normally the cooling down of the engine during descending and taxiing will be sufficient to allow the engine to be shut off as soon as the aircraft is stopped.

At increased operating temperatures make an engine cooling run of at least minimum 2 minutes.

3.9) Cold weather operation

General note

Generally, an engine service should be carried out before the start of the cold season.

Coolant

For selection of coolant and mixing ratio, see "Coolant", Chapter 2.2).

Lubricant

For selection of oil, see table of Lubricants Chapter 2.4).

Cold start

- With throttle closed and choke activated (open throttle renders starting carb ineffective).
- Be aware, no spark below crankshaft speed of 220 rpm (propeller speed of 90 rpm).
- As performance of electric starter is greatly reduced when hot, limit starting to periods not much longer than 10 sec. With a well charged battery, adding a second battery will not improve cold starts.

Remedy - Cold start

Step	Procedure
1	Use of multigrade oil with the low end viscosity code of 5 or 10.
2	Gap electrode on spark plug to the minimum or fit new spark plugs.
3	Preheat engine.

Icing in the air intake system

Icing due humidity

Carburetor icing due to humidity may occur on the venturi and on the throttle valve due to fuel evaporation and leads to performance loss and change in mixture.

Remedy

- Intake air pre-heating is the only effective remedy. See Flight Manual supplied by the aircraft manufacturer.
- The turbocharger will heat up the intake air. If however a intake air pre-heating is necessary, observe the aircraft manufacturers engine installation and operating instruction.

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Icing due to water in fuel

Icing due to water in fuel

NOTICE

Fuels containing alcohol always carry a small amount of water in solution. In case of temperature changes or increase of alcohol content, water or a mixture of alcohol and water may settle and could cause troubles.

Water in fuel will accumulate at the lower parts of the fuel system and leads to freezing of fuel lines, filters or jets.

Remedy

- Use non-contaminated fuel (filtered through suede)
- Generously sized water separators
- Fuel lines routing inclined
- Prevent condensation of humidity, i. e avoid temperature differences between aircraft and fuel.

NOTES

4) Abnormal operation

Introduction

⚠ WARNING Non-compliance can result in serious injuries or death!
At unusual engine behaviour conduct checks as per Maintenance Manual, Chapter 05-50-00 before the next flight.

NOTE: Further checks - see Maintenance Manual.

Table of contents

This chapter of the Operators Manual contains expanded operating and maintenance instruction at abnormal operation.

4.1) Sudden drop of boost pressure and speed

Sudden drop of boost pressure and speed

Any exceeding of the max. admissible engine speed or boost pressure has to be recorded by the pilot in the logbook, stating the duration, exact time and extent of exceeding.

Loud noise or bang	
Possible cause	**Remedy**
Fracture of the turbo	Look for landing possibility.
	Flight with reduced performance may be possible.
	Monitor oil pressure.

Orange caution lamp of TCU (turbo control unit) is blinking	
Possible cause	**Remedy**
Wastegate does not close	Limited flying operation as possibly wastegate does not respond.

NOTE: A minimum performance of approx. 66 kW (88 HP) remains available.

4.2) Sudden rise of boost pressure and speed

Sudden rise of boost pressure and speed

Any exceeding of the max. admissible engine speed or boost pressure has to be recorded by the pilot in the logbook, stating the duration, exact time and extent of exceeding.

Orange caution lamp of TCU (turbo control unit) is blinking	
Possible cause	**Remedy**
Wastegate fully closed	Immediately reduce engine speed until boost pressure and speed are within operating limits.
	Limited flying operation as wastegate may be fully closed and control of the boost pressure is only possible via throttle lever.

Bowden cable(s) for actuation of throttle valve(s) broken	
Possible cause	**Remedy**
Due to spring pressure the throttle valve(s) will be fully open - **full throttle!**	Limited flying operation as wastegate may be fully closed and control of the boost pressure and rpm is only possible via ignition unit.

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4.3) Periodical rise and drop of boost pressure and speed (boost pressure control is surging)

Rise and drop of boost pressure and speed

Switching off the servo motor momentarily or permanently, has to be recorded by the pilot in the logbook, stating the duration, exact time and duration of switching off.

NOTICE

If this action does not stabilize operation, **switch off** servo **completely**. If need be, reduce engine speed until boost pressure and speed are within the operating limits again.

Orange caution lamp of TCU is not blinking	
Possible cause	**Remedy**
Pressure control is not possible.	Limited flying operation. **Switch off** servo motor **for a moment** (max. 5 sec).
	After a short regulating time operation should stabilize.

4.4) Caution lamps

4.4.1) Red boost lamp of TCU permanently illuminating

Red boost lamp permanently illuminating

In case of exceeding the max. admissible boost pressure, this has to be recorded by the pilot in the logbook, stating the duration and exact time of exceeding of limits.

NOTICE The boost pressure will not be reduced automatically.

Possible cause	Remedy
The maximum admissible boost pressure was exceeded.	Reduce speed and boost pressure manually to be within the operating limits.
	Limited flying operation, as boost pressure control may be unavailable or insufficiently.

4.4.2) Red boost lamp of TCU blinking

Red boost lamp blinking

In case of exceeding the “take-off“ time limits, this has to be recorded by the pilot in the logbook, stating the duration and exact time of exceeding of limits.

NOTICE The boost pressure will not be reduced automatically.

Possible cause	Remedy
The maximum “take-off“ time limitation was exceeded.	Reduce speed and boost pressure at least to maximum continuous speed.

4.4.3) Orange caution lamp of TCU blinking

Orange caution lamp of TCU blinking

In case of blinking of the orange caution lamp of TCU, this has to be recorded by the pilot in the logbook, stating the duration, exact time and extent of exceeding limits.

NOTICE

If the manually controlled variable is not possible, then turn off the servo motor.

Possible cause	Remedy
Indicates a failure of a sensor, sensor wiring, TCU, or leakage in the airbox	Reduce speed and boost pressure manually to be within the operating limits.
	Limited flying operation, as this may indicate the boost pressure control is no more or insufficiently possible and may affect engine performance.

4.5) Failure of the voltage supply to the TCU

Failure of voltage supply

Any exceeding of the max. admissible operating limits must be recorded by the pilot in the logbook, stating the duration, exact time and extent of exceeding.

Possible cause	Remedy
At a failure of voltage supply the servo motor will remain in its momentary position.	Limited flight operation as boost pressure control is not possible.

4.6) Start during flight

Engine stop

- Starting procedure same as on ground, however, on a warm engine without choke.

4.7) Exceeding of max. admissible engine speed

Exceeding of max. engine speed

- Reduce engine speed. Any exceeding of the max. admissible engine speed has to be entered by the pilot into the logbook, stating duration and extent of overspeed.

4.8) Exceeding of max. admissible cyl. head temperature

Exceeding of cylinder head temperature

NOTICE

Reduce engine power setting to the minimum necessary to maintain flight and carry out precautionary landing.

- Any exceeding of the max. admissible cylinder head temperature has to be entered by the pilot into the logbook, stating duration and extent of over-temperature condition.

4.9) Exceeding of max. admissible oil temperature

Exceeding of oil temperature

NOTICE

Reduce engine power setting to the minimum necessary to maintain flight and carry out precautionary landing.

- Any exceeding of the max. oil temperature must be entered by the pilot in the logbook, stating duration and extent of over-temperature condition

4.10) Oil pressure below minimum - during flight

Oil pressure below minimum

NOTICE

Reduce engine power setting to the minimum necessary to maintain flight and carry out precautionary landing.

- Check oil system.

4.11) Oil pressure below minimum - on ground

Oil pressure below minimum

Immediately stop the engine and check for reason. Check oil system.

- Check oil quantity in oil tank.
- Check oil quality. See Chapter 2.4).

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4.12) Engine on fire or fire in the engine compartment

Engine of fire

In the event of fire or signs, e.g. heavy smoke:

Step	Procedure
1	Both electric fuel pumps and the main switched off.
2	The fuel valve has to be closed.
3	If the fire should extinguish it may be tried again to actuate the main fuel pumps and to start the engine (see section Engine start).

NOTICE If the fire starts anew the fuel system has to be shut off immediatly.

Any shut-off of the fuel system for short periods or permanent has to be entered by the pilot into the logbook starting date and duration of shut-off.

4.13) Trouble shooting

Introduction

All checks in accordance with the Maintenance Manual (current issue/revision).

⚠ WARNING

Non-compliance can result in serious injuries or death!
Only qualified staff (authorized by the Aviation Authorities) trained on this particular engine, is allowed to carry out maintenance and repair work.

NOTICE

If the following hints regarding remedy do not solve the problem, contact an authorized workshop. The engine must not be operated until the problem is rectified.

Table of content

This chapter of the Operators Manual contains possible cause and remedy in case of trouble shooting.

Starting problems

Engine does not start

Possible cause	Remedy
Ignition off.	switch on.
Closed fuel valve or clogged filter.	open valve, clean or renew filter, check fuel system for leaks.
No fuel in tank.	refuel.
Starting speed too low, faulty or discharged battery.	fit fully charged battery.
Starting speed too low, start problems on cold engine.	use top quality, low friction oil; allow for sufficient cooling period to counter for performance drop on hot starter; pre-heat engine.
Fuel air-ratio to rich	start without electric booster pump. start without start carb (Choke).

Engine run

Engine idles rough after warm-up period, smoky exhaust emission

Possible cause	Remedy
Starting carb (Choke) activated.	close starting carb (Choke).

Engine keeps running with ignition off

Possible cause	Remedy
Overheating of engine.	let engine cool down at idling at approx. 2000 rpm.

Knocking under load

Possible cause	Remedy
Octane rating of fuel too low.	use fuel with higher octane rating.

Oil pressure

Low oil pressure

Possible cause	Remedy
Not enough oil in oil tank.	Check oil return line for free passage, renew oil seal.

Oil level

Possible cause	Remedy
Oil too cold during engine operation.	cover oil cooler surface, maintain the oil temperature prescribed.

Cold engine start

Engine hard to start at low temperature

Possible cause	Remedy
Starting speed too low.	preheat engine.
Low charge battery.	fit fully charged battery.
High oil pressure.	At cold start a pressure reading of up to around 7 bar (102 psi) does not indicate a malfunction.
Oil pressure too low after cold start.	Too much resistance in the oil suction tube at low temperatures. Stop engine and preheat oil. At oil pressure reading too low than 1 bar oils with lower viscosity are to be used. See Service Instruction SI-914-019, current issue.
NOTE:	Oil pressure must be measured at idle at an oil temperature of minimum 50 °C (120 °F). Be sure the oil pressure does not go below minimum at idle.

5) Performance data

Introduction

The performance tables and performance graphs on the next few pages are intended to show you what kind of performance to expect from your engine in terms of power output. The indicated power can be achieved by following the procedures laid out in the Operators Manual and ensuring that the engine is well-maintained.

Table of content

This chapter of the Operators Manual contains performance tables and performance graphs.

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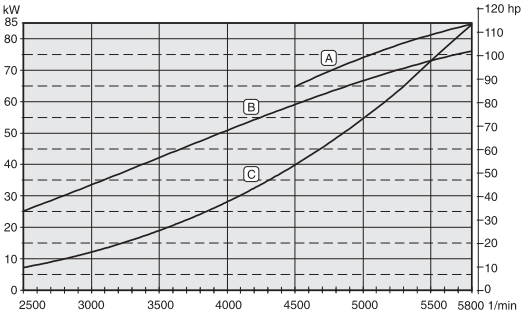
Performance graphs for stand. conditions (ISA)

Engine performance

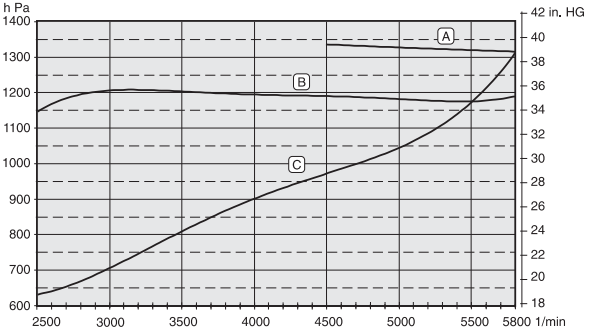


A: Engine curve (take-off performance)
B: Engine curve (continuous full throttle performance)
C: Propeller curve (Power requirement of propeller)

Fig. 1 *08641*

NOTE: The manifold pressure in the compensating tube is always lower by the pressure loss in the carburetors than the TCU controlled airbox pressure and may be therefore subject to bigger deviations.

Manifold pressure



A: Engine curve (take-off performance): 84.5 kW at 5800 rpm
1300 hPa (38.4 in.HG)
*1320 hPa (39.0 in.HG)
B: Engine curve (continuous full throttle performance):
73.5 kW at 5500 rpm
1150 hPa (34.0 in.HG)
*1180 hPa (34.9 in.HG)
C: Propeller curve (Power requirement of propeller)
*914 F starting with engine no. 4,420.200 (TCU part no. 966741)
*914 UL starting with engine no. 4,417.598
(TCU part no. 966471)

Fig. 2 *08642*

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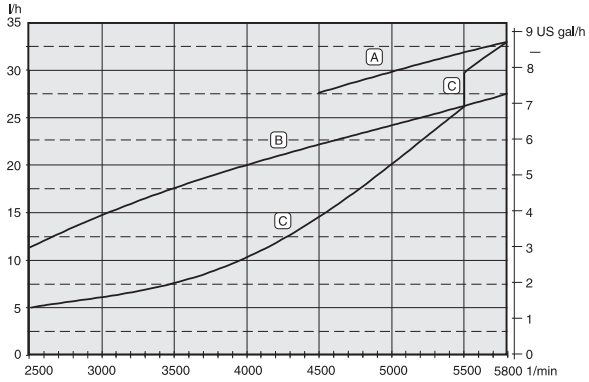
Fuel consumption



A: Engine curve (take-off performance)
B: Engine curve (continuous full throttle performance)
C: Propeller curve (Power requirement of propeller)

Fig. 3 *08643*

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Performance data for variable pitch propeller

Engine speed over 5500 rpm is restricted to 5 minutes.

Run the engine in accordance with the following table.

Power setting	Engine speed (rpm)	Performance (kW)/(HP)		Torque (Nm) (ft.lb.)		Manifold press. (in.HG)	Throttle position (%)
Take-off power	5800	84.5	115	139	102 ft.lb	39	115,0
max. continuous power	5500	73.5	100	128	93 ft.lb	35	100,0
75 %	5000	55.1	74	105	77 ft.lb	31	approx. 67
65 %	4800	47.8	64	95	70 ft.lb	29	approx. 64
55 %	4300	40.4	54	90	66 ft.lb	28	approx. 59

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Performance graph for non-standard conditions

Take-off performance (kW)

Altitude	Temperature ISA		Temperature difference to ISA																	
(ft)	(°C)	(°K)	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35
-2000	19	292	101	99	97	95	94	92	90	89	87	86	84	83	81	80	79	78	76
0	15	288	100	98	96	94	93	91	89	88	86	85	83	82	80	79	78	77	
2000	11	284	99	97	95	93	92	90	88	87	85	84	82	81	79	78	77	76	
4000	7	280	98	96	94	92	91	89	87	86	84	83	81	80	78	77	76		
6000	3	276	97	95	93	91	90	88	86	85	83	81	80	79	77	76			
8000	-1	272	96	94	92	90	88	87	85	83	82	80	79	78	76				

Max. Continuous power (kW)

Altitude	Temperature ISA		Temperature difference to ISA																	
(ft)	(°C)	(°K)	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35
-2000	19	292	88	86	85	83	81	80	78	77	76	74	73	72	71	70	69	67	66
0	15	288	87	85	84	82	80	79	78	76	75	74	72	71	70	69	68	67	66
2000	11	284	87	85	83	81	80	78	77	76	74	73	72	70	69	68	67	66	65
4000	7	280	86	84	82	81	79	78	76	75	73	72	71	70	68	67	66	65	64
6000	3	276	85	83	82	80	78	77	75	74	73	71	70	69	68	66	65	64	
8000	-1	272	84	82	81	79	77	76	74	73	72	70	69	68	67	66	64	63	
10000	-5	268	83	82	80	78	77	75	74	72	71	69	68	67	66	65	63		
12000	-9	264	82	81	79	77	76	74	72	71	70	68	67	66	65	64			
14000	-13	260	81	79	77	76	74	73	71	70	68	67	66	65	63				
16000	-17	256	80	78	76	75	73	72	70	69	67	66	65	64					

Fig. 4 *03123*

Example:

Max. continuous power at 10 000 ft?

Temperature ISA at 10 000 ft ..... -5 °C
Ambient temperature at 10 000 ft ..... -15 °C
Temperature difference to ISA ..... -10 °C

Max. continuous power as per table..... 72 kW

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NOTES

6) Weights

Introduction

The stated weights are dry weights (without operating fluids) and are guide values only.
Further weight information relating to the equipment can be found in the current Installation Manual.

Table of content

This chapter of the Operators Manual contains an extensive list of approved equipment for this engine.

6.1) Engine

- **with**: carburetors, generator, ignition unit and oil container, electric starter, stainless steel muffler, engine suspension frame, turbocharger and TCU (turbocharger control unit)
- **without**: radiator and fuel pump

Configuration 2/4	
914 F	**914 UL**
71.7 kg (158 lb)	71.7 kg (158 lb) with overload clutch
	70.0 kg (154 lb) without clutch

Configuration 3	
914 F	**914 UL**
74.4 kg (164 lb)	

6.2) Accessories

Part	Weight
External alternator	3.0 kg (6.6 lb)
Vacuum pump	0.8 kg (1.8 lb)
Overload clutch	1.7 kg (3.7 lb)
NOTE: The overload clutch is installed on all certified aircraft engines and on non-certified aircraft engines of the configuration 3.	

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7) Description of systems

Introduction

This chapter of the Operator Manual contains the description of cooling system, fuel system, lubrication system, electric system and the propeller gearbox.

Table of content

As already mentioned in the preface, the system descriptions only apply to the engine, not to a specific application in a particular aircraft. The aircraft manufacturers Operators Manual is therefore definitive in terms of the operation of the engine, as it contains all the aircraft specific instructions.

7.1) Cooling system of the engine

General note

See Fig. 1.

Cooling

The cooling system of the ROTAX 914 is designed for liquid cooling of the cylinder heads and ram-air cooling of the cylinders. The cooling system of the cylinder heads is a **closed** circuit with an expansion tank.

Coolant

The coolant flow is forced by a water pump, driven from the camshaft, from the radiator to the cylinder heads. From the top of the cylinder heads the coolant passes on to the expansion tank (1). Since the standard location of the radiator (2) is below engine level, the expansion tank located on top of the engine allows for coolant expansion.

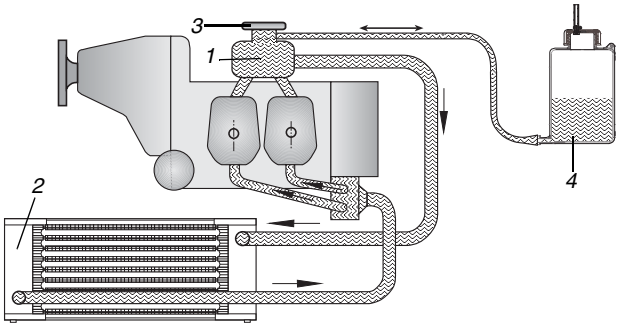
Expansion tank

The expansion tank is closed by a pressure cap (3) (with excess pressure valve and return valve). At temperature rise of the coolant the excess pressure valve opens and the coolant will flow via a hose at atmospheric pressure to the transparent overflow bottle (4). When cooling down, the coolant will be sucked back into the cooling circuit.

Coolant temperature measuring

Readings are taken on measuring point of the hottest cylinder head, depending on engine installation.

NOTE: The temperature sensors are located in cylinder head 2 and 3.



Part	Function
1	expansion tank
2	radiator
3	pressure cap
4	overflow bottle

Fig. 1 *09152*

7.2) Fuel system

General note

See Fig. 2

Fuel

The fuel flows from the tank (1) via a filter/water trap (2) to the two electric fuel pumps (3) connected in series. From the pumps fuel passes on via the fuel pressure control (4) to the two carburetors (5).

NOTE: Parallel to each fuel pump a separate check valve (6) is installed.

Fuel pressure control

The fuel pressure control ensures that the fuel pressure is always maintained approx. 0.25 bar (3.63 psi) above the variable boost pressure in the “airbox“ (8).

Return line

NOTICE

The return line must not present flow resistance. Pay attention to possible constriction of diameter or obstruction, to avoid overflowing of carburetors.

Via the return line (7) surplus fuel flows back to the fuel tank.

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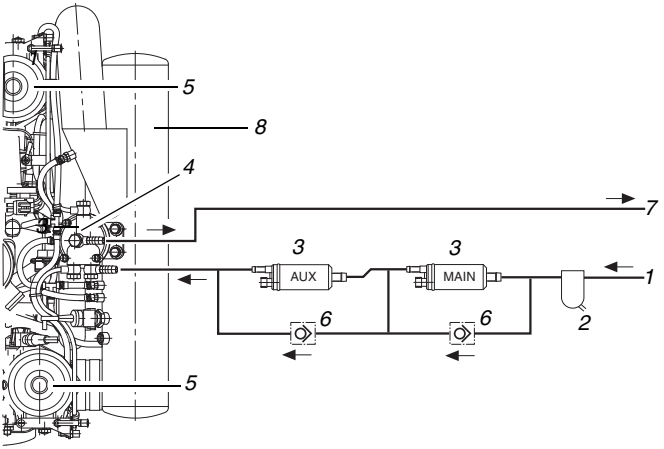

Part	Function
1	fuel tank
2	filter/water trap
3	electric fuel pumps
4	fuel pressure control
5	carburetor
6	check valve
7	return line
8	airbox

Fig. 2 *00103*

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7.3) Lubrication system

General note

See Fig. 3

The ROTAX 914 engine is provided with a dry sump forced lubrication system with a main oil pump with integrated pressure regulator (1) and an additional suction pump.

Lubrication

The main oil pump (2) sucks the motor oil from the oil tank (3) via the oil cooler (4) and forces it through the oil filter to the points of lubrication (lubricates also the plain bearings of the turbocharger and the propeller governor).

NOTE: The oil cooler is optional.

Crankcase

The surplus oil emerging from the points of lubrication accumulates on the bottom of crankcase and is forced back to the oil tank by the piston blow-by gases.

Oil pump

The oil pumps are driven by the camshaft.

Oil circuit vented

The oil circuit is vented via bore (5) on the oil tank.

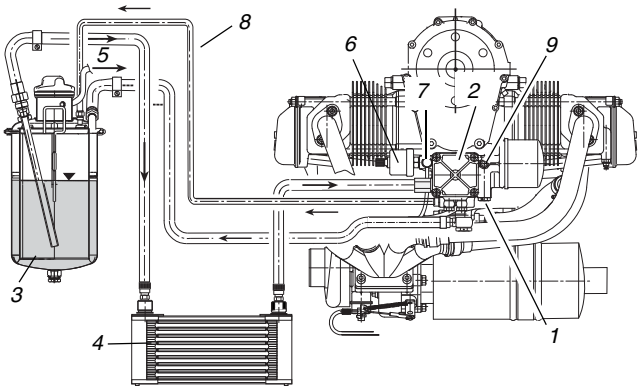
Oil temperature sensor

The oil temperature sensor (9) for reading of the oil inlet temperature is located on the oil pump housing.

Turbocharger

The turbocharger is lubricated via a separate oil line (7) (from the main oil pump).

The oil emerging from the turbocharger collects in a stainless steel oil sump and is sucked back to the secondary oil pump and then pumpes back to the main oil tank via the oil line (8).



Part	Function
1	pressure regulator
2	oil pump
3	oil tank
4	oil cooler
5	venting bore
6	oil pressure sensor
7	oil line (main oil pump)
8	oil line (secondary oil pump to oil tank)
9	oil temperature sensor

Fig. 3 *08580*

7.4) Electric system

General note

See Fig. 4

The ROTAX 914 engine is equipped with a dual ignition unit of a breakerless, capacitor discharge design, with an integrated generator.

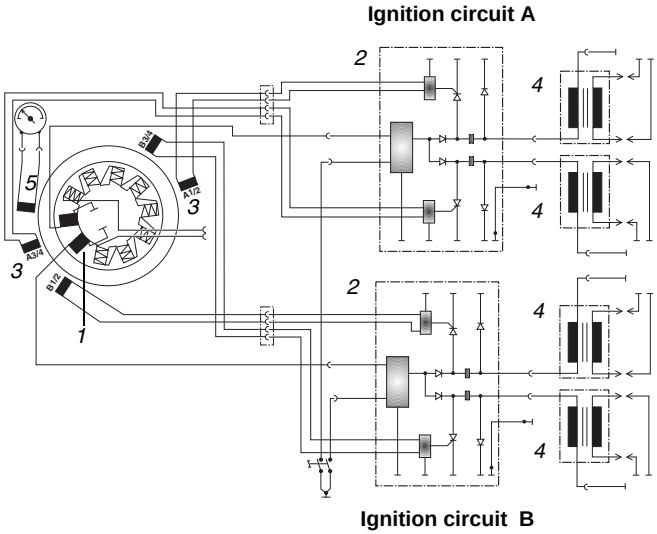
The ignition unit needs no external power supply.

Charging coils

Two independent charging coils (1) located on the generator stator supply one ignition circuit each. The energy is stored in capacitors of the electronic modules (2). At the moment of ignition 2 each of the 4 external trigger coils (3) actuate the discharge of the capacitors via the primary circuit of the dual ignition coils (4).

NOTE: The trigger coil (5) is provided for the rev counter signal.

Firing order: 1-4-2-3.



Part	Function
1	charging coils
2	electronic modules
3,5	trigger coils
4	dual ignition coils

Fig. 4 *00425*

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7.5) Turbo charger and control system

General note

The ROTAX 914 engine is equipped with an exhaust gas turbocharger, making use of the energy in the exhaust gas for precompression of the intake air (boost pressure).

Regulation boost pressure

The boost pressure in the airbox is controlled by means of an electronically controlled flap (wastegate) in the exhaust gas turbine.

NOTE: The wastegate regulates the speed of the turbocharger and consequently the boost pressure in the airbox.

Throttle position

See Fig. 5

The required nominal boost pressure in the airbox is determined by the throttle position sensor mounted on the carburetor 2/4. The sensor's transmitted position is linear from 0 to 115 % corresponding to a throttle position from idle to full power.

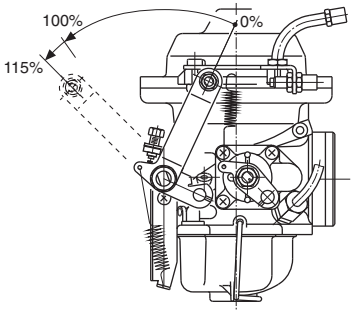

Fig. 5 *03044*

Nominal boost pressure

See Fig. 6

For correlation between throttle position and nominal boost pressure in the airbox, refer to the diagram.

NOTICE

As shown in the diagram, the throttle position at 108 to 110 % results in a rapid rise of nominal boost pressure. To avoid unstable boost, the throttle should be moved smoothly through this area either to full power (115 %) or, on a power reduction, to max. continuous power (100 %).

In this range (108 to 110 % throttle position) small changes in throttle position have a big effect on engine performance and speed, but are virtually not apparent for the pilot from the throttle lever position.

NOTICE

The exact setting for a specific performance is virtually impossible in this range and has to be prevented, as it might cause control fluctuations (surging).

Throttle position versus nominal airbox pressure

NOTE: In the course of model refinement some parameters have been slightly changed. Diagram and table shown the current state of software.

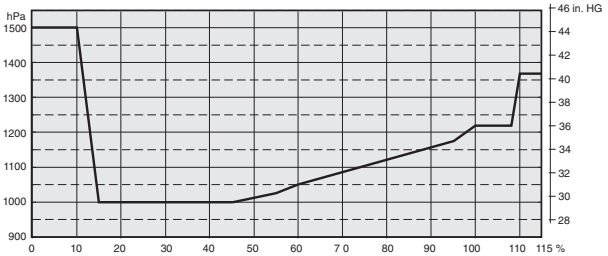

Fig. 6 *00170*

The most important points for engine operation:

engine performance	throttle position	nominal manifold pressure
idling of engine	~ 0 %	1500 hPa (44.3 in.HG)
max. continuous performance	100-108 %	1220 hPa (36.0 in.HG)
take-off performance	110-115 %	1370 hPa (40.5 in.HG)

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Nominal pressure

Besides the throttle position, overspeeding of the engine and too high intake air temperature have an effect on the nominal boost pressure.
If one of the stated factors exceeds the specified limits, the boost pressure is automatically reduced, thus protecting the engine against overload.

7.5.1) TCU caution lamps

Caution lamp

The TCU (Turbo Control Unit) is furnished additionally with output connections for an external "**red**" boost lamp and an "**orange**" caution lamp for indication of function of the TCU.

Function test

⚠ WARNING

Non-compliance can result in serious injuries or death!
The engine must not be taken into operation before having corrected the cause of deficiency.

When switching on the voltage supply, the two lamps are automatically subject to a function test. Both lamps illuminate for 1-2 seconds, then they extinguish. If they do not, a check as per Maintenance Manual is necessary.

Orange caution lamp

If the caution lamp illuminates during the function test and then goes off this indicates the TCU is ready for operation.
If the lamp is blinking, this indicates a malfunction of the TCU or its periphery.
See Chapter 4.1) Abnormal operation.

Red boost lamp

NOTICE

The red boost lamp helps the pilot to avoid full power operation for longer than 5 minutes as otherwise the engine would be thermally and mechanically overstressed.

- Exceeding of the admissible boost pressure will activate the red boost lamp, being continuously illuminated.
  See Chapter 4.1) Abnormal operation.
- The TCU registers the time of full throttle operation (boost pressure). Full throttle operation for longer than 5 minutes will make the red boost lamp blink.
  See Chapter 4.1) Abnormal operation.

7.6) Propeller gearbox

General note

See Fig. 7

Reduction ratio

For the engine type 914 one reduction ratio is available

Reduction ratio	914 F/UL
crankshaft: propeller shaft	2.43:1

Overload clutch

Depending on engine type, certification and configuration the propeller gearbox is supplied with or without an overload clutch.

NOTE: This overload clutch will prevent any undue load to the crankshaft in case of ground contact of the propeller.

NOTE: The overload clutch is installed on serial production on all certified aircraft engines and on the non-certified aircraft engines of configuration 3.

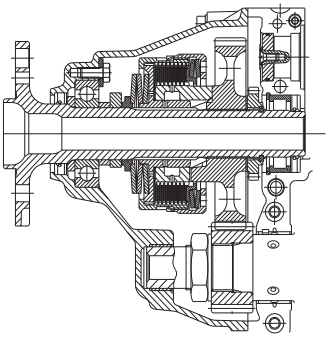

Fig. 7 *02531*

NOTE: Fig. shows a propeller gearbox of configuration 2 with the integrated overload clutch.

Torsional shock absorber

The design incorporates a torsional shock absorber. The shock absorbing is based on progressive torsional cushioning due to axial spring load acting on a dog hub.

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Backlash

On the gearbox version with overload clutch the design incorporates a friction damped free play at the dogs to warrant proper engine idling. Due to this backlash at the dogs a distinct torsional impact arises at start, stop and at sudden load changes, but it will remain harmless.

Vacuum pump or hydraulic governor

At configuration 3 and/or 4.

Alternatively either a vacuum pump **or** a hydraulic governor for constant speed propeller can be used. The drive is in each case via the propeller reduction gear.

gear ratio	
crankshaft: propeller shaft	2.43:1
propeller shaft: hydraulic governor/ vacuum pump	0.758:1
crankshaft: hydraulic governor/ vacuum pump	1.842:1

NOTE: Transmission ratio between crankshaft and hydraulic governor or vacuum pump is 1.842 i.e. the speed of the hydraulic governor or vacuum pump is 0.54 of engine speed.

NOTES

8) Checks

Introduction

All checks to be carried out as specified in the current Maintenance Manual (last revision).

⚠ WARNING

Non-compliance can result in serious injuries or death!
Only qualified staff (authorized by the Aviation Authorities) trained on this particular engine, is allowed to carry out maintenance and repair work.

NOTICE

Carry out all directives of Service Bulletins (SB), according to their **priority**.
Observe according Service Instructions (SI) and Service Lettter (SL).

Table of content

This chapter of the Operators Manual contains checks of the aircraft engine.

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8.1) Engine preservation

General note

⚠ WARNING

Risk of burnings and scalds!
Hot engine parts!
Always allow engine to cool down to ambient temperature before start of any work.

Due to the special material of the cylinder wall, there is no need for extra protection against internal cylinder corrosion for the ROTAX aircraft engines. At extreme climatic conditions and for long out of service periods we recommend the following to protect the valve guides against corrosion:

Step	Procedure
1	Operate the engine until the temperatures have stabilized for a period of 5 min (engine oil temperature between 50 to 70 °C (122 to 160 °F).
2	Switch the engine OFF.
3	Allow the engine to cool down.
4	Change oil.
5	Remove the air intake filters and insert approx. 30 cm³ (1 fl oz) of corrosion inhibiting oil into the carburetor throat with the engine running at increased idle speed. Shut off engine.
6	Drain carburetor float chamber.
7	Apply oil to all joints on carburetors.
8	Close **all** openings on the cold engine, such as exhaust end pipe, venting tube, air filter etc. against entry of dirt and humidity.
9	Spray all steel external engine parts with corrosion inhibiting oil.

8.2) Engine back to operation

If preservation (including oil change) took place within a year of storage, oil renewal will not be necessary. For longer storage periods repeat preservation annually.

Step	Procedure
1	Remove all plugs and caps.
2	Clean spark plugs with plastic brush and solvent .
3	Reinstall.

9) Supplement

Introduction

According to the regulation of EASA part 21 A.3 / FAR 21.3 the manufacturer shall evaluate field information and report to the authority. In case of any relevant occurrences that may involve malfunction of the engine, the form on the next page should be filled out and sent to the responsible authorized ROTAX® distributor.

NOTE: The form is also available from the official ROTAX® AIRCRAFT ENGINES Homepage in electronic version.

www.rotax-aircraft-engines.com

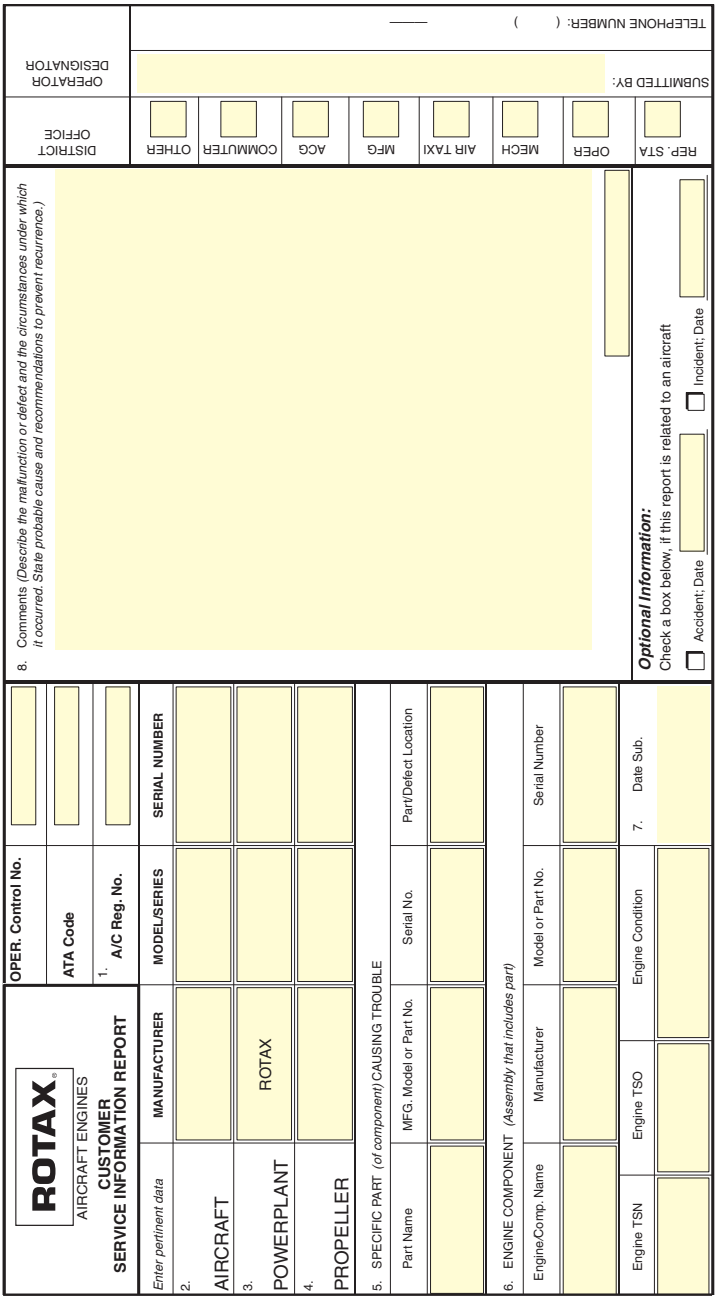
Register: **Document type/Diverses**

Table of content

This chapter of the Operators Manual contains the form “customer service information report“ and the list of authorized distributors for ROTAX aircraft engines.

NOTES

9.1) Form



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NOTES

9.2) Authorized Distributor

General note

See the official ROTAX® AIRCRAFT ENGINES Homepage www.rotax-aircraft-engines.com

List

Overview of authorized distributors of ROTAX aircraft engines.

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CROATIA / FORMER YUGOSLAVIA (EXEPT SLOVENIA):

➤**SHAFT D.O.O.**
B.L. Mandica 161 a
HR-54000 OSIJEK
Tel.: +385 (0) 31 /280-046,
Fax: +385 (0) 31 /281-602
E-mail: shaft@os.tel.hr
Contact person: Ing. Ivan Vdovjak

CZECHIA / SLOVAKIA:

➤**TEVESO S.R.O.**
Skroupova 441
CS-50002 HRADEC KRALOVE
Tel.: +42 049 / 5217 127,
Fax: +42 049 / 5217 226
E-mail: motory@teveso.cz
Website: www.teveso.cz
Contact persons: Ing. Jiri Samal

SWEDEN / FINLAND / NORWAY / ESTONIA / LATVIA / LITHUANIA / DENMARK:

➤**LYCON ENGINEERING AB**
Härkeberga, SE-74596 ENKÖPING
Tel.: +46 (0) 171 / 414039,
E-mail: info@lycon.se
Website: www.aeronord.eu

FRANCE / ALGERIA / BELGIUM / LUXEMBURG / MAROCCO / MONACO / TUNESIA:

➤**MOTEUR AERO DISTRIBUTION**
11 Blvd Albert 1
98000 MONACO
Tel.: +377 (0) 93 30 17 40,
Fax: +377 (0) 93 30 17 60
E-mail: mad@libello.com
Website: www.moteuraerodistribution.com
Contact person: Philippe Thys

GERMANY / AUSTRIA / BULGARIA / HUNGARY / LIECHTENSTEIN / ROMANIA / SWITZERLAND / THE NETHERLANDS:

➤**FRANZ AIRCRAFT ENGINES VERTRIEB GMBH**
Am Weidengrund 1a, 83135 Schechen,
GERMANY
Tel.: +49 (0) 8039 / 90350,
Fax: +49 (0) 8039 / 9035-35
E-mail: info@franz-aircraft.de
Website: www.franz-aircraft.de
Contact person: Eduard Franz

GREAT BRITAIN / IRELAND / ICELAND:

➤**SKYDRIVE LTD.**
Burnside, Deppers Bridge
SOUTHAM, WARWICKSHIRE CV47 2SU
Tel.: +44 (0) 1926 / 612 188,
Fax: +44 (0) 1926 / 613 781
E-mail: sales@skydrive.co.uk
Website: www.skydrive.co.uk
Contact person: Nigel Beale

SLOVENIA:

➤**PIPISTREL D.O.O. AJDOVSCINA**
Goriska Cesta 50A
5270 AJDOVSCINA
Tel.: +386 (0) 5 / 3663 873,
Fax: +386 (0) 5 / 3661 263
E-mail:info@pipistrel.si
Website:www.pipistrel.si
Contact person: Leon Brecelj

POLAND:

➤**FASTON LTD.**
ul. Zwirki i Wigury 47
PL-21-040 SWIDNIK
Tel.: +48 (0) 81/ 751-2882;
Fax: +48 (0) 81 / 751-5740
E-mail: faston@go2.pl
Contact person: Mariusz Oltarzewski

ITALY / CYPRUS / GREECE / MALTA / PORTUGAL / SPAIN / TURKEY:

➤**LUCIANO SORLINI S.P.A.**
Piazza Roma, 1
Carzago di Calvagese Riviera (Brescia), Italy
Tel.: +39 030 / 601 033,
Fax: +39 030 / 601 463
E-mail: avio@sorlini.com
Website: www.sorlini.com
Contact person: Alberto Comincioli

2) A M E R I C A

CANADA:

➤**ROTECH RESEARCH CANADA, LTD.**
6235 Okanagan Landing Rd.
VERNON, B.C., V1H 1M5, CANADA
Tel.: +1 250 / 260-6299,
Fax: +1 250 / 260-6269
E-mail: inquiries@rotec.com
Website: www.rotec.com

NORTH / MIDDLE / SOUTH AMERICA:

➤**KODIAK RESEARCH LTD.**
P.O. Box N 658
Bay & Deveaux Street
NASSAU, BAHAMAS
Tel.: +1 242 / 356 5377,
Fax: +1 242 / 356 2409
E-mail: custsupport@kodiakbs.com
Website: www.kodiakbs.com

3) A U S T R A L I A / N E W Z E A L A N D / P A P U A N E W G U I N E A:

➤**BERT FLOOD IMPORTS PTY. LTD.**
P.O. Box 61, 16-17 Chris Drive
LILYDALE, VICTORIA 3140
Tel.: +61 (0) 3 / 9735 5655,
Fax: +61 (0) 3 / 9735 5699
E-mail: wal@bertfloodimports.com.au
Website: www.bertfloodimports.com.au
Contact person: Mark Lester

4) A F R I C A

EGYPT:

➤**AL MOALLA**
P.O. Box 7787, ABU DHABI
Tel.: +971 (0) 2/ 444 7378,
Fax: +971 (0) 2/444 6896
E-mail: almoalla@emirates.net.ae
Contact person: Hussain Al Moalla

LIBYA:

➤**LUCIANO SORLINI S.P.A.**
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Carzago di Calvagese Riviera (Brescia), Italy
Tel.: +39 030 / 601 033,
Fax: +39 030 / 601 463
E-mail: avio@sorlini.com
Website: www.sorlini.com
Contact person: Alberto Comincioli

ANGOLA / BOTSWANA / LESOTHO/ MADAGASCAR / MALAWI / MOZAMBIQUE/ NAMIBIA / SOUTH AFRICA / SWAZILAND/ ZAMBIA / ZIMBABWE:

➤**AVIATION ENGINES ANDACCESSORIES (PTY) LTD**
P.O. Box 15749, Lambton 1414,
SOUTH AFRICA
Tel.: +27 (0) 11 / 824 3368,
Fax: +27 (0) 11 / 824 3339
E-mail: niren@cometaviationsupplies.co.za
Website: www.aviation-engines.co.za
Contact person: Niren Chotoki

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➤**WAASPS LTD**
PMB KA49, Kotoka International Airport, Accra, GHANA
Tel.: +233 (0) 28 5075254,
Fax: +233 (0) 217 717 92
E-mail:info@waasps.com
Website:www.waasps.com
Contact person: Jonathan Porter

5) A S I A

CHINA / HONG KONG / MACAO:

➤**PEIPORT INDUSTRIES LTD.**
Rm. 1302, Westlands Centre
20 Westlands Road, Quarry Bay
HONG KONG
Tel.: +852 (0) 2885 / 9525,
Fax: +852 (0) 2886 / 3241
E-mail: admin@peiport.com.hk
Website: www.peiport.com
Contact person: Larry Yeung

CIS:

➤**AVIAGAMMA JSCO.**
P.O. Box 51, 125 057 MOSCOW
Tel.: +7 499 / 158 31 23,
Fax: +7 499 / 158 62 22
E-mail: aviagamma@mtu-net.ru
Website: www.aviagamma.ru
Contact person: Vladimir Andriytschuk
General Director

INDIA:

➤**VARMAN AVIATION PVT. LTD.**
Aviation Complex, 16-17
EPIP, Whitefield
BANGALORE - 560066
Tel.: +91 (0) 80 / 28412536, 28412655, 28412656
Fax: +91 (0) 80 / 28413559
E-mail: varman@blr.vsnl.net.in
Website: www.varman.com
Contact person: M. M. Varman

IRAN:

➤**ASEMAN PISHRANEH CO.**
Register Code: 149432
13 Km of Babaee Exp. Way, next to Telo Road,
Sepehr Aero Club, Tehran, IRAN
Tel.: +98 (0) 21 77000201,
Fax: +98 (0) 21 77000030
E-mail: info@asmpish.com
Contact person: Ali Habibi Najafi

ISRAEL:

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President

INDONESIA / MALAYSIA / PHILIP-PINES / SINGAPORE / THAILAND / TAIWAN:

➤**BERT FLOOD IMPORTS PTY. LTD.**
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ROTAX®
AIRCRAFT ENGINES

PRIBYL | HEINDL WERBEAGENTUR

Motornummer / Engine serial no.

Flugzeugtype / Type of aircraft

Flugzeugkennzeichen / Aircraft registration no.

ROTAX® Vertriebspartner

ROTAX® authorized distributor

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