ROTAX®
AIRCRAFT ENGINES

OPERATORS MANUAL

FOR ROTAX® ENGINE TYPE 912 i SERIES

ref. no.: OM-912 i | part no.: 898740

picture: ROTAX® 912 iS with options

⚠ WARNING

Before starting the engine, read the Operators Manual, as it contains important safety relevant information. Failure to do so may result in personal injuries including death. Consult the original equipment manufacturers 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 of 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 Operator 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 manufacturers 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 possible the structure of the „GAMA Specification #1 for Pilot’s Operating Handbook“. The Operators Manual is subdivided into the 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)
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Description of systems	Chapter 7)
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NOTES

LEP) List of effective pages

Chapter	Page	Date
	cover page	
INTRO	INTRO-1	01 01 2012
	INTRO-2	01 01 2012
LEP	LEP-1	04 01 2014
	LEP-2	01 01 2012
TOA	TOA-1	04 01 2014
	TOA-2	01 01 2012
	TOA-3	04 01 2014
	TOA-4	01 01 2012
1	1-1	01 01 2012
	1-2	01 01 2012
	1-3	01 01 2012
	1-4	01 01 2012
	1-5	01 01 2012
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	1-7	01 01 2012
	1-8	01 01 2012
	1-9	01 01 2012
	1-10	01 01 2012
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	1-12	07 01 2012
	1-13	01 01 2012
	1-14	04 01 2014
2	2-1	01 01 2012
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	2-3	04 01 2014
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	3-7	10 01 2013
	3-8	04 01 2014
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	3-16	04 01 2014

Chapter	Page	Date
4	4-1	01 01 2012
	4-2	07 01 2012
	4-3	01 01 2012
	4-4	01 01 2012
	4-5	01 01 2012
	4-6	01 01 2012
	4-7	01 01 2012
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	4-9	04 01 2014
	4-10	01 01 2012
5	5-1	01 01 2012
	5-2	04 01 2014
	5-3	04 01 2014
	5-4	04 01 2014
	5-5	04 01 2014
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6	6-1	01 01 2012
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7	7-1	01 01 2012
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	7-10	01 01 2012
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8	8-1	04 01 2014
	8-2	01 01 2012
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	9-6	01 01 2012
	9-7	01 01 2012
	9-8	04 01 2014
	rear page	

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TOA) Table of amendments

Approval*

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

current no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclu-sion	signa-ture
0	1 up to 9	all	01 01 2012				
1	LEP	LEP-1	07 01 2012	DOA*			
1	TOA	TOA-1, 3	07 01 2012	DOA*			
1	1	1-11, 11-12	07 01 2012	DOA*			
1	2	2-2, 2-3	07 01 2012	DOA*			
1	4	4-2	07 01 2012	DOA*			
2	LEP	LEP-1	04 01 2014	DOA*			
2	TOA	TOA-1, 3	04 01 2014	DOA*			
2	1	1-6,1-11,1-14	04 01 2014	DOA*			
2	2	2-2, 2-3, 2-5	04 01 2014	DOA*			
2	3	3-1, 3-6,	04 01 2014	DOA*			
		3-8 to 3-16	04 01 2014	DOA*			
2	4	4-8, 4-9	04 01 2014	DOA*			
2	5	5-2 to 5-6	04 01 2014	DOA*			
2	7	7-5, 7-6	04 01 2014	DOA*			
2	8	8-1	04 01 2014	DOA*			
2	9	9-8	04 01 2014	DOA*			

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TOA) Summary of amendments

Content Summary of the relevant amendments in this context, but without requirement on completeness.

Current No.	Chapter	Page	Date of change	Comments
1	1	1-11	07 01 2012	Standard version corrected
1	1	1-12	07 01 2012	Certification supplemented
1	2	2-2	07 01 2012	Oil pressure
1	2	2-3	07 01 2012	Ambient temperature
1	4	4-2	07 01 2012	Available landing site
2	1	1-11,1-14	04 01 2014	Standard version corrected, Note added
2	2	2-2, 2-3	04 01 2014	Notice added,EGT temperature changed, [psi] values corrected
		2-5	04 01 2014	AVGAS description corrected
2	3	3-8 to 3-16	04 01 2014	Engine Start-, Check-, Take-off-, Shut down procedure changed/updated
2	4	4-8, 4-9	04 01 2014	Text corrected, step added
2	5	5-2 - 5-6	04 01 2014	New charts + POWER/ECO description
2	7	7-5, 7-6	04 01 2014	General note: text added, new grafic
2	8	8-1	04 01 2014	Note added
2	9	9-8	04 01 2014	Distributor for Pakistan added

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 Distributor or Service Center for ROTAX aircraft engines.

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

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

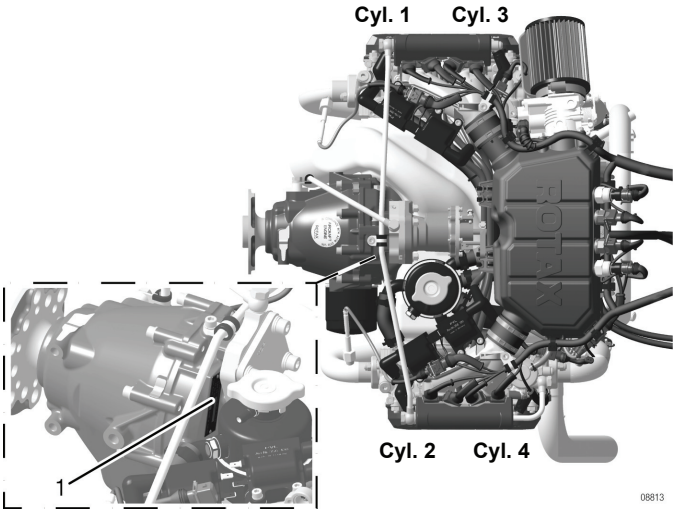
For more detailed information regarding, maintenance, safety- or flight operation, consult the documentation provided by the aircraft manufacturer and/or dealer.

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, behind of the propeller gearbox. See Fig. 1.



Part	Function
1	Engine serial number

Fig 1

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1.2) Abbreviations and terms used in this Manual

Abbreviation

Abbreviation	Description
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
rpm	Revolutions per minute
912 iS	see OM (Type designation)
912 iSc	see OM (Type designation)
A	Ampere
A/C	Aircraft
ACG	Austro Control GmbH
API	American Petrol Institute
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
CAN/CGSB	Canadian General Standards Board
CSA	Constant Speed Actuator
CS-E	Certification Specifications for Engines
CW	Clockwise
CCW	Counter-clockwise
DOA	Design Organisation Approval
EASA	European Aviation Safety Agency
ECU	Engine Control Unit
EMS	Engine Management System
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
h	hours
IFR	Instrument Flight Rules
INTRO	Introduction
iRMT	independent ROTAX Maintenance Technician
ISA	International Standard Atmosphere
kg	kilograms
kW	Kilowatt
LANE EMS A+B	Lane ECU
LEP	List of effective pages
MON	Motor octane number
Nm	Newton meter
OM	Operators Manual
part no.	Part number

Abbreviation	Description
RON	Research Octane Number
RV	Record of Revisions
RON	Research Octane Number
ROTAX	is a trade mark of BRP-Powertrain GmbH & Co KG
SAE	Society of Automotive Engineers
SI	Service Instruction
SB	Service Bulletin
SL	Service Letter
TC	Type certificate
TOA	Table of amendments
V	Volt
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.

Measure

Specifications are given in the SI metric system with the USA equivalent in parenthesis.

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 components.**

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

ENVIRONMENT NOTE

Environment note gives you tips and behaviors to environmental protection.

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!
For each use of VFR or IFR in an aircraft the applicable requirements and other existing regulations must be adhered.

- 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 dealer.

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.
- Engine-specific training courses are authorized by the distributors according to manufacturer specifications (iRMT).

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 (iRMT)

- 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 dealer. BRP-Powertrain requires that any service be carried out and verified by a technician that has a current iRMT rating.

- 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 interest 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.

Governor

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

1.5) Technical documentation

General note

These documents form the instructions ensuring continued airworthiness of ROTAX aircraft engines.
The information contained is based on data and experience that are considered applicable for skilled mechanics under normal conditions.
Due to the fast technical progress and fulfilment of particular specifications of the customers it may occur that existing laws, safety prescriptions, constructional and operational regulations cannot be transferred completely to the object bought, in particular for special constructions, or may not be sufficient.

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 with the aid of the table of amendments. The first column indicates the revision state. This figure should be compared with the revision provided on ROTAX-Aircraft Engines Website: www.FLYROTAX.com.

Amendments and current versions can be downloaded free of change.

Replacement pages

Furthermore the Manual is constructed in such a way that single pages can be replaced instead of the complete document. The list of effective pages is given in the chapter LEP. The particular edition and revision number is given on the footer of each page.

Reference

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

Illustrationen

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 Manual are stored in a graphic data base system 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, single central camshaft push rods - OHV
- Liquid cooled cylinder heads
- Ram air cooled cylinders
- Dry sump forced lubrication
- Fully redundant electronic engine management (EMS) includes fuel injection, characteristic ignition, etc.
- Propeller drive via gearbox with integrated mechanical shock absorber and overload clutch
- Oiltank
- Electric starter (12 V 0.8 kW)
- Fuel pump assy.

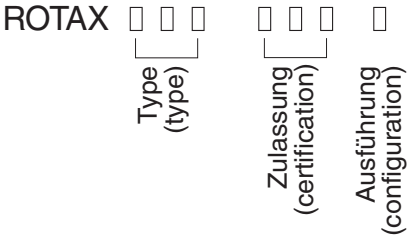
Optional

- Preparation for hydraulic governor for constant speed propeller: (configuration 3 only)
- Exhaust system
- Cooling air baffle
- Engine suspension frame

1.7) Type description

e.g. 912 iSc 3

The type description is made up the following.



Designation

Designation		Description
Type	**912**	4-cyl. horizontally opposed, normal aspirated engine
Certification	**iSc**	Certified to EASA CS-E (TC No. EASA.E.121)
	iS	Non-certified aircraft engines
Configuration	**2**	Prop shaft with flange for fixed prop.
	3	Prop shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller.

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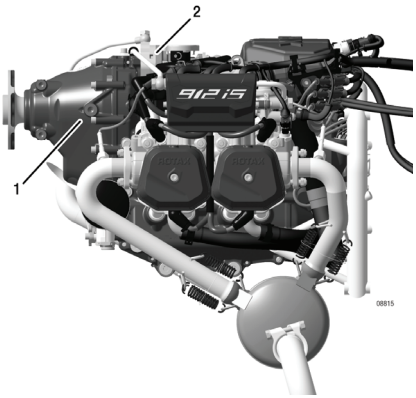
1.8) Engine components, engine views, cylinder designation

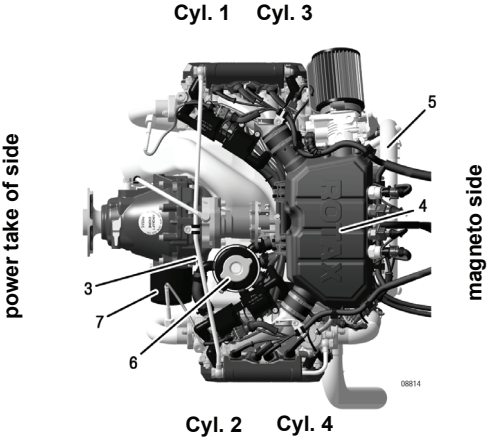
Side view



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

Fig. 2

Top view



Part	Function
3	Engine serial number
4	Airbox
5	Electric starter
6	Expansion tank with excess pressure valve
7	Oil filter

Fig. 3

1.9) Technical data

See table

Description	912 iSc/iS
Bore	84 mm (3.31 in)
Stroke	61 mm (2.40 in)
Displacement	1352 cm^3 (82.5 in^3)
Compression ratio.	10.8:1

1.10) Fuel consumption

NOTE: This table is valid only for engine operation without faults. In case of faults a higher fuel consumption may occur.

See table

Fuel consumption in l/h (US gal/h)	912 iSc/iS
At take-off performance (5800 rpm)	26.1 l/h (6.9 gal/h)
At max. continuous performance (5500 rpm)	23.6 l/h (6.2 gal/h)
At 75 % continuous performance	16.5 l/h (4.3 gal/h)
Specific consumption at 75 % continuous performance	250 g/kWh (0.41 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)

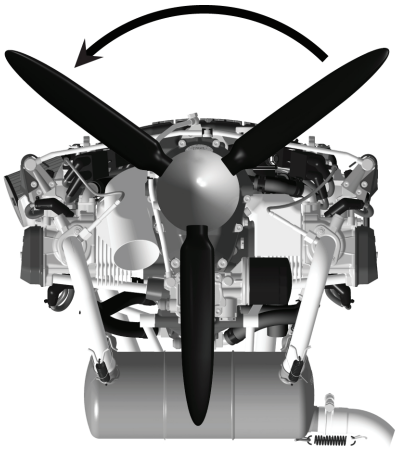


Fig. 4

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2) Operating instructions

Introduction

The data of the certified engines are based on type certificate of type 912 iSc.

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

NOTICE

The engine can be operated within the operating limits without time limits. If the limit is exceeded, the engine must be operated so that this value falls back into the allowed range. **Carry out the instructions for abnormal operation!**

- Standard engine (incl. input rating for governor). Without auxiliary equipment (e.g. external alternator).
- Installation in accordance to installation guidelines (e.g. intake and exhaust system). See latest Installation Manual.
- ISA Condition (**I**nternational **S**tandard **A**tmosphere).

Motortype	iS	iS Sport
Take-off performance	73.5 kW (100 HP) at 5800 rpm	73.5 kW (100 HP) at 5800 rpm
Max. cont. performance	69 kW (93 HP) at 5500 rpm	72 kW (97 HP) at 5500 rpm

Take-off performance	73.5 kW (100 HP) at 5800 rpm
Max. continuous performance	69 kW (93 HP) at 5500 rpm

Speed

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

Acceleration

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

Max.	5 seconds at max. -0.5 g

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)
Normal	2.0 to 5.0 bar (29-73 psi) (above 3500 rpm)

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Oil temperature

See also Chapter 2.4).

Max. (oil inlet temperature to the oil pump)	130 °C (266 °F)
NOTE: The oil temperature shown on the display instrument could be higher than real. It depends on the installation location of the engine and the location of the oil temperature sensor.	
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)

Coolant temperature

Coolant temperature	
Max.	120 °C (248 °F)

Ambient temperature

Max. in flight	60 °C (140 °F) (manifold temperature)
Max. at start	50 °C (120 °F) (ambient temperature)
Min. at start	-20 °C (-13 °F) (oil temperature)

Fuel pressure

Max.	3.2 bar (46.5 psi)
Min.	2.8 bar (40.5 psi)

Propeller governor

Power consumption of the hydraulic propeller governor	
Max.	600 W

External alternator

Power consumption of the external alternator	
Max.	600 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-912 i-001 for the selection of the correct coolant.

Conventional coolant

Conventional coolant mixed with water has the advantage of a higher specific thermal capacity than water-less 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 coolant manufacturers instructions about the coolant mixture.

	mixture ratio %	
designation	**concentrate**	**water**
Conventional e.g. BASF Glysantine Protect Plus G48 anticorrosion	50	50

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2.3) Operating media-Fuel

General note

NOTICE Obey the latest edition of Service Instruction SI-912 i-001 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.

Antiknock properties

Fuels with following specification can be used:

Fuel specification	
	Usage/Description
Anti knock properties	**912 iSc/iS**
	Min. RON 95 (Min. AKI* 91)

*Anti Knock Index (RON+MON)/2

MOGAS

	Usage/Description
MOGAS	**912 iSc/iS**
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.

	Usage/Description
AVGAS	**912 iSc/iS**
Aviation Standard	AVGAS 100 LL (ASTM D910)

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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 Information SI-912 i-001, latest edition.

Oil type

Motorcycle oil of a registered brand with gear additives.

NOTICE

At the selection of suitable lubricants refer to the additional information in the Service Information SI-912 i-001, 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 required.
- Because of the incorporated overload clutch, oils with friction modifier additives are unsuitable as this could result in clutch slippage 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.
- Conventional aircraft oils (a.d.= ashless dispersant) are not suitable. Oils with ashless dispersant do not have suitable cleaning agents for modern designs such as the ROTAX 912 i Series.
- Oils primarity for Diesel engines have **insufficient high temperature properties and additives which favour clutch slipping, and are generally unsuitable.**

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

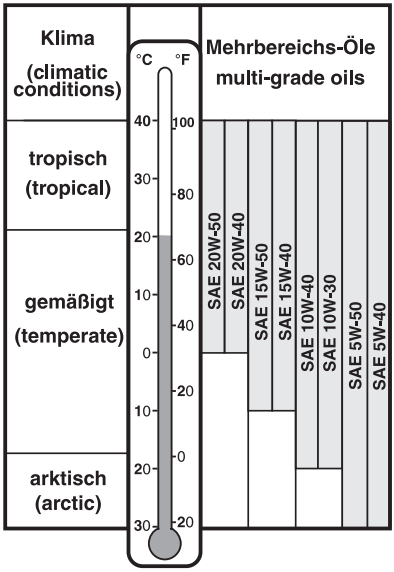

Fig. 1 *06317*

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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 the ECU and secure the aircraft. The main switch (EMS-switch) has to be deactivated. If a key switch is used, then pull out the key.

NOTICE

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

Coolant level

NOTICE

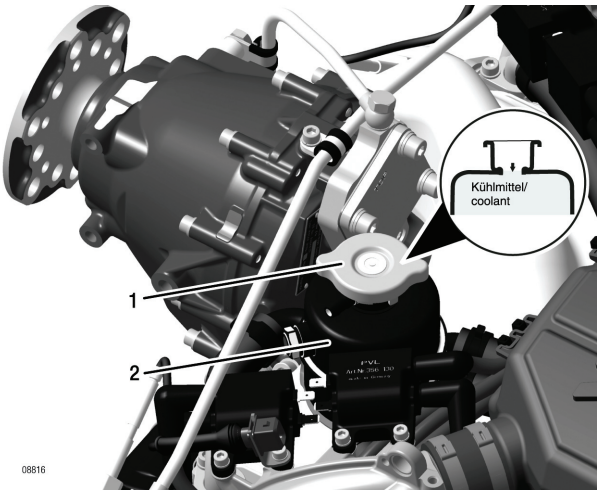
The coolant specifications of the section Chapter 2.2) Operating media are to be observed!

Step	Procedure
1	Verify coolant level in the **expansion tank**, replenish as required up to top. The max. coolant level must be flush with the bottom of the filter neck. See Fig. 1.
2	Verify coolant level in the **overflow bottle**, replenish as required. The coolant level must be between max. and min. mark. See Fig. 1.

ENVIRONMENT NOTE

Protect the environment and never spill any coolant.

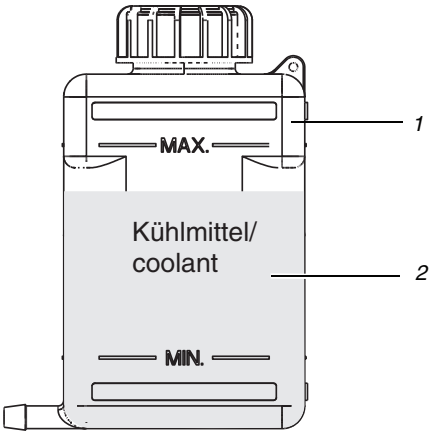
Expansion tank



Part	Function
1	Radiator cap
2	Expansion tank

Fig. 1

Overflow bottle



Part	Function
1	Overflow bottle
2	Coolant

Fig. 2 *09150*

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Mech./electronic components

Check of mechanical/electronic components

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

Throttle valve

Step	Procedure
1	Verify free movement of throttle valve and the complete range.

Exhaust system

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

Sensors/wiring harness

Step	Procedure
1	Visual inspection for mechanical and thermal damages.

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!
MASTER SWITCH, LANE A and LANE B switch "OFF". Before moving the propeller anchor the aircraft.

⚠ 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.

Oil level

NOTICE

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

Step	Procedure
1	Check oil level and add oil if necessary.
2	NOTE: Propeller shouldn't be turned reverse the normal direction of engine rotation. Remove oil tank cover, turn the propeller slowly 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 gas flow via the piston rings into the crankcase. The speed of rotation is not important as the pressure and the amount of gas which is transfered into the crankcase.
4	This process is finished when air is returning back to the oil tank and can be noticed by a gurgle from the open oil tank.
5	Install oil tank cap.

Oil level (oil dip-stick)

NOTE: The oil level should be in the upper half (between the “50%“ and the “max“ mark) and should never falls 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 forced out through the venting system.

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

ENVIRONMENT NOTE

Protect the environment and never spill any oil.

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3.4) Engine start

Safety

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

Engine start

Step	Designation	Procedure
1	Fuel valve	**ON**
2	Accomplish aircraft specific startup	**activate Flight Display**
3	**Master Switch**	**ON**
4	**Fuel pump switch (Fuel pump 1 or Fuel pump 2)**	**ON**
	NOTICE **Only switch on one fuel pump when starting the engine.** Switching on both fuel pumps can lead to a bad start behavior.	
5	**LANE select switch A** **LANE select switch B**	**ON**
6	**Start Power Switch**	**Hold Start Power Switch** during step 7,8,9 and 10.
7	Warning lamps	**Check if Warning Lamps** illuminate and extinguish after around 3 seconds.
	NOTICE When the voltage supply is switched on, both lamps are automatically subject to a function test. Both lamps illuminate for around 3 seconds and then extinguish. If one of the two warning lamps start to flash, fail to illuminate, or still illuminates after a few secounds, then this indicates an anomaly. See therefore Chapter 4).	
8	Engine instruments	**Check** if **fuel pressure** has reached its fuel pressure **of 3 bar**.
9	Throttle valve	Put throttle **between 1 to 2 cm throttle opening** (correlates with 55 %-65 % throttle valve opening).

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Step	Designation	Procedure
	NOTICE For more and detailed information on the throttle opening during engine start up see the diagram. See Fig. 3	
10	Starter Switch	**Press until the engine runs** and release after engine has reached 1500 rpm or more (stable engine run).
	NOTICE Activate starter for **maximum of 10 seconds** only (without interruption), followed by a **cooling period of 2 minutes**.	
11	Throttle valve	**Reduce throttle lever as required.**
12	Engine instruments	**Check for error messages** and if all operator limits are within the operator limits defined in the Operators Manual. Check if oil pressure has risen within 10 seconds and monitor oil pressure.
	NOTICE Increasing engine speed is only permitted at **steady oil pressure readings above 3 bar**.	
13	Throttle valve	I**ncrease engine speed above 2500 rpm** and **hold speed at least 5 secounds** (await generator shift from **Gen B to Gen A**).
	NOTICE If, after the engine start, a warning lamp flashes or lights up, perform a LANE and IGNITION check. After the LANE and IGNITION check both warning lamps must be deactivated, otherwise there is an error that must be located and repaired before the next flight.	
14	Engine instruments	**Check for error messages** and if all operator limits don‘t exceed the operator limits defined in the Operators Manual. Check **if generator switching was realized flawless.**

⚠ 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 also Chapter 2.1).

Engine start performance

Good engine start behavior will be achieved when setting the throttle at 50 % (± 5 %) during engine start. This number will lead in the aircraft approximately to a throttlelever travel of 1-2 cm.

NOTE: These numbers depend strongly on the design of the throttle leverage and will vary from aircraft to aircraft.

NOTICE

The throttle needs to be closed as required right after the engine start in order to avoid unnecessary high engine rpm while the engine is still cold.

For detailed information see following diagram.

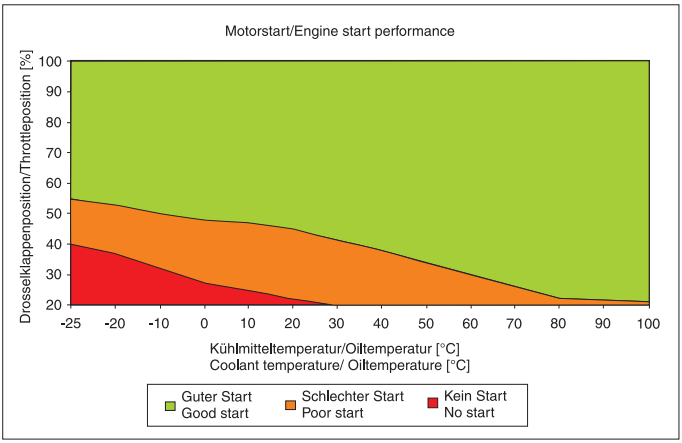

Fig. 3 *08252*

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.

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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.

3.6) Holding point control

Ground test

NOTICE

After a full-load ground test allow a short cooling run at idle speed 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 double ignition

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

LANE and Ignition Check:

NOTICE

If the engine speed drops or any error messages are present from the EMS then find out what the cause is and take corresponding action to rectify the problem.

Step	Procedure
1	Rise engine speed up to **4000 rpm**.
2	Turn **"OFF" LANE selector switch A.** Observe the rev counter.
NOTICE	The speed drop may not exceed **180 rpm engine speed**, which corresponds 75 rpm propeller speed.
3	Turn **„ON" LANE selector switch A**.
4	Turn **„OFF" LANE selector switch B.** Perform checks in same way as LANE A.
5	Turn **"ON" LANE selector switch B**.
6	Reduce to idle speed.
7	Check **power supply** and minimum voltage of 12 V at each LANE.

NOTE: LANE A and LANE B have different sensor inputs. During LANE and IGNITION check some sensor values are not displayed depending on the position of the LANE select switches.

Not available sensor values if LANE A = ON and LANE B = OFF:

- Coolant temperature
- Exhaust gas temperatures from cyl. 1-4
- Ambient temperature
- Ambient pressure
- Throttle lever position

Not available sensor values if LANE B = ON and LANE A = OFF:

- Oil temperature
- Oil pressure

Check of fuel pumps (fuel pump modules)

It must be ensured that both fuel pumps are working and no loss of power or uneven running by turning off a fuel pump occurs. The limits for fuel pressure must not be exceeded

Basic position for the Take-off, both fuel pumps „**ON“**.

Step	Procedure
1	Set engine speed to **2000 rpm**.
2	Turn auxiliary fuel pump OFF for 5 seconds.
3	Check fuel pressure, then turn auxiliary fuel pump ON.
4	Turn main fuel pump OFF for 5 seconds.
5	Check fuel pressure, then turn main fuel pump ON.

NOTICE If the fuel pressure is not within the limits, the cause must be determined. The engine must not be put into service until the problem is rectified.

Check the power output

To check the acceleration and available power, run the engine at full load with the aircraft stationary for a maximum of 10 seconds (take the idle speed from the Operators Manual of the aircraft, as it depends on the type of propeller being used).

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Performance

Step	Procedure
1	Set performance as per performance specifications Chapter 5) and respect operating limits as per Chapter 2.1).
2	Carry out performance checks in accordance with the aircraft manufacturer regulations.

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 should be avoided.

3.7) Take-off

Safety

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

- Observe the monitor oil temperature, oil pressure (**LANE select switch B** has to turned **"ON"**) and coolant temperature (**LANE select switch A** has to turned **"ON"**). Limits must not be exceeded! See Chapter 2.1) Operating limits.
- Respect "cold weather operation" recommendations, see Chapter 3.10).

Climb

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

3.8) Cruising

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 possibly accumulated condensation water, at least once a day 100 °C (212 °F) oil temperature must be reached.

3.9) Engine shut-off

General note

Normally the cooling down of the engine during descending and taxiing will be sufficient to allow the ECU 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.

Step	Procedure
1	Check the engine instruments.
2	Reduce engine speed down to idling.
3	Set the **LANE select switch B** to **"OFF"**.
4	Set the **LANE select switch A** to **"OFF"**.
5	Switch the fuel pumps **"OFF"**.
6	Shut-off according to the aircraft manufacturer regulations.
7	Set **main switch** to **"OFF"**. Wait for engine stop.

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3.10) 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

- As performance of electric starter is greatly reduced when hot, limit starting to periods not much longer than 10 sec.

Remedy - Cold start

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

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
- 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 Line 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) Fault indicated by the EMS lamps

EMS lamps

NOTICE

Reduce engine power setting to the minimum necessary and curry out precautionary landing.

The aircraft should be flown to the nearest available landing site (Airfield, Airstrip, Airport) if any of the following combinations of the EMS lamps arise:

- One lamp permanently on, one off.
- One lamp permanently on, one flashing.
- Both lamps permanently on.
- Both lamps flashing.

EMS lamps operating states

If one of the lamps is flashing while the other is off then limited flight operation are permitted up to a maximum of 10 hours.

LANE A	LANE B	Action
OFF	Flashing	Limited flight operation
Flashing	OFF	Limited flight operation
OFF	ON	Land the aircraft
Flashing	Flashing	Land the aircraft
Flashing	ON	Land the aircraft
ON	OFF	Land the aircraft
ON	Flashing	Land the aircraft
ON	ON	Land the aircraft

ON = permanently on

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4.2) Engine not responding to power inputs

Engine not responding

- Possible breakage of throttle valve actuation/linkage.
- Limited flight operation with available power possible.
- A maintenance inspection should be carried out.

4.3) Occurence of uncharacteristic and severe engine vibrations

Engine vibrations

- If the vibrations occur in conjunction with a loss of power then the engine may only be firing on 3 cylinders.
- Limited flight operation.
- A maintenance inspection should be carried out.

4.4) Re-Start during flight

Engine stop

- Starting procedure same as on ground, however, on a warm engine.

4.5) Failure of the EMS power supply

Failure of the EMS

- If the EMS power supplies (alternator A) fails then the ECU automatically switches one-time over to the second EMS power supply (alternator B).

NOTICE No charging of battery!

- While alternator B runs, no power drop is recognizable.
- Failure of both EMS power supplies (alternator A/B) result in engine stoppage.
  Remedy: Switch “ON“ the **backup battery switch**. In this case the power supply is provided by the aircraft battery.
- Land the aircraft at the next available opportunity.
- A maintenance inspection should be carried out.

4.6) Exceeding max. admissible engine speed

Exceeding engine speed

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

4.7) Exceeding of max. coolant temperature

Exceeding coolant temperature

NOTICE

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

- Any exceeding of the max. admissible coolant temperature has to be entered by the pilot into logbook, stating duration and extent of over-temperature condition.
- A maintenance inspection should be carried out.
- Check the ECU error log file.

4.8) Exceeding of max. admissible oil temperature

Exceeding oil temperature

NOTICE

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

- Any exceeding of the max. admissible cylinder head temperature has to be entered by the pilot into logbook, stating duration and extent of over-temperature condition.
- A maintenance inspection should be carried out.
- Check the ECU error log file.

4.9) Oil pressure below minimum - during flight

Oil pressure too low

NOTICE

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

- Check oil system.
- A maintenance inspection should be carried out.
- Check the ECU error log file.

4.10) Oil pressure below minimum - on ground

Oil pressure too low

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

- Check oil quantity in oil tank.
- Check oil quality. See also Chapter 2.4).
- A maintenance inspection should be carried out.

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4.11) Oil pressure above permitted range at low ambient temperatures

Oil pressure too high

- Reduce engine speed and check the oil pressure again once it has reached a higher oil temperature.
- If the oil pressure display remains unchanged when the engine speed is reduced then a fault in the oil pressure display is likely.
- A maintenance inspection should be carried out.
- Check the ECU error log file.

4.12) Engine on fire or fire in the engine compartment

Engine on fire

NOTICE

Carry out emergency procedures as prescribed in the flight manual of the engine manufacturer.

- After landing locate the cause of fire and resolve the error before next flight by qualified staff (authorized by the Aviation Authorities).
- An entry in the logbook must be made.
- A maintenance inspection should be carried out.

4.13) Fuel pressure outside range

Exceeding fuel pressure

NOTICE

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

- If the pressure is too high, switch the auxiliary pump OFF. If this has no effect then limited flight operation with reduced power is possible.
- If the pressure is too low, switch the auxiliary pump ON and the main pump OFF. If this has no effect then limited flight operation with reduced power is possible.
- A maintenance inspection should be carried out.

4.14) Maximum permissible exhaust temperature exceeded

Exceeded exhaust temperature

NOTICE

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

- Check the exhaust temperature.
- Oil and coolant limits must not be exceeded.
- A maintenance inspection should be carried out.

4.15) EMS voltage supply below the minimum required level

Voltage supply below level

- Limited flight operation is possible if the voltage (alternator A or B) is OK here.
- Proceed according to section: „Failure of the EMS power supply“ if this shows no effect.

NOTICE

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

- A maintenance inspection should be carried out.

4.16) The sprag clutch decouples not from the starter

Spag clutch is permanently in engagement position

NOTICE

Switch the engine “**OFF**“. Risk of fire and danger of the electric starter overheating.

- Move the throttle lever to the idle position.
- Set the **EMS main switches** to **“OFF“**.
- Switch both **LANE select switches** to **“OFF“**.
- A maintenance inspection should be carried out.

4.17) 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
Switch the **LANE select switch** A/B to **"OFF"**.	Switch the **EMS main switch** LANE select switch A/B to **"ON"**.
Set the **EMS main switch** to **"OFF"**.	Set the **EMS main switch** to **"AUTO"**.
Closed fuel selector/valve.	Open valve or clean filter, alternatively renew filter. Check fuel system for leakage.
No fuel in tank.	Refuel.
Fuel pumps	Set both to **"ON".**
Starting speed too low, faulty or discharged battery.	Fit fully charged battery.
Starting speed too low, starting problems on cold engine.	Use top quality, low friction oil; allow for sufficient cooling period to counter for performance drop on hot starter; preheat engine.
Wrong fuel (Jetfuel or Diesel).	Change of fuel.

Engine run

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.
Intake air temperature to high.	Reduce the power. Check air filter according to Maintenance Manual Line Chapter 12-20-00.

Oil pressure

Low oil pressure

Possible cause	Remedy
Not enough oil in oil tank.	Refill oil.

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Oil level

Oil level is increasing

Possible cause	Remedy
Oil too cold during engine operation.	Cover oil cooler surface, maintain the oil temperature prescribed.
Contamination with diesel fuel.	Check fuel.

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 system at low temperatures due to cold oil. Stop engine and preheat oil. After a cold start the oil tank must be observed and the pressure should be above 1.5 bar (22 psi). Otherwise, the speed must be lowered again, because not enough cold oil can be sucked. If oil pressure is reading lower than 1 bar (15 psi) oils with lower viscosity are to be used. See SI-912 i-001, 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.

NOTES

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 table and performance graphs.

Performance data Engine 912 iSc/iS

Performance data for standard conditions (ISA)

Providing engine speed over 5500 rpm is restricted to 5 minutes.

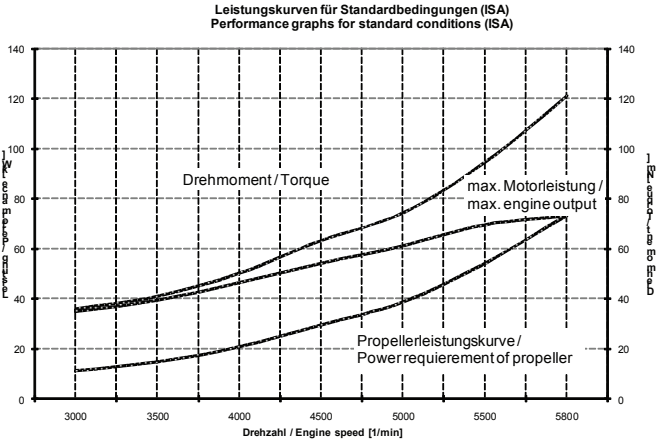

Fig. 1 *08698*

Performance data Engine 912 iSc/iS Sport

Providing engine speed over 5500 rpm is restricted to 5 minutes.

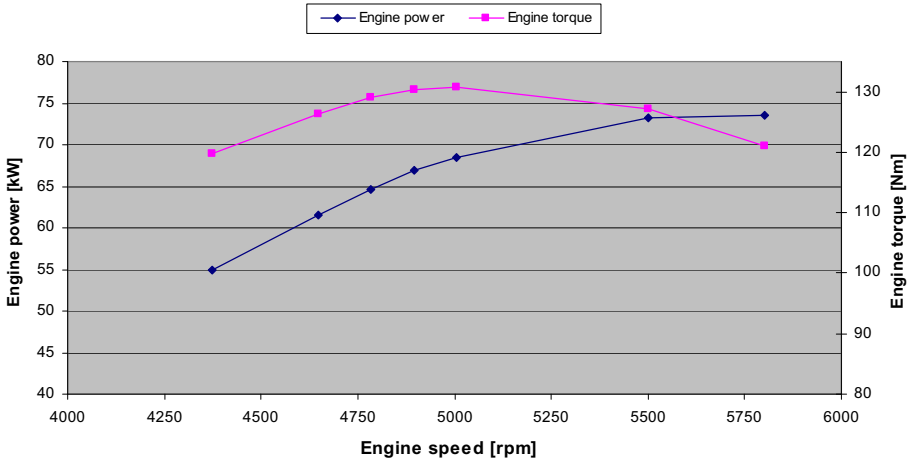

Fig. 2 *04390*

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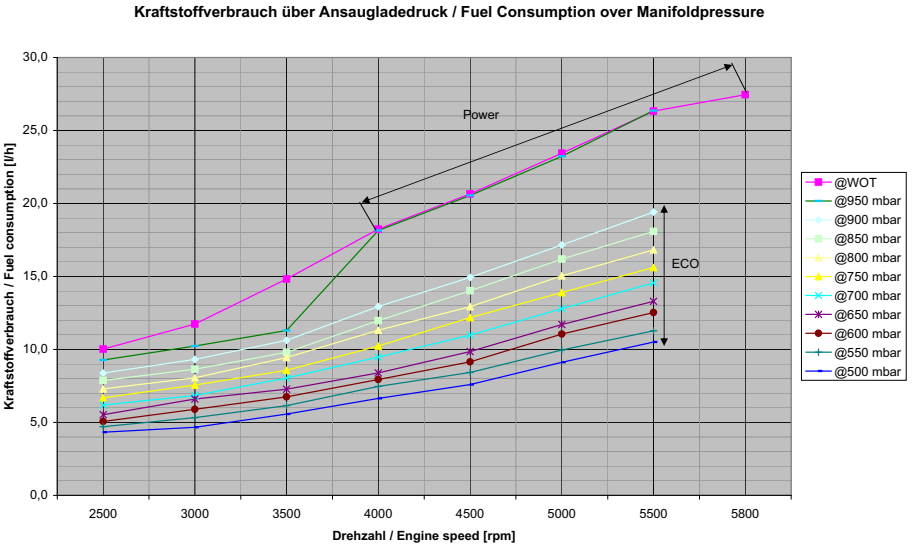

Fig. 3 *06370*

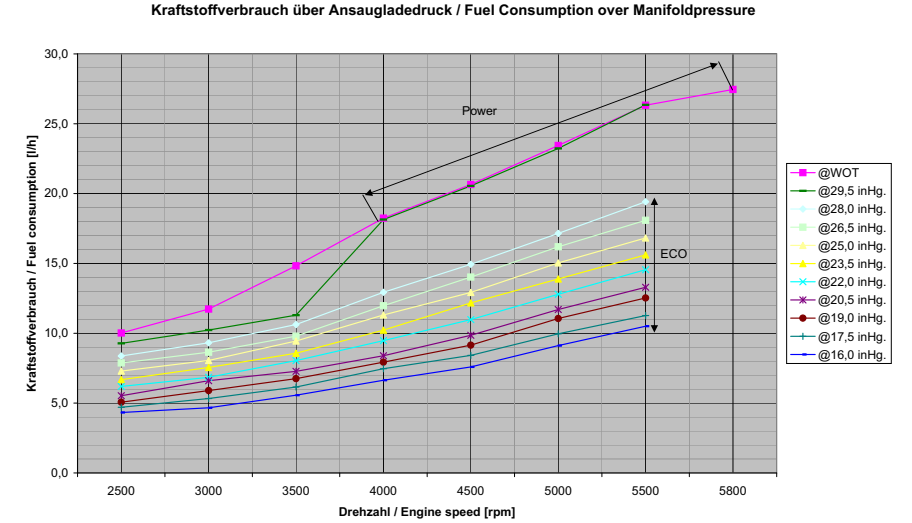

Fig. 4 *06371*

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Performance data Engine 912 iSc/iS

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		Fuel consumption (L / h)
			(Nm)	(ft.lb)	
Take-off power	5800	73.5/100	121.0	89.24	26.1
max. continuous power	5500	69.0/92	119.8	88.36	23.6
75 %	5000	51.8/69	98.7	72.79	16.5
65 %	4800	44.9/60	89.5	66.01	13.7
50 %	4300	34.5/46	75.3	55.53	11.1

Performance data Engine 912 iSc/iS Sport

Power setting	Engine speed (rpm)	Performance (kW)/(HP)	Torque		Fuel consumption (L / h)
			(Nm)	(ft.lb)	
Take-off power	5800	73.5/100	121,4	89.54	26.1
max. continuous power	5500	72.0/97.9	126,4	93.23	23.6
75 %	5000	54.0/73.4	103,1	76.04	16.5
65 %	4800	46.7/63.5	93,3	68.81	13.7
50 %	4300	35.9/48.8	78,5	57.90	11.1

NOTE: Further essential information regarding engine behavior see Service Letter SL-912 i-003, latest edition.

POWER vs. ECO mode

The 912 iSc/iS engine has two different modes, the POWER and ECO mode where the fuel consumption changes significantly. See from Fig. 2 to Fig. 4.

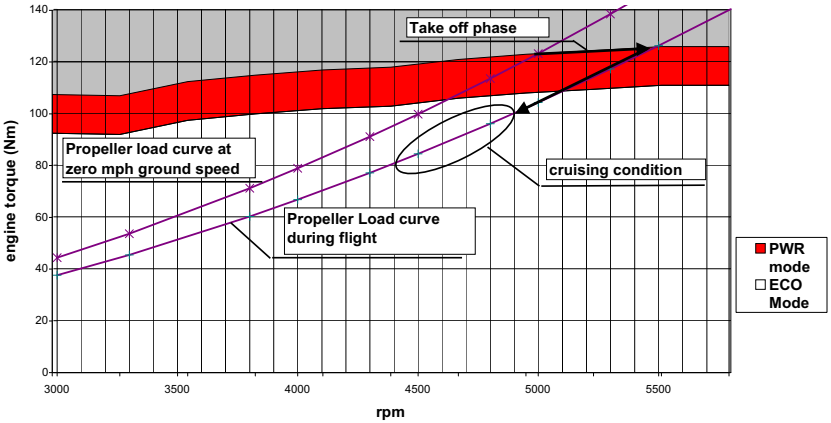


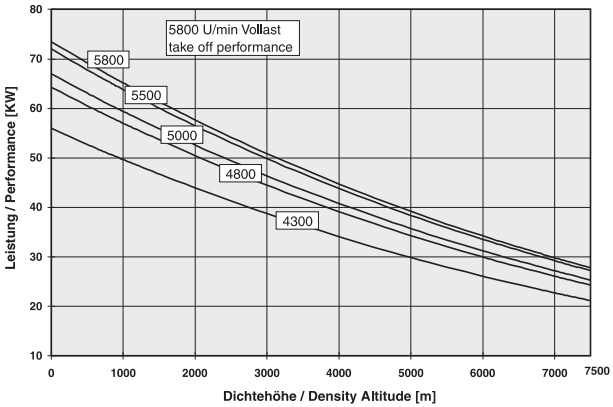
Fig. 5 *09857*

Performance graph Engine 912 iSc/iS

Performance graph for non-standard conditions

The following graph shows the performance drop with increasing flight altitude. The curves show the performance at 5800, 5500, 5000, 4800 and 4300 rpm, at full throttle.

At deviation of temperature conditions from standard atmosphere conditions the engine performance to be expected can be calculated from the performance indicated, multiplied by standard temperature, divided by actual temperature in °K.



$$P_{akt.} = P_{stand.} \frac{T_{standard}}{T_{aktuell}}$$

T [K] = t [°C]+273

Fig. 6 *08636*

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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) Weights - Engine

- inclusive oil tank
- inclusive electric system: wiring harness, ECU, FUSE BOX and start relay

912 iSc/iS
63.6 kg (140.2 lb)

- exclusive of: engine suspension frame, exhaust system, fuel pumps assy., cooling baffle, radiator, oil cooler

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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 engine 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

NOTE: The temperatur sensor at delivery is located in cylinder head 4.

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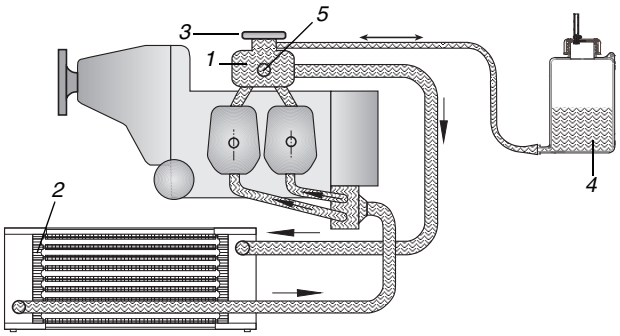

Part	Function
1	Expansion tank
2	Radiator
3	Pressure cap
4	Overflow bottle
5	Level glass

Fig. 1 *06339*

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7.2) Fuel system

General note See Fig. 2.

Fuel The fuel flows from the tank (1) via a fine filter (4) to the electric fuel pumps (2,3) from where it is then pumped to the fuel rail, the fuel injectors and to the fuel pressure regulator (5).

Fuel pump switches The fuel pumps are activated directly through the switch OFF/ON. During take off both switches (main and aux.) must be ON.

Fuel pressure regulator A fuel pressure regulator ensures that the pressure differential between the fuel injectors and the intake manifold remains constant. This enables the fuel injection system to inject the same quantity of fuel at any point given the same injection period.

Return line Through the return line surplus fuel flows back to the fuel tank and suction side of fuel system.

NOTE: The return line must be always returned into the tank, from which fuel is sucked in to the oil pump.

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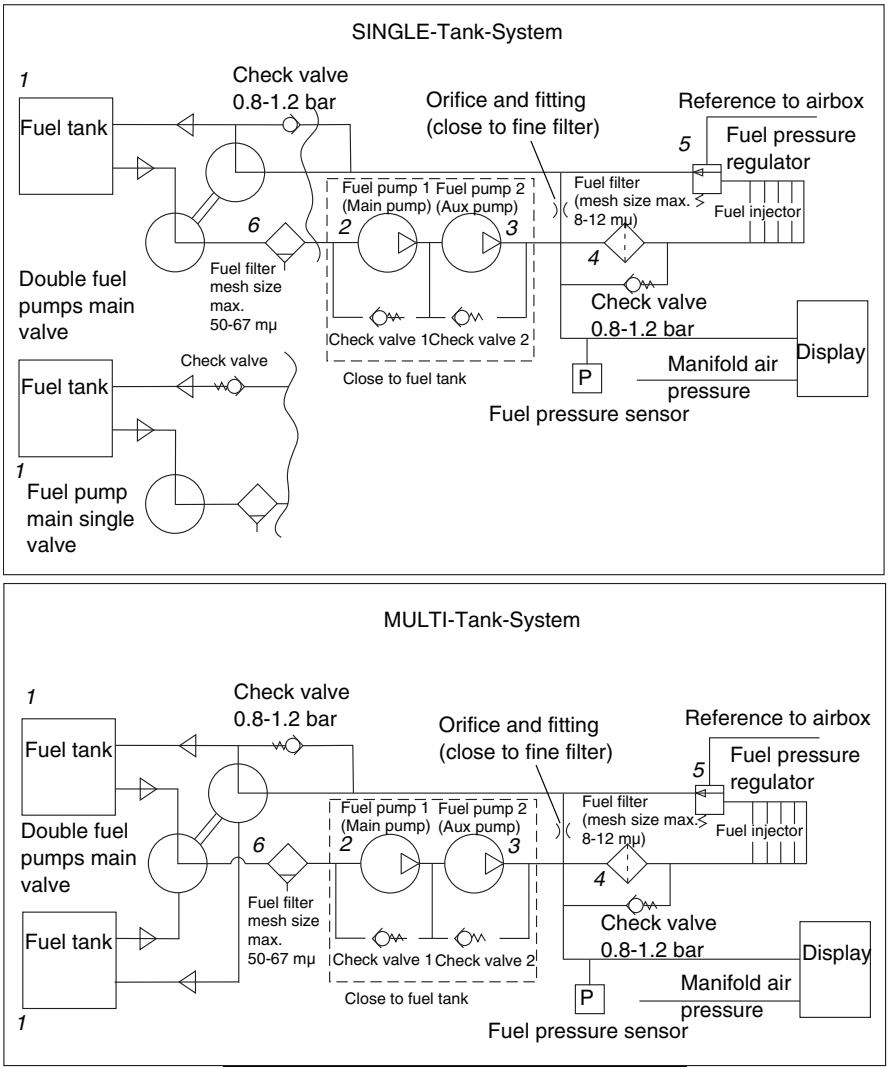

Part	Function
1	Fuel tank
2	Fuel pump 1
3	Fuel pump 2
4	Fine filter
5	Fuel pressure regulator
6	Coarse filter/Water trap

Fig. 2 *06293*

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7.3) Lubrication system

General note

See Fig. 3.

The engines are provided with a dry sump forced lubrication system with a main oil pump with integrated pressure regulator (1) and oil pressure sensor (8).

Lubrication

The oil pump (2) sucks the motor oil from the oil tank (3) via the oil cooler (4) and forces it through the oil filter (5) to the points of lubrication in the engine.

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 pump is driven by the camshaft.

Oil venting system

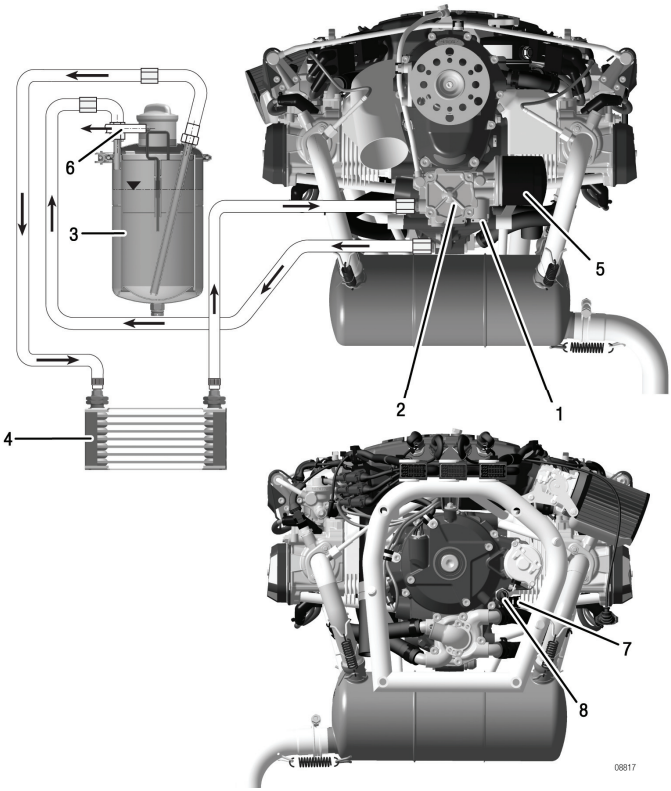
The oil circuit is vented via bore (6) on the oil tank.

Oil temperature sensor

The oil temperature sensor (7) for reading of the oil inlet temperature is located on the crankcase.

Oil pressure sensor

The oil pressure sensor (8) for reading of the oil pressure is located on the ignition housing.



Part	Function
1	Pressure regulator
2	Oil pump
3	Oil tank
4	Oil cooler
5	Oil filter
6	Venting tube
7	Temperature sensor (oil)
8	Pressure sensor (oil)

Fig. 3

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7.4) Electric system

General note

The ROTAX 912 iSc/iS is equipped with an electronic guided dual ignition unit with integrated generator.
The ignition unit is easy to maintain and needs (except for start the engine) no external power supply.

EMS overview

The EMS primarily comprises:

- High-voltage ignition components (connectors, spark plugs, ignition cables, double ignition coils)
- ECU
- ECU (actuators) - OUTPUT
    - 4 doublesignition coils
    - Lamps
    - Fuel injection 2 per cylinder
    - CAN data for an indicating instrument
- ECU (signals) - INPUT
    - Sensors
- EMS power supply
    - Regulator rectifier
    - Generator
- FUSE BOX (all power supply components, including the fuses, etc., can be found in the power supply unit)
- Switches
- Cables/wiring

EMS power supply

The EMS power supply primarily comprises 2 alternators with permanent magnets. It also comprises an external rectifier, voltage stabilizer and overvoltage protection, which are integrated in the FUSE BOX. The two 3-phase A/C current generators (alternators) are physically separated in the engine integrated power supply units. One is used for the ECU and the other one is available for the aircraft. They are driven by the crankshaft and require no external supply once the engine has reached its idle speed.

NOTE: Until the idle speed is reached, the EMS requires an external 12 V supply from the onboard system of the aircraft.

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LANE select switches A/B

The two independent LANE select switches A and B connect the ECU for the relevant LANE to the EMS power supply.

The start power switch makes a connection only during the start-up procedure between the ECU, ignition system and the EMS lamps with the external onboard battery.

EMS main switch

5 switch settings:

- EMS master switch, 2 fuel pumps, LANE select switch A, LANE select switch B.

Switch position	Action	Test
EMS main switch "ON"	Activates the EMS power supply	EMS power supply works
LANE select switch A "ON/OFF"	Activates the LANE A (LANE B is "OFF")	LANE A works
LANE select switch B "ON/OFF"	Activates the LANE B (LANE A is "OFF")	LANE B works
Fuel pump (main pump) "ON/OFF"	Activates the fuel pump 1	Fuel pump 1 works
Fuel aux pump "ON/OFF"	Activates the fuel pump 2	Fuel pump 2 works

NOTICE

When using a rotary switch (ignition switch with integrated LANE select options) it must have the following functions.

The EMS main switch has 4 switch positions:

- **A "ON"**, **B "ON"**, **AUTO (A+B"ON")** and **"OFF"**

It is used to conduct various tests (e.g. ignition tests).

Switch position	Action	Test
A ON	Activates the LANE A (LANE B is OFF)	LANE A works
B ON	Activates the LANE B (LANE A is OFF)	LANE B works
AUTO	Activates LANE A and LANE B	LANE A for engine run
OFF	Shut-down of the engine	Engine should shut-down

NOTICE

If only one LANE is turned “ON“, the engine is powered by one ignition circuit, depending on which ignition circuit was choosen.

- The **start-up button** activates the starter motor
- The **switches** for the two fuel pumps are used for activation of the two fuel pumps.

NOTE: Choose **“AUTO“** for in-flight position of the LANE selector switch.

Ignition system

The 912 iSc/iS is equipped with 4 double ignition coils. The ignition system is almost entirely wear-free, as the ECU generates and processes the ignition signal electronically.

Firing sequence: 1-4-2-3.

Fuel injection

The engine is equipped with an electronic fuel injection system. This system is controlled by the ECU and enables highly accurate metering of the fuel according to operating and load conditions, whilst at the same time also taking ambient conditions into account.
The key input variables are throttle valve position, engine speed signal, intake air temperature, ambient pressure, boost pressure and exhaust temperature.
Ultimately, the required fuel quantity or injection period is determined on the basis of the calculated air density in the airbox. It is monitored continuously.

ECU

The ECU is a digital engine control unit which contains the LANE A and the LANE B in a single housing. In principle, each LANE represents an independent computer.

In the "**AUTO**" (both LANE select switch "**ON**") setting, the ECU decides which LANE takes control (redundancy management) according to the health level of the EMS.

Any errors or values outside the operating limits are indicated by an EMS lamp for each lane.

NOTE: The ECU also contains an databus system (CANaerospace). A large number of engine parameters and warnings can be displayed on a separate display. Usage is up to the aircraft manufacturer.

Warning lamps Error messages

All the information messages, warnings and displays below relate to the lamps and not to databus information messages.

LANE A	LANE B	Action
OFF	Flashing	Limited flight operation
Flashing	OFF	Limited flight operation
OFF	ON	Land the aircraft
Flashing	Flashing	Land the aircraft
Flashing	ON	Land the aircraft
ON	OFF	Land the aircraft
ON	Flashing	Land the aircraft
ON	ON	Land the aircraft

ON = permanently on

Main functions of the ECU

Other main functions of the ECU include:

- Ignition control
- Fuel injection control
- Indication of faults and values that are outside operating limits
- Storing faults
- Power supply monitoring

7.5) Propeller gearbox

Reduction ratio

For the engine type 912 iSc/iS one reduction ratio is available.

Reduction ratio	912 iSc/iS
crankshaft: propeller shaft	2.43:1

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.

Governor

Alternatively a hydraulic governor for constant speed propeller can be used. The drive is via the propeller reduction gear.

8) Checks

Safety

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 Letter (SL).

NOTE: Other useful information for service and airworthiness of your engine you'll find on **www.rotax-owner.com**

Table of content

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

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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 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	Engine warm up.
2	Engine cool down.
3	Change oil.
4	Remove the top spark plugs and spray all openings withcorrosion inhibiting oil.
5	Turn the propeller several times by hand in direction of the engine rotation, so that the corrosion inhibiting oil all necessary points reaches.
6	Install the Spark plug in according the Maintenance Manual.
7	Close **all** openings on the cold engine, such as exhaust end pipe, venting tube, air filter etc. against entry of dirt and humidity.
8	Spray all external engine parts of steel 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 fasteners.
2	Clean spark plugs with plastic brush and solvent.

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 Website in electronic version.

www.FLYROTAX.com

Table of content

This chapter of the Operators Manual contains the form and the list of authorized distributors for ROTAX aircraft engines.

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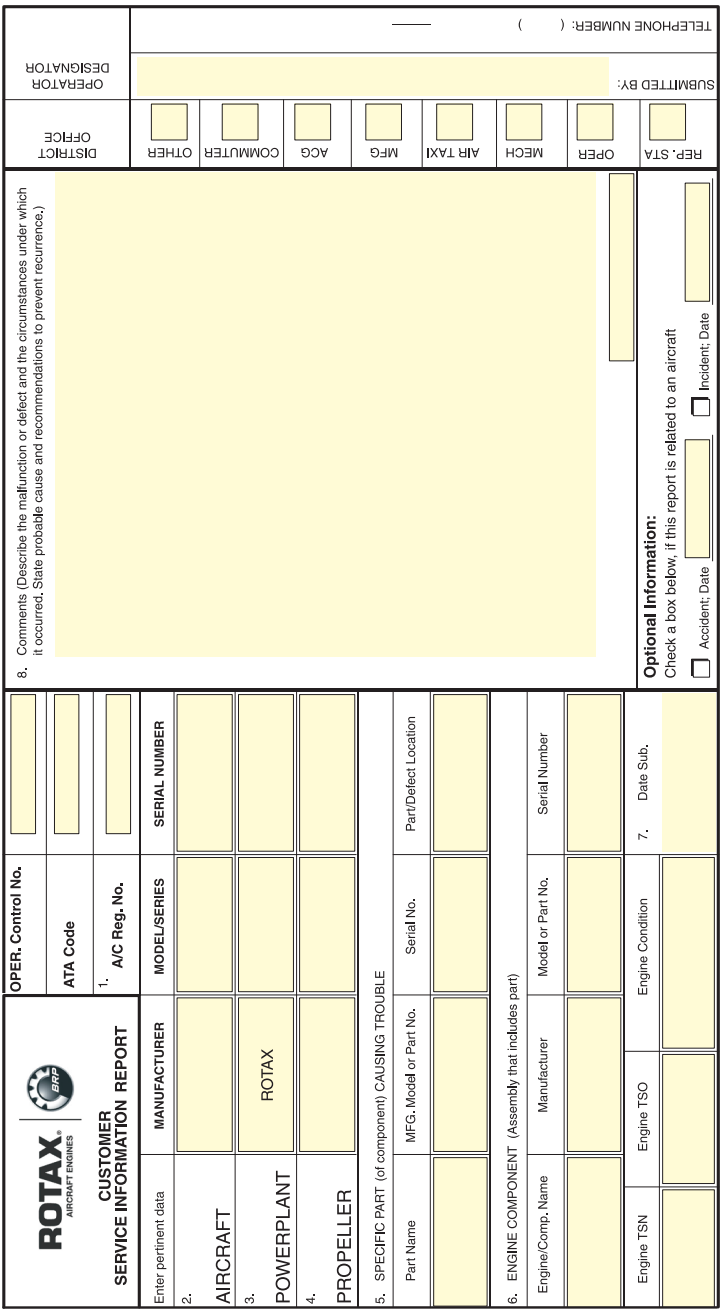
NOTES

9.1) Form



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NOTES

9.2) Authorized Distributor

General note

See the official ROTAX® AIRCRAFT ENGINES Website www.FLYROTAX.com

List

Overview about authorized distributor for ROTAX aircraft engines.

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1) E U R O P E

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 / CROATIA / CYPRUS / GREECE / MALTA / PORTUGAL / SPAIN / TURKEY / FORMER YUGOSLAVIA (EXEPT SLOVENIA)

➤**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:

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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
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E-mail: aviagamma@mtu-net.ru
Website: www.aviagamma.ru
Contact person: Vladimir Andriytschuk
General Director

KOREA:

➤**KOREA BUSINESS AIR SERVICE CO. LTD.**
672-4 KBAS Bldg. Deungchon-dong,
Kangseo-ku, Seoul, South Korea
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Fax: +81 (0) 550 / 83 8224
E-mail: jua@shizuokanet.ne.jp
Contact person:Yoshihiko Tajika
President

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➤**VARMAN AVIATION PVT. LTD.**
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28412656
Fax: +91 (0) 80 / 28413559
E-mail: varman@blr.vsnl.net.in
Website: www.varman.com
Contact person: M. M. Varman

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Contact person: Alberto Comincioli

ROTAX®
AIRCRAFT ENGINES

Motornummer / Engine serial no.

Flugzeugtype / Type of aircraft

Flugzeugkennzeichen / Aircraft registration no.

ROTAX® Vertriebspartner

ROTAX® authorized distributor

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