ROTAX®

OPERATORS MANUAL

FOR ROTAX ENGINE TYPE 912 SERIES

REF NO.: OM-912 I PART NO.: 899700

A BRP BRAND

⚠ 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!

Translation into other languages might be performed in the course of language localization but does not lie within ROTAX® scope of responsibility. In any case the original text in English language and the metric units are authoritative.

Table of Content

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INTRO) Introduction

Topics in this chapter

Foreword

BRP-Rotax GmbH & Co KG (hereinafter “BRP-Rotax”) provides “Instructions for Continued Airworthiness”, which are based on the design, tests and certification of the engine and its components. These instructions apply only to engines and components supplied by BRP-Rotax.

Before operating the engine, read this Operators Manual (OM) carefully. If any passages of the Manual are not clearly understood or in case of any questions, please contact our ROTAX® Authorized Distributors or their independent Service Centers.

This Operators Manual (OM) contains important information about safe operation of the engine together with descriptions of the systems, technical data, operating media and the operational limits of the engine.

The specified information and procedures 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

BRP-Rotax wishes you much pleasure and satisfaction flying your aircraft powered by this ROTAX® aircraft engine.

Document structure

The structure of the Manual follows whenever it is possible the structure of the “GAMA Specification #1 for Pilot’s Operating Handbook“.

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LEP) LIST OF EFFECTIVE PAGES

Each new revision to the Operators Manual will have a new List of Effective Pages.

Chapter	Page	Date
	cover page	
INTRO	1	June 01 2025
	2	June 01 2025
LEP	1	June 01 2025
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TOA	1	June 01 2025
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	3	June 01 2025
	4	June 01 2025
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	2	June 01 2025
	rear page	

TOA) Table of amendments

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

Edition 4/Rev. 0	November 01 2016	
Edition 4/Rev. 1	January 01 2023	Obsolete with Revision 2, which is a complete revision.
Edition 4/Rev. 2	June 01 2025	

current no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclusion	signature
0	INTRO	all	Nov. 01 2016	DOA*			
0	LEP	all	Nov. 01 2016	DOA*			
0	TOA	all	Nov. 01 2016	DOA*			
0	1 up to 9	all	Nov. 01 2016	DOA*			

current no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclusion	signature
1	INTRO	all	Jan. 01 2023	DOA*			
1	LEP	all	Jan. 01 2023	DOA*			
1	TOA	all	Jan. 01 2023	DOA*			
1	1 up to 9	all	Jan. 01 2023	DOA*			

current no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclusion	signature
2	INTRO	all	June 01 2025	DOA*			
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2	1	10, 13, 15, 22	June 01 2025	DOA*			
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2	5	8, 9, 10	June 01 2025	DOA*			
2	7 (old) 6 (new)	6, 11, 12, 13	June 01 2025	DOA*			
2	8 (old) 7 (new)	1	June 01 2025	DOA*			
2	9 (old) 8 (new)	2	June 01 2025	DOA*			

Summary of amendments

Summary of the relevant amendments in this context, but without any claim to completeness.

current no.	chapter	page	date of change	comments
0	1 up to 9	all	Nov. 01 2016	New layout and change of company name
1	1 up to 9	all	Jan. 01 2023	New text – Intentionally Left Blank
1	1	1–2	Jan. 01 2023	New text
1	1	1–14, 1–17	Jan. 01 2023	from Chapter 1 to Chapter 7
1	3, 4	all	Jan. 01 2023	Chapter changed
1	6	all	Jan. 01 2023	Deleted (part of IM)
1	8	8–2	Jan. 01 2023	New text: Corrosion
1	9	9–2	Jan. 01 2023	New form
2	1	2	June 01 2025	Text added
2	1	13	June 01 2025	Text added
2	1	15	June 01 2025	Text added
2	2	2	June 01 2025	Textual addition in NOTICE
2	2	3	June 01 2025	Text added
2	2	5	June 01 2025	Text added in NOTICE
2	2	7	June 01 2025	Table added
2	2	8	June 01 2025	Table added
2	2	10	June 01 2025	New text (General)
2	2	12	June 01 2025	Text added
2	3	6, 7	June 01 2025	Text added
2	4	5	June 01 2025	New text
2	4	6	June 01 2025	Text added
2	4	9	June 01 2025	Text added, ew text
2	4	11	June 01 2025	New text (Engine shutdown tips)
2	4	13	June 01 2025	New Chapter (Engine power setting)

current no.	chapter	page	date of change	comments
2	4	14	June 01 2025	New Chapter (Engine load) New Chapter (Ignition system – Easy-start activation)
2	5	8, 9, 10	June 01 2025	New Chapter (Power setting)
2	7	all	June 01 2025	Chapter-numbering changed from 7 to 6
2	8	all	June 01 2025	Chapter-numbering changed from 8 to 7
2	9	all	June 01 2025	Chapter-numbering changed from 9 to 8
2	7 (old) 6 (new)	6	June 01 2025	Text added
2	6 (new)	11, 12, 13	June 01 2025	New Chapter (Ignition system)
2	6 (new)	13	June 01 2025	New Chapter (Intake air system)
2	8 (old) 7 (new)	1	June 01 2025	Text added
2	8 (new)	1	June 01 2025	Text added

1) General note

Topics in this chapter

1.1) General

Purpose

The purpose of this Operators Manual (OM) is to familiarize the aircraft manufacturers installing this aircraft engine with operating instructions and safety information.

This document is not intended for use by end customers (private aircraft owners, flight schools...) for operating the engine. Due to various executions of engine installations, only the aircraft manufacturer is able to provide end customers with operation and safety information tailored for a specific aircraft.

Nevertheless, all provided information in this Operators Manual (OM) (such as operating limits, safety information, operation instructions...) must be adhered to. The aircraft manufacturer is obliged to forward this information to the end customer in an appropriate way (e.g. within the aircraft specific aircraft flight manual (AFM), pilot operating handbook (POH), etc.).

For detailed information related to aircraft and aircraft/engine installation, maintenance, safety or flight operation, consult the documentation provided by the aircraft manufacturer and/or its dealer. For additional information on engines, their maintenance or parts, you can also contact your nearest ROTAX® authorized aircraft engines distributor or their independent Service Center.

Engine serial number

When making inquiries or ordering parts, always indicate the engine serial number. Due to continuous product improvement, engines of the same engine type might require different support and spare parts. The engine serial number is located on the top of the crankcase, magneto side.

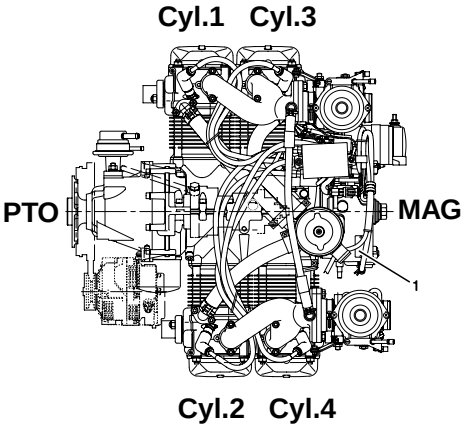

Figure 1: Pos. 1: Engine serial number

1.2) Abbreviations and terms (depending on respective engine type)

Abbreviations	Description
*	Reference to another section
	center of gravity
	The drop symbol indicates use of sealing agents, adhesives or lubricants (only in the Maintenance Manual Heavy)
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
rpm	Revolutions per minute
A	Ampere
AAPTS	Ambient Air Pressure Temperature Sensor
AC	alternating current
AD	Airworthiness Directives
Ah	Ampere hour
A/C	Aircraft
AC-DC	EMS Modul voltage converter
AR	as required
assy.	assembly
ASB	Alert Service Bulletin
ACG	Austro Control GmbH
ACL	Anti Collision Light
API	American Petrol Institute
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
AWG	American Wire Gauge
CAN	Controller Area Network
CCS	Camshaft position sensor
Coil 1–4	Ignition coils 1–4
CPS 1+2	Crankshaft Position Sensor 1+2
CSA	Constant Speed Actuator

Abbreviations	Description
CTS	Cooling Temperature Sensor
CW	clockwise
CCW	counter-clockwise
CGSB	Canadian General Standards Board
DCDI	Dual Capacitor Discharge Ignition
DC	direct current
DOA	Design Organisation Approval
DOT	Department of Transport
EASA	European Aviation Safety Agency
IM	Installation Manual
ECU	Engine Control Unit
EGT	Exhaust Gas Temperature
INTRO	Introduction
EMS	Engine Management System
EMS GND	Engine system internal ground reference which is intended to be disconnected from aircraft common ground during flight
EMC	Electromagnetic compatibility
EN	European Standard
ETFE	Ethylene Tetrafluoroethylene
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FOD	Foreign object damage
FL	Flight Level
Fuse box	Power conditioning and distribution for the EMS
hr.	hours
HIC A	Harness Interface Connector A
HIC B	Harness Interface Connector B
IAT	Indicated Air Temperature
ICA	Instructions for Continued Airworthiness
IFR	Instrument Flight Rules

Abbreviations	Description
IFSD	In-flight-shutdown
INJ 1–8	Injector 1–8
IPC	Illustrated Parts Catalog
ips	inch per second
iRMT	independent ROTAX Maintenance Technician
ISA	International Standard Atmosphere
kg	Kilograms
KNOCK	Knock sensor
Lane A	System A of Engine Management System
Lane B	System B of Engine Management System
LOPC	Loss of power control
MAPS 1 & 2	Manifold Air Pressure Sensor 1 & 2
MATS 1 & 2	Manifold Air Temperature Sensor 1 & 2
MCON 1.2	Sealed electrical connector
MON	Motor Octane Number
MAG	Magneto Side
N	Newton
n.a.	not available
NDT	Non Destructive Testing
NEW	Part must be replaced against NEW (mentioned in figures)
Nm	Newtonmeter
NVFR	Night Visual Flight Rules
OAT	Outside Air Temperature
OHM	Overhaul Manual
OHV	Over Head Valve
OM	Operators Manual
OPS	Oil Pressure Sensor
OTS	Oil Temperature Sensor
PCD	Pitch Circle Diameters
PCV	Pressure Control Valve

Abbreviations	Description
PMA	Permanent magnet alternator
POA	Production Organization Approval
PS	Power supply
PTFE	Polytetrafluoroethylene (Teflon)
PTO	Power Take Off
Rev.	Revision
ROTAX®	is a trademark of BRP-Rotax GmbH & Co KG
RON	Research Octane Number
RON 424	ROTAX® Standard 424
s.v.	still valid (only Illustrated Parts Catalog)
S/N	Serial Number
SAE	Society of Automotive Engineers
SEP	Single Engine Piston
SB	Service Bulletin
SI	Service Instruction
SI-PAC	Service Instruction Parts and Accessories
SPST	Single pole single throw
STP	Shielded twisted pair wire
SL	Service Letter
SMD	Surface Mounted Devices
TBO	Time Between Overhaul
TC	Type certificate
part no.	part number
TOA	Table Of Amendments
TOC	Table Of Contents
TPS	Throttle Position Sensor
TSN	Time Since New
TSNP	Time Since New Part
TSO	Time Since Overhaul
V	Volt
VFR	Visual Flight Rules

Abbreviations	Description
LEP	List of Effective Pages
MM	Maintenance Manual
MEP	Multi Engine Piston
X3	Connector on Engine Management System wiring harness which serves as an interface for power supply
XXXX	shows the component serial number

1.3) Safety

Although reading such information does not eliminate any hazards, it promotes understanding, and applying the information will promote correct use of the engine. Always apply common workshop safety rules.

The information and descriptions of components and systems contained in this Manual are correct at the time of publication. BRP-Rotax maintains a policy of continuous improvement of its products without imposing upon itself any obligation to retrofit products previously manufactured.

Revisions

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

Measurement

Specifications are given in the SI metric system with the imperial and US customary measurement system equivalents in parenthesis.

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 or even fatal injury.

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

NOTICE
Identifies an instruction which, if not followed, may severely damage the engine or could void any warranty.

NOTE

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

ENVIRONMENTAL NOTE

Environmental notes give you tips on environmental protection.

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

1.4) Safety information

Use for intended purpose

⚠ WARNING

Non-compliance can result in serious injuries or death!
Never fly the aircraft equipped with this engine at locations, air speeds, altitudes or in other situations which do not allow a successful no-power landing after sudden engine stoppage.

- This engine is not suitable for acrobatics (inverted flight, etc.). Flight attitudes outside the permissible limits are not allowed.
- This engine has exclusively been developed and tested for fixed wing pusher and tractor applications and gyroplanes. In case of any other usage, the OEM is responsible for testing and the correct function of the engine.
- 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-Rotax grants no warranty on the suitability of its engine's use on any particular aircraft. Further, BRP-Rotax grants no warranty on 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 DAY VFR, NIGHT VFR or IFR in an aircraft the applicable legal requirements and other existing regulations must be adhered to.

- 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 reciprocating 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 a solo flight. 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 provided by the authorized distributors according to manufacturer specifications (iRMT).

Regulations

- Respect all legal requirements or local rules pertaining to flight operation in your flying area. Only fly 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 in the ROTAX® engine package. Verification to the latest regulations such as FAR or EASA has to be conducted by the aircraft manufacturer.

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)

- Since special training, tools and equipment are required, engine servicing shall only be performed by an authorized ROTAX® aircraft engine distributor or their independent service center. BRP-Rotax requires that any service or maintenance work be carried out and verified by a technician that has a current iRMT rating.
- When the engine will not be operated for a longer period protect the engine and fuel system from contamination and environmental exposure.

Engine operation

- 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 the risk of 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

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

Documentation

- Installation Manual (IM)
- Operators Manual (OM)
- Maintenance Manual Line (MML)
- Maintenance Manual Heavy (MMH)
- Overhaul Manual (OHM)
- Illustrated Parts Catalog (IPC)
- Alert Service Bulletins (ASB)
- Service Bulletins (SB)
- Service Instructions (SI)
- Service Instruction-Parts and Accessories (SI-PAC)
- Service Letters (SL)

Status

The status of Manuals can be determined by checking the table of amendments. The first column of this table indicates the revision status which should be compared with the revision provided on the ROTAX®-Website: www.FLYROTAX.com
Amendments and current versions can be downloaded free of charge.

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 list of effective pages. 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-Rotax if not stated otherwise.

This symbol informs you of additional references (data sheets, Manuals, etc.) associated with the given subject.

Illustrations

The illustrations in this manual are merely sketches and show typical arrangements. They may not represent full detail or the exact shape of the parts but should outline the same or similar function. Therefore deriving dimensions or other details from illustrations is not permitted.
TYPICAL indicates a general view which may not represent exact details.

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. AE 5iS001) is of no significance for the content.

1.6) Type description (912 Series)

The type description consists of the following:

Designation		Description
Type	**912**	4-cyl. horizontally opposed, normal aspirated engine
Certification	**A**	Certified to JAR 22 (TC No. EASA.E.121)
	F, S	Certified to FAR 33 (TC No. E00051 EN) JAR-E (TC No. EASA. E.121)
	UL, ULS	Approved to according ASTM F2339
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.
Suffix	**-01**	Explanation of the type designation suffix, see SB-912-068

Available options (optional equipment) for the engine type mentioned above:

Options	external alternator	vacuum pump	drive for rev counter/ hour meter	governor
for configuration 2	yes	yes	yes	no
for configuration 3	yes	no	yes	yes

NOTE

Conversion of the configuration 2 to configuration 3 and vice versa may be accomplished by ROTAX® authorized aircraft engines distributors or their independent service centers.

For further information see the current
SI-916 i-006 / SI-915 i-009 / SI-912 i-023 / SI-912-031 / SI-914-032
Change of the gearbox configuration for ROTAX® Aircraft Engine and Maintenance Manual Heavy (MMH) of the respective engine type Chapter 72-00-00 Propeller gearbox.

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2) Operating instructions

Topics in this chapter

The data of the certified engine are based on the type certificate of type 912 A JAR 22 (TC No. EASA.E.121), 912 F/S FAR 33 (TC No. E00051 EN), JAR-E (TC No. EASA.E. 121).

Introduction

The operating limits for certified engines are also given in the type certificate for the relevant engine type.
This chapter of the Operators Manual (OM) contains the operating limits that must be observed and adhered to while operating this type of engine.

2.1) Operating limits (912 A/F/UL)

Performance

Performance data relate to ISA (**I**nternational **S**tandard **A**tmosphere) conditions without governor, external alternator etc.

Take-off performance	59.6 kW at 5800 rpm
Max. continuous performance	58 kW at 5500 rpm

Speed

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

Oil pressure	
Max.	7 bar (102 psi)
Min.	0.8 bar (11.6 psi) (below 3500 rpm) 1.5 bar (22 psi) [1]
Normal	2.0 to 5.0 bar (29 to 72.5 psi) (above 3500 rpm) 1.5 to 5.0 bar (22 to 72.5 psi) [1]

NOTICE
Oil pressure above max. for a short period is admissible at cold start.

Oil temperature

Oil temperature	
Max.	140 °C (285 °F)
Min.	50 °C (122 °F)
Normal operating temperature approx. 90 to 110 °C (190 to 230 °F)	

1. 912 UL to S/N 4 402 387/912 A to S/N 4 410 266 /912 F to S/N 4 412 764

EGT

Exhaust gas temperature	
Max.	880 °C (1616 °F)

Conventional coolant

Applicable for engine S/N without Suffix -01.

See also Chapter 2.3.

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

Cylinder head temperature	
Max.	150 °C (302 °F)
Permanent monitoring of coolant temperature and cylinder head temperature is necessary.	

Waterless coolant

See also Chapter 2.3

Cylinder head temperature	
Max.	150 °C (302 °F)
Permanent monitoring of cylinder head temperature is necessary.	

Conventional coolant

See also Chapter 2.3

Applicable for engine S/N with Suffix -01.

Coolant temperature limit measured in the cylinder head	Engine type
under Max. 120 °C (248 °F) Normal operative range between 80 °C and 110 °C (176 °F and 230 °F)	912 A/F/UL
Permanent monitoring of coolant temperature is necessary.	

Engine start, operating temperature

Max.	50 °C (122 °F) (ambient temperature)
Min.	-25 °C (-13 °F) (oil temperature)

Fuel pressure

⚠ WARNING

Non-compliance can result in serious injuries or death!
Fuel pressure in excess of stated limit can lead to an override of the float valve with subsequent engine stop.

The aircraft engine manufacturer strongly recommends the installation of an additional pump, unless this has not been covered by legal obligations so far.

Fuel pressure	
Max.	0.4 bar (5.8 psi) (0.5 bar (7.26 psi)) [2]
Min.	0.15 bar (2.2 psi)

NOTE

Low fuel pressure indications are possible and allowed. But the pressure must stabilize to the operating limit within 10 seconds. If not, the cause should be determined and rectified. Due to the technical design and installation conditions (construction of the return line, etc.) pressure fluctuations, at the fuel pump are possible. These pressure fluctuations within the specified operating limits are not considered a problem.

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

2. applicable only for fuel pump from S/N 11.0036

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 limits (912 S/ULS)

Performance

Performance data relate to ISA (**I**nternational **S**tandard **A**tmosphere) conditions without governor, external alternator etc.

Take-off performance	73.5 kW at 5800 rpm
Max. continuous performance	69 kW at 5500 rpm

Speed

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

Oil pressure	
Max.	7 bar (101.5 psi)
Min.	0.8 bar (11.6 psi) (below 3500 rpm)
Normal	2.0 to 5.0 bar (29 to 72.5 psi) (above 3500 rpm)

NOTICE
Oil pressure above max. for a short period is admissible at cold start.

Oil temperature

Oil temperature	
Max.	130 °C (266 °F)
Min.	50 °C (122 °F)
Normal operating temperature: approx. 90 to 110 °C (190 to 230 °F)	

EGT

Exhaust gas temperature	
Max.	880 °C (1616 °F)

Conventional coolant

See also Chapter 2.3.

Applicable for engine S/N without Suffix -01.

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

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

Conventional coolant

Applicable for engine S/N with Suffix -01.

Coolant temperature limit measured in cylinder head	Engine type
Max. 120 °C (248 °F)	912 S/ULS
Permanent monitoring of coolant temperature is necessary.	

Engine start, operating temperature

Max.	50 °C (122 °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 lead to engine stoppage.

The aircraft engine manufacturer strongly recommends the installation of an additional pump, unless this has not been covered by legal obligations so far.

Fuel pressure [3]	
Max.	0.4 bar (5.8 psi) (0.5 bar (7.25 psi)) [4]
Min.	0.15 bar (2.18 psi)

NOTE

Due to the technical design and installation conditions (construction of the return line, etc.) pressure fluctuations at the fuel pump are possible. These pressure fluctuations within the specified operating limits are not considered a problem.

Low fuel pressure indications are also possible and allowed, but the pressure must stabilize to the operating limit within 10 seconds. However, low pressure indications below 0.08 bar (1.16 psi) may only last a maximum of 1 second. If not, the cause must be determined and rectified.

Engine Compartment

Temperature	
Max.	80 °C (176 °F)

3. relative to ambient pressure
4. applicable only for fuel pump from S/N 11.0036

Air Intake

Air Intake heat up [5]	
Max.	8 °C (14.4 °F)
delta temperature at WOT 5800 rpm (with carb heat valve in OFF position) ambient pressure > 950 mbar (28.5 inHg)	

NOTE

Air Intake heat up = Air temperature measured in the airbox – Ambient temperature. Without airbox measure the air temperature on the outside of the air filter.

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.

5. only if airbox equipped

2.3) Operating media – Coolant

NOTICE

Obey the latest edition of Service Instruction SI-912-016, for the selection of the correct operating media.

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 manufacturer's documentation.

Mixture

NOTICE

Obey the operating media manufacturer's instructions!

Applicable for engine S/N without Suffix -01.

	Mixture ratio %	
Designation	**Concentrate**	**Water**
conventional e.g. BASF Glysantine anticorrosion	50 [6]	50
waterless e.g. Aero Cool 180°	100	0

Applicable for engine S/N with Suffix -01.

	Mixture ratio %	
Designation	**Concentrate**	**Water**
conventional e.g. BASF Glysantine anticorrosion	50 [6]	50

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

2.4) Operating media – Fuel

General

Service Instruction SI-912-016 / SI-914-019 / SI-912 i-001 / SI-915 i-001 / SI-916 i-001, “Selection of suitable operating fluids for ROTAX® Engine Type 916 i (Series), 915 i (Series), 912 i (Series), 912 and 914 (Series)” shows the generally approved fuels.
Several other factors need to be considered during the process of fuel selection:

- Prevailing ambient conditions (pressure and temperature, depending on location and climate zone of usage, see Chapter 3.3.1.
- Engine operation in applications with potential high engine loads (e.g. glider towing, flight schools, float-planes & amphibious aircraft).
- Probability of pilot errors during operating; (e.g. incorrect application of propeller pitch or carburetor heat by inexperienced students in flight school applications).

NOTE

In general, improved fuel quality with minimum RON 98 fuels can mitigate other factors with increased probability of piston damage and increases engine longevity and safety margin. The selection of proper fuels is one of the main levers to prevent piston damage, especially in the case of other contributing factors being present.

Independent of the chosen fuel the following topics are also crucial:

- Clean fuel (consider filtering/screening while fueling).
- No contaminants (water, alcohol, oil, diesel, fuel additives).
- Appropriate storage (duration, approved container).
- If available select summer / winter blends according to the relevant season (using remaining winter blend in tank during warmer temperatures increases the risk of vapor formation).
- Source, transport, storage, and refueling (equipment, environment, etc.) must be considered.
- Refrain from using fuels which exceed specified Alcohol content > 10% (E10+).

NOTE

Implement procedures to regularly check, track and document the quality of the fuel used. In case of piston damages, it is mandatory to provide a fuel sample of the fuel being used during the time of incident.

Antiknock properties

The fuels with following specifications can be used.

	Usage/Description	
	912 A/F/UL	**912 S/ULS**
Anti knock properties	Min. RON 90 (min. AKI [7] 87)	Min. RON 95 (min. AKI [7] 91)

NOTE

For fuels according to ASTM D4814 specifications following AKI (Anti Knock Index) value has to be observed: e.g. min. AKI 91.

MOGAS

	Usage/Description	
MOGAS	**912 A/F/UL**	**912 S/ULS**
European standard	EN 228 normal EN 228 super EN 228 super plus	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 A/F/UL**	**912 S/ULS**
Aviation Standard	AVGAS 100 LL (ASTM D910)	AVGAS 100 LL (ASTM D910)

7. Anti Knock Index (RON+MON)/2

2.5) Operating media – Lubricants

NOTICE

Obey the manufacturer's instructions about the lubricants.
If the engine mainly runs on AVGAS more frequent oil changes will be required. See current Service Information SI-912-016.

Oil type and specification	For the selection of suitable lubricants refer to the additional information in the current Service Information SI-912-016.
Oil consumption	Max. 0.06 l/h (0.13 liq pt/h)
Oil viscosity	For the oil viscosity refer to the additional information in the current Service Instruction SI-912-016.

3) Abnormal operation

Topics in this chapter

⚠ WARNING

Non-compliance can result in serious injuries or death!
Unless stated otherwise in this chapter, operating an engine with limited airworthiness is not permitted. At unusual engine behavior conduct checks as per Maintenance Manual Line (MML) Chapter 05-50-00 before the next flight. Only qualified staff (authorized by the Aviation Authorities) trained on this particular engine, is allowed to carry out maintenance and repair work.

The following description of procedures depends on the respective type of installation in the aircraft and shall therefore only be seen functionally.

3.1) Re-Start during flight

If the propeller continues to rotate during flight by windmilling, but the speed is not sufficient to start the engine, the electric starter can be used. It is not required to wait until the propeller stops rotating.

3.2) Exceeding max. admissible engine speed

Exceeding engine speed

Reduce the engine speed. Any exceeding of the max. admissible engine speed must be entered by the pilot into logbook, stating the exact time and duration of engine over speed.

- A maintenance inspection should be carried out

3.3) Temperature

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

3.3.1) Exceeding of max. admissible cooling system temperature

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

3.3.2) Exceeding of max. admissible cyl. head temperature

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

Cylinder head temperature max.

Applicable for engine S/N without Suffix -01.

- Any exceeding of the max. admissible cylinder head temperature must be entered by the pilot into the logbook, stating duration and extent of over-temperature condition.
- Carry out an unscheduled maintenance check according to Maintenance Manual Line (MML) chapter 05-50-00.

3.3.3) Exceeding of max. admissible coolant temperature

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

Coolant temperature max.

Applicable for engine S/N with Suffix -01.

- Any exceeding of the max. admissible coolant temperature must be entered by the pilot into the logbook, stating duration and extent of over-temperature condition.
- Carry out an unscheduled maintenance check according to Maintenance Manual Line (MML) chapter 05-50-00.

3.3.4) Exceeding of max. admissible oil temperature

NOTICE

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

Exceeding oil temperature

- Any exceeding of the max. oil temperature must be entered by the pilot in the logbook, stating duration and extent of over-temperature condition.
- A maintenance inspection should be carried out.

3.4) Oil pressure

NOTICE

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

Oil pressure

Oil pressure below minimum – during flight

- Check oil system.
- A maintenance inspection should be carried out.

3.4.1) 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 Chapter 2.5
- A maintenance inspection should be carried out.

3.4.2) Oil pressure above permitted range at low ambient temperatures

NOTICE

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

Oil pressure too high

- Reduce engine speed and check the oil pressure again once it has reached a higher oil temperature
- A maintenance inspection should be carried out

3.5) Engine on fire or fire in the engine compartment

NOTICE

Carry out emergency procedures as prescribed in the flight manual of the aircraft 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

3.6) Troubleshooting

⚠ 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 distributor. The engine must not be operated until the problem is rectified.

Perform all checks in accordance with the latest Maintenance Manuals (MML and MMH).

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; preheat engine.
Wrong fuel (Jetfuel or Diesel).	Change of fuel, clean entire fuel system.

Engine run

Engine keeps running while ignition switch is turned 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.

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

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

Oil pressure

Low oil pressure

Possible cause	Remedy
Not enough oil in oil tank.	Refill oil.
Oil too hot.	Cool down oil.

High oil pressure

Possible cause	Remedy
Oil too cold.	Cover oil cooler or install thermostat.
Wrong viscosity of oil.	Change oil to lower viscosity.

Perform all checks in accordance with the latest Maintenance Manuals (MML and MMH).

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 for diesel contamination and purge entire fuel system if diesel is found.

Engine hard to start at low temperature

Possible cause	Remedy
Starting speed too low.	Preheat engine.
Faulty or discharged battery.	Fit fully charged battery.
High oil pressure.	At cold start an oil pressure reading of up to around 7 bar (101.5 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 oil 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-912-001, current issue.

NOTE

Oil pressure must be measured at idle at an oil temperature of minimum 50 °C (122 °F). Be sure the oil pressure does not go below minimum at idle.

4) Standard operation

Topics in this chapter

Introduction

To warrant reliability and efficiency of the engine, meet and carefully observe all the operating and maintenance instructions.
The following description of procedures depends on the respective type of installation in the aircraft and shall therefore only be seen functionally.

NOTE

The control elements mentioned in this chapter are only symbolic and should support the understanding of the procedures. The execution of control elements is in the responsibility of the aircraft manufacturer.

4.1) Daily checks

Safety

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

⚠ WARNING

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

⚠ WARNING

Non-compliance can result in serious injuries or death!
Ignition “OFF” Before moving the propeller switch off both ignition circuit 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

Operating media must be observed.
Inappropriate coolant quantity can lead to serious engine damage.

The specifications given in Chapter 2.3 must be adhered to when refilling coolant.

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 filler neck.
2	Verify coolant level in the **overflow bottle**, replenish as required. The coolant level must be between max. and min. mark.

ENVIRONMENTAL NOTE

Protect the environment!
Do not harm the environment by spilling coolant. Dispose coolant in an environmentally friendly manner.

Expansion tank

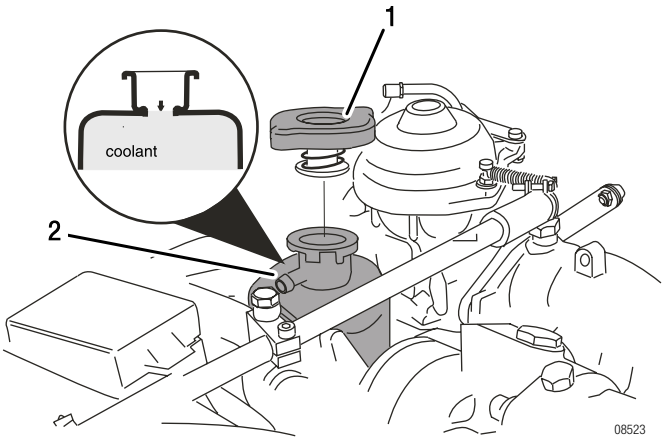


Figure 1: Expansion tank

1 Radiator cap *2 Expansion tank*

Overflow bottle

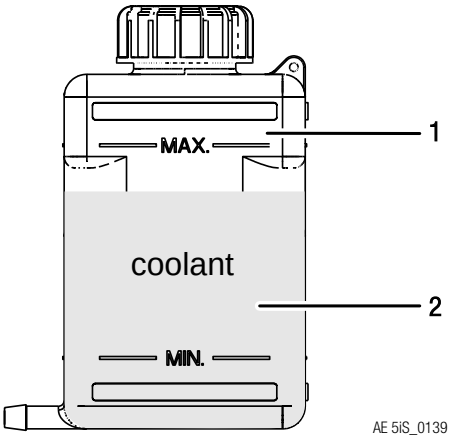


Figure 2: Overflow bottle

1 Overflow bottle *2 Coolant*

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.
2	Verify free movement of throttle valve and the complete range.
3	Inspect for damages, leakage and general condition of exhaust system.
4	Visual inspection for mechanical and thermal damages of sensor, actuators and the wiring harness.

Gearbox

Version **without** overload clutch:
No further checks are necessary.

Version **with** overload clutch:

Step	Procedure
1	Turn the propeller by hand back and forth, feeling the free rotation of 30° before the crankshaft starts to rotate. If propeller can be turned between the dogs with little force (lower than 25 Nm (19 ft.lb)), further inspection is required.

Carburetor

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

Exhaust system

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

Step	Procedure
1	Inspect for damages, restrictions, and general condition of the air intake (like air filters, airbox, etc.)
2	Ensure proper actuation of carb heat system (e.g. proper adjusted Bowden cable and flap). Carburetor heat flap must be fully closed when carb heat is off.
3	Verify the correct actuation of the airbox push/pull mechanical linkage, no wear is allowed.

4.2) Before engine start

Carry out pre-flight checks.

4.3) Pre-flight checks

Safety

⚠ WARNING

Risk of burns and scalds! Hot engine parts!
Conduct checks on cold 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

Operating media must be observed.
Inappropriate oil quantity can lead to serious engine damage.

The specifications given in Chapter 2.4 must be adhered to when refilling oil.

Step	Procedure
1	**NOTE** *Propeller shouldn't be turned in reverse of the normal direction of engine rotation.* Remove bayonet cap from the oil tank, turn the propeller slowly by hand in direction of engine rotation several times to push residual oil from the engine into the oil tank.
2	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 but rather the continuous pressure and the amount of gas which is transferred into the crankcase.
3	This process is finished when air is returning back to the oil tank and can be noticed by an audible gurgle from the open oil tank.
4	Check oil level and add oil if necessary. The oil level should be in the upper half (between the “50%“ and the “max“ mark) and should never falls below the “min.“ mark of the oil dipstick. 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 (0.48 qt). Oil consumption max 0.06 l/h (0.06 qt/h).
5	Re-install bayonet cap.

ENVIRONMENTAL NOTE

Protect the environment.
Do not harm the environment by spilling oil. Dispose of oil in an environmentally friendly manner.

4.4) Engine start

⚠ WARNING

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

Engine start

Step	Designation	Procedure
1	Fuel valve	open
2	Starting carb (choke)	activated
	IF engine in operating temperature	**Then** start the engine without choke.
3	Throttle lever	set on idle position
4	Master switch	ON
5	Ignition	both circuits switched on

NOTICE

Do not actuate starter button (switch) as long as the engine is running. Wait until complete stop of engine!

Step	Designation	Procedure
6	Starter button	actuate

NOTICE

Activate starter for maximum of 10 consecutive seconds only, followed by a cooldown period of 2 minutes.

Step	Designation	Procedure
7	As soon as engine runs	adjust throttle to achieve smooth running at approx. 2500 rpm.
8	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).

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. Engine rpm may only be increased so far as the oil pressure re-mains steady.

Step	Designation	Procedure
9	Starting carb (choke)	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.

4.5) After engine start

⚠ WARNING

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

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 (122 °F).
3	Check temperatures and pressure.

Throttle response

NOTICE

After a full-load ground test allow a cooling run at idle speed to prevent vapour formation in the cylinder head.

Step	Procedure
1	Full throttle ground test (follow the Aircraft Flight Manual (AFM) / Pilot Operating Handbook (POH)) since engine speed depends on the propeller used.

Ignition check

After engine warm-up and prior to take-off, check the two ignition circuits at **4000 rpm** (approx. 1700 rpm propeller).

Step	Procedure
1	Speed (engine rpm) 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 (engine rpm) 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.

Intake air

Step	Procedure
1	After engine warm-up and prior to take-off, check the Air intake heat up (without carb heat) value. See Chapter 2.2

NOTE

Follow the instructions in the Aircraft Flight Manual (AFM) / Pilot Operating Handbook (POH) for operation in different climates.

4.6) Take-off

⚠ WARNING
Non-compliance can result in serious injuries or death! Monitor Operating limits. Limits must not be exceeded.

Climb

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

4.7) Cruising

Performance

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

Oil temperature

Step	Procedure
1	Avoid operation below normal 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.

4.8) Engine shut-off

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. Ensure the engine is at its lowest possible idle speed (minimum of 1400 rpm) before selecting "ignition OFF".

Engine shut-down tips

Step	Procedure
1	It is always prudent to park the aircraft with the nose pointing into wind to aid the cooling after shut down and prevent excessive heat soak under the engine cowling.
2	Reduce loading on the propeller and gearbox by adjusting the propeller to fine pitch (in-flight variable pitch propellers) and move throttle to idle position.
3	After cooling down run, throttle must be at idle so engine at its minimum speed, switch ignition off on one circuit for a short time (2 – 3 seconds) then switch off the second circuit.

NOTE

To decrease power, first reduce MAP with the throttle, and then decrease rpm with the propeller control.
See also Chapter 4.10.

4.9) Cold weather operation

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

Coolant

For selection of coolant and mixing ratio, see Chapter 2.3.

Lubricant

For selection of oil, see table of Lubricants Chapter 2.5.

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	Check electrode gap of spark plugs and if worn fit new spark plugs. See Maintenance Manual Line (MML) of the respective engine type.
3	Preheat engine.

Icing in the air intake system

Icing due to 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

- Carburetor heat is the only effective remedy. See Flight Manual or other operating instructions regarding the carburetor heat supplied by the aircraft manufacturer.

NOTE

Elevated air intake temperatures can contribute to piston damage, especially in combination with high engine loads. Particularly, when the carburetor heat system is activated along with high engine power settings e.g. during touch-and-go with carburetor heat on. The misuse of carburetor heat (e.g. activated carb. heat during touch and go's) may result in piston damage / pre-ignition and/or detonation and consequently damages in the engine (piston/ cylinders), loss of power and vibrations.

⚠ WARNING

It is not permitted to partially activate the carburetor heat system.

The carburetor heat system has to be either activated/on or deactivated/off completely. Intermediate positions of the throttle valves in the ROTAX® genuine airbox may lead to a separation of the "hot" and the "fresh" air in the airbox which consequently leads to the provision of too hot air to one carburetor and fresh unheated air to the other carburetor. This does not only affect the system's capability to prevent carburetor icing when needed but also may lead to damage of the pistons/cylinders which were supplied with too hot air.

NOTE

The procedure and limits provided in Chapter 4.7 have to be considered accordingly.

Icing

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 and without undrained low points
- Prevent condensation of humidity, i. e avoid temperature differences between aircraft and fuel

4.10) Engine power setting

General

Manifold absolute pressure (MAP) and engine speed (in RPM) are vital parameters when controlling engine power and the combustion process. The combination of these aforementioned parameters strongly influences the internal stress (e.g. internal cylinder pressure) on the engine and therefore the margin/robustness of engines for piston damage / pre-ignition and/or detonation. There are several measures to increase the margin/robustness for piston damage / pre-ignition and/or detonation. The correct operation of the engine by the pilot (e.g. power setting and power adjustments) is of paramount importance.
See Chapter 5.1.1 for performance data.

NOTE

Beside the combination of engine control parameters the type and quality of fuel has the most individual influence on piston damage/pre-ignition.

Operator requirements

- Follow the aircraft manufacturer's instructions in their Aircraft Flight Manual (AFM) / Pilot Operating Handbook (POH) with respect to carburetor heat application.
- Ensure to educate (unfamiliar) pilots with respect to the importance of proper usage of carburetor heat in particular in combination of high power settings (e.g. during take off and touch and go, etc.).

NOTE

Verify that all the operating limits are respected in all flight conditions.

4.11) Engine load

Background information

Depending on the usage of the aircraft, the engine may be exposed to different load patterns. The following points are considered as high load applications:

- High drag or heavy aircraft such as float-planes and amphibious aircraft.
- Glider towing (as there are repeated climbs with high load).
- Flight school operation as the following situations might occur on a regular basis:
  High load due to frequency of starts and touch-and-go's.
  Errors of students in stress situations like e.g. violation of allowed operating envelope, improper use of carb heat and propeller pitch.
  Simulated engine failure on twin engine applications.
  Training of emergency procedures.

NOTE

Using minimum RON 98 fuel provides excellent contribution to minimizing the probability of piston damages, especially in high load applications.

NOTE

Fixed pitch propellers manufactured with too much pitch, ground adjustable propellers configured with too much pitch and incorrectly controlled in-flight adjustable propellers may cause overload of the engine.

Performance recommendations

- Restrict engine speed over 5500 rpm to 5 min maximum.
- Choose manifold absolute pressure (MAP) and engine RPM according to the selected fuel.
- Choose manifold absolute pressure (MAP) and engine RPM with respect to the carb. heat activation.

NOTE

In case of high engine load applications, the usage of minimum RON 98 fuels is recommended.

4.12) Ignition system – Easy-start activation

Operator requirements

Do not attempt to intentionally activate the easy-start function except when starting the engine.
See also Chapter 6.7.

5) Performance and fuel consumption

Topics in this chapter

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 (OM) and ensuring that the engine is well-maintained.

5.1) Performance data

Performance graphs
Engine 912 A/F/UL

Performance graphs for stand. conditions (ISA)

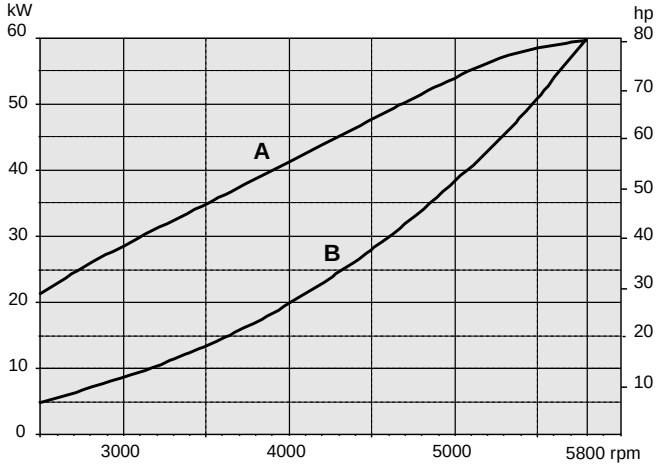


Figure 1: Performance graphs 912 A/F/UL

A max. engine output

B power requirement of propeller

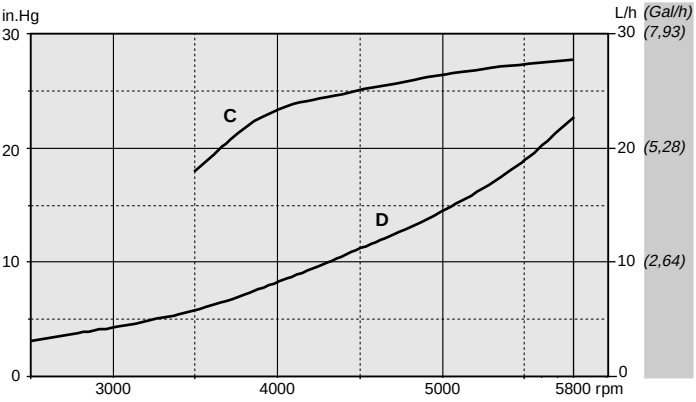


Figure 2: Values along propeller curve

C manifold pressure

D fuel consumption

Performance data Engine 912 A/F/UL

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)	Perform-ance (kW)/(HP)	Torque (Nm)/(ft. lb)	Manifold pressure (in. Hg)
Take-off power	5800	59.6 / 80	98.1 / 72.35	full throttle
max. continu-ous power	5500	58.0 / 78	100.7 / 74.27	full throttle
75 %	5000	43.5 / 58	83.1 / 61.29	27.2
65 %	4800	37.7 / 50	75.0 / 55.32	26.5
55 %	4300	31.9 / 43	70.8 / 52.22	26.3

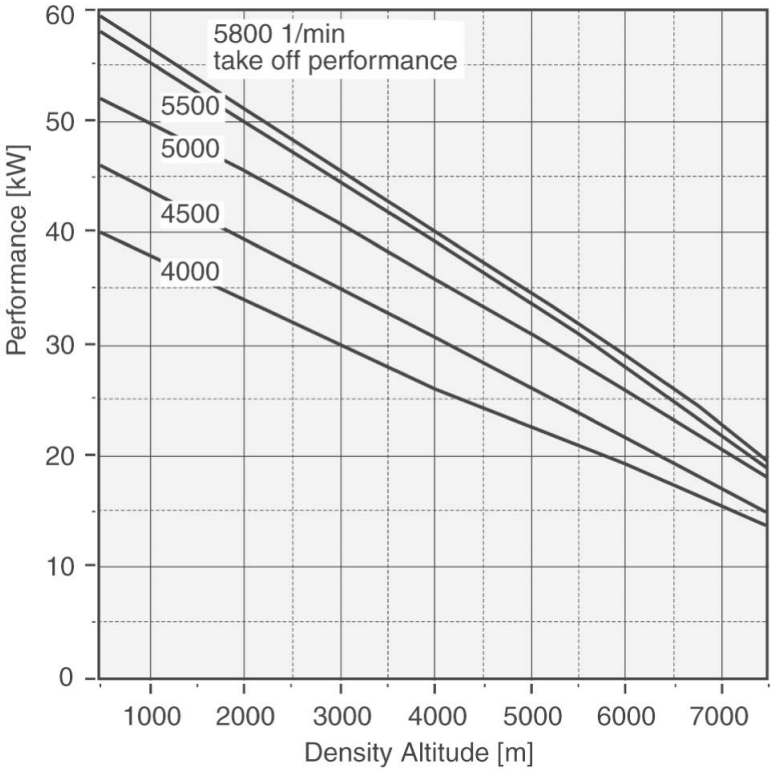
NOTE

Further essential information regarding engine behavior see Service Letter SL-912-016, latest edition.

Performance data Engine 912 A/F/UL

Performance data variable pitch propeller

The following graph shows the performance drop with increasing flight altitude. The curves show the performance at 5800, 5500, 5000, 4500 and 4000 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.



$$P_{act.} = P_{stand.} \frac{T_{standard}}{T_{actually}}$$

$$T\,[K] = t\,[°C] + 273$$

Figure 3: Performance graphs 912 A/F/UL

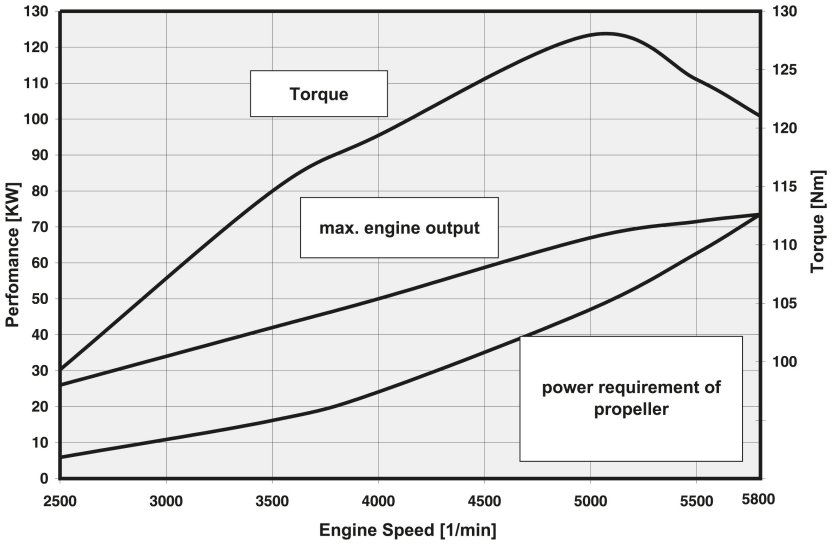


Figure 4: Performance graphs Engine 912 S/ULS

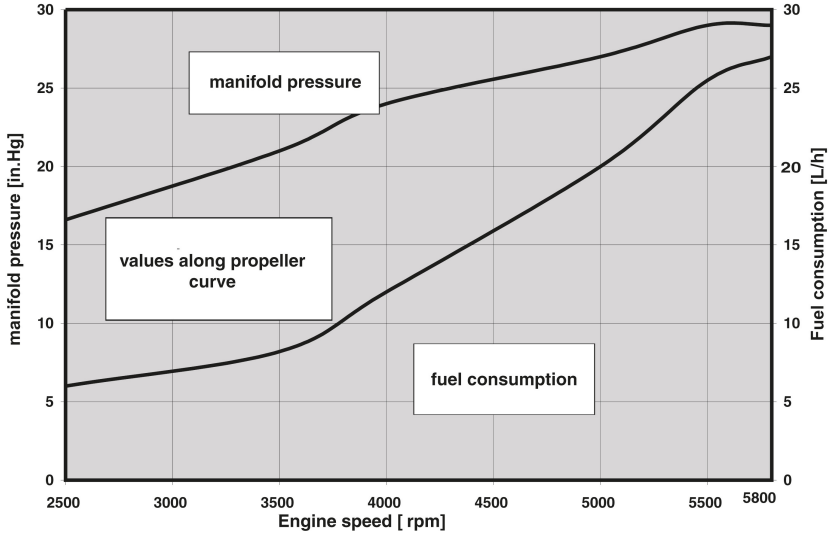


Figure 5: Performance graphs Motor 912 S/ULS

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.

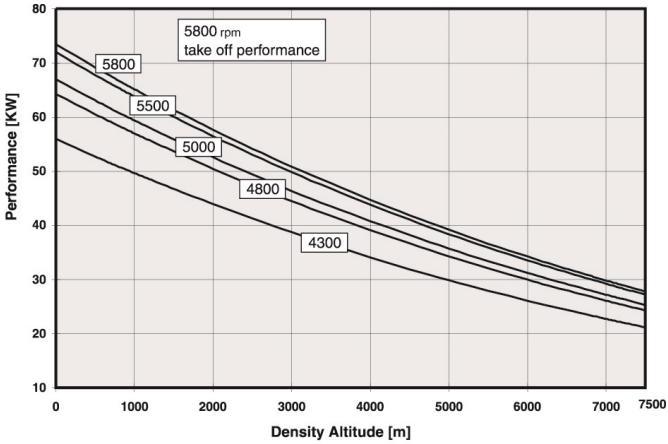
Power setting	Engine speed (rpm)	Perform-ance (kW) / (HP)	Torque (Nm) / (ft. lb)	Manifold pressure (in.Hg)
Take-off power	5800	73.5 / 100	121.0 / 89.24	27.5
Max. contin-uos power	5500	69.0 / 90	119.8 / 88.36	27
75 %	5000	51.0 / 68	97.4 / 71.84	26
65 %	4800	44.6 / 60	88.7 / 65.42	26
55 %	4300	38.0 / 50	84.3 / 62.17	24

NOTE

Further essential information regarding engine behavior see current Service Bulletin SB-912-079.

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.



$$P_{act.} = P_{stand.} \frac{T_{standard}}{T_{actually}}$$

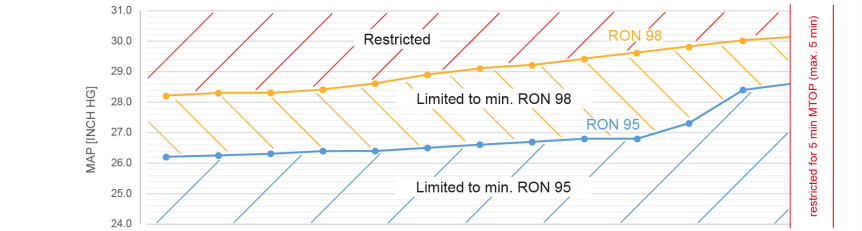
T [K] = t [°C]+273

Figure 6: Performance graph

5.1.1) Power setting

Operator requirements

In case of an aircraft equipped with a MAP gauge by the OEM use the following graph to determine appropriate MAP and RPM settings depending on fuel type to ensure maximum margin/robustness for piston damage/pre-ignitions.



ENGINE SPEED [RPM]	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	5800
PROP SPEED [RPM]	1029	1132	1235	1337	1440	1543	1646	1749	1852	1955	2058	2160	2263	2387
RON 95 [INCH HG]	26.2	26.25	26.3	26.35	26.4	26.5	26.6	26.7	26.8	26.8	27.3	28.4	28.6	-
RON 98 [INCH HG]	28.2	28.25	28.3	28.45	28.6	28.85	29.1	29.2	29.4	29.6	29.8	30.0	30.1	-

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Figure 7

Manifold absolute pressure (MAP) and engine speed settings for ROTAX® 912 S/ULS for fuel type RON 95 and RON 98 [8]

⚠ WARNING

The area above 25.3 inch Hg must be avoided at all times when the carb. heat is on/activated.

The blue and orange lines represent the limits for RON 95 and RON 98 respectively above which piston damage may occur. The areas above the RON 95 inch Hg line and the RON 98 inch Hg line respectively must be avoided at all times. RON 95 and RON 98 lines are valid for manifold air temperature up to max. 50 °C / 122 °F.

For the allowed fuels as per latest Service Instruction (SI)[9] the octane number of the specific fuel dictates which operating limits do apply (RON 95 or RON 98). If mixtures of different fuels

8. for specification of fuel types see Service Instruction SI-912-016.
9. for specification of fuel types see Service Instruction SI-912-016 and current Service Bulletin SB-912–079.

are utilized, refer to the lower octane fuel as reference for selecting the operating limits.

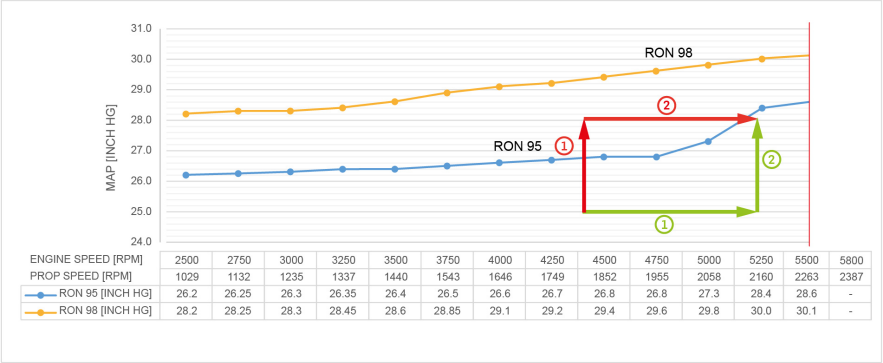
In addition to the manifold absolute pressure and engine/propeller speed limitations, adjustment of the power needs to be performed in a correct way:

- Power increase needs to be led with the propeller control followed by the throttle control as outlined in the table below.

Step	Procedure – Power increase
1	First increase propeller speed (rpm).
2	Then increase MAP with the throttle lever.

NOTICE

Red arrows describe the way it should not be done. Green arrows describe the right way.



ENGINE SPEED [RPM]	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	5800
PROP SPEED [RPM]	1029	1132	1235	1337	1440	1543	1646	1749	1852	1955	2058	2160	2263	2387
RON 95 [INCH HG]	26.2	26.25	26.3	26.35	26.4	26.5	26.6	26.7	26.8	26.8	27.3	28.4	28.6	-
RON 98 [INCH HG]	28.2	28.25	28.3	28.45	28.6	28.85	29.1	29.2	29.4	29.6	29.8	30.0	30.1	-

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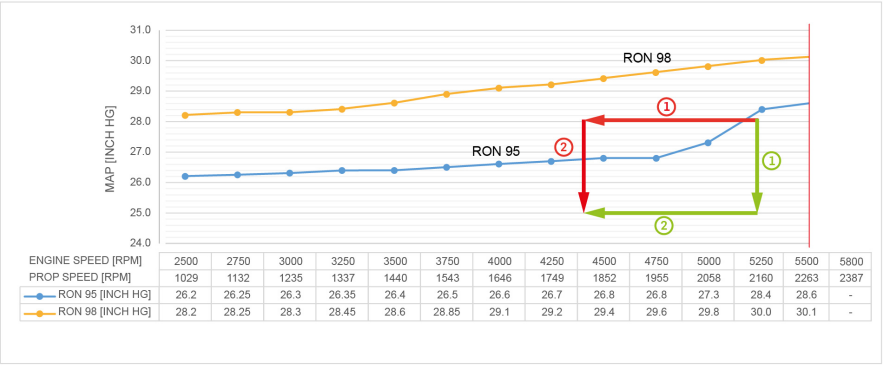
Figure 8: Power increase

- Power reduction needs to be led with the throttle control followed by the propeller control as outlined in the table below.

Step	Procedure – Power reduction
1	First reduce MAP with the throttle.
2	Then decrease propeller speed (rpm).

NOTICE

Red arrows describe the way it should not be done. Green arrows describe the right way.



ENGINE SPEED [RPM]	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	5800
PROP SPEED [RPM]	1029	1132	1235	1337	1440	1543	1646	1749	1852	1955	2058	2160	2263	2387
RON 95 [INCH HG]	26.2	26.25	26.3	26.35	26.4	26.5	26.6	26.7	26.8	26.8	27.3	28.4	28.6	-
RON 98 [INCH HG]	28.2	28.25	28.3	28.45	28.6	28.85	29.1	29.2	29.4	29.6	29.8	30.0	30.1	-

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Figure 9: Power recuction

5.2) Fuel consumption

Fuel consumption	912 A/F/UL	912 S/ULS
At take-off performance	24.0 l/h (6.3 gal/h)	27.0 l/h (7.1 gal/h)
At max. continuous performance	22.6 l/h (5.6 gal/h)	25.0 l/h (6.6 gal/h)
At 75 % continuous performance	16.2 l/h (4.3 gal/h)	18.5 l/h (4.9 gal/h)
Specific consumption at max. continuous performance	285 g/kWh (0.47 lb/hph)	285 g/kWh (0.47 lb/hph)

6) System Description

Topics in this chapter

Introduction

This chapter of the Operators Manual (OM) contains information about the general engine specification as well as a description of cooling system, fuel system, lubrication system, electric system and the propeller gearbox.
The system description refers only to the engine and not to a specific application in a particular aircraft. The aircraft manufacturer's Operators Manual (OM) is therefore definitive in terms of the operation of the engine, as it contains all the aircraft specific instructions.

The design shown in this chapter does not represent a specified execution but should support the understanding of the system.

6.1) General specification

6.1.1) Basic specification

Basic

- 4 stroke, 4 cyl. horizontally opposed, spark ignition engine, single central camshaft hydraulic tappets - push rods - OHV (Over Head Valve)
- Liquid cooled cylinder heads
- Ram air cooled cylinders
- Dry sump forced lubrication
- Dual ignition of breakerless, capacitor discharge design
- 2 constant depression carburetors
- Mechanical fuel pump
- Electric starter (12 V 0.7 kW), 912 S/ULS (12 V 0.9 kW)
- Integrated AC generator with external rectifier regulator
- Propeller drive via integrated gearbox with mechanical shock absorber and overload clutch

NOTE

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

Optional

- Electric starter (12 V 0.9 kW)
- External alternator (12 V 40 A DC)
- Vacuum pump drive
- Hydraulic constant speed propeller governor drive

6.1.2) Technical data

Description	912 A/F/UL	912 S/ULS
Bore	79.5 mm (3.13 in)	84 mm (3.31 in)
Stroke	61 mm (2.40 in)	61 mm (2.40 in)
Displacement	1211 cm³ (73.9 in³)	1352 cm³ (82.5 in³)
Compression ratio.	9.0 : 1	10.8 : 1

6.1.3) Engine components

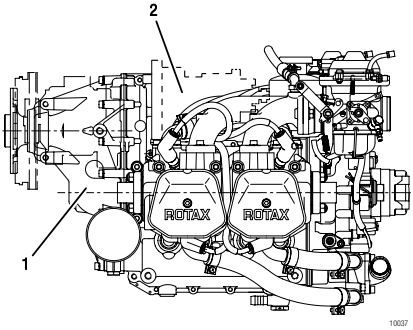


Figure 1: Engine components

1 Propeller gear box

2 Vacuum pump or hydraulic governor for constant speed propeller

6.1.4) Cylinder arrangement

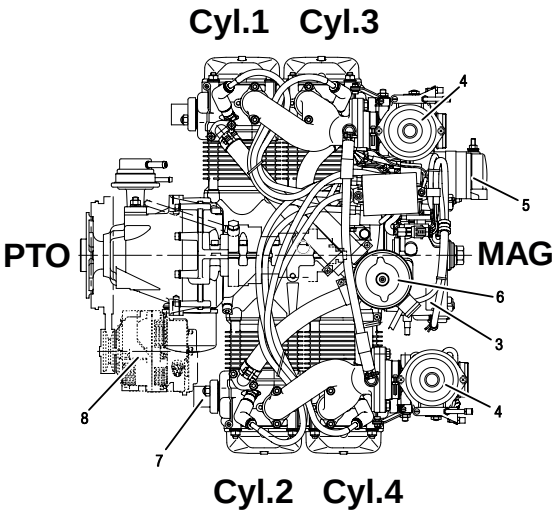


Figure 2: Cylinder arrangement

6.1.5) Direction of rotation

Direction of rotation on propeller shaft: counter clockwise, viewed from the front.

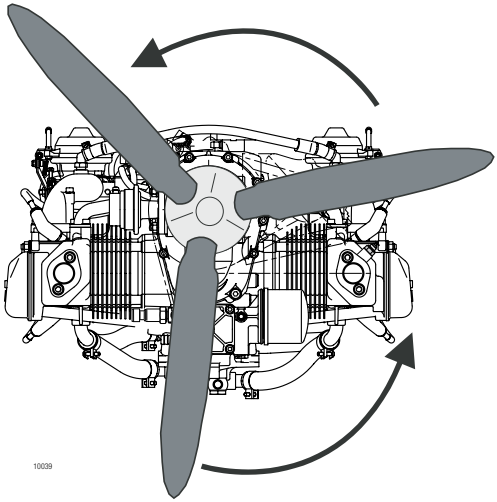


Figure 3: Normal direction of propeller rotation (engine)

6.2) Cooling system

System Overview

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 flow

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. Since the standard location of the radiator is below engine level, the expansion tank located on the top of the engine allows for coolant expansion.

Expansion tank

From the expansion tank the coolant is sucked back to the water pump. In common installations the coolant passes a radiator in between. Additionally the expansion tank is closed by a pressure cap (with excess pressure valve and return valve). At temperature rise of the coolant the excess pressure valve opens and the coolant will escape via hose at atmospheric pressure. In common installation this hose is connected to an overflow bottle. This overflow bottle allows the coolant to be sucked back into the cooling circuit as the engine is cooling down.

NOTE

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

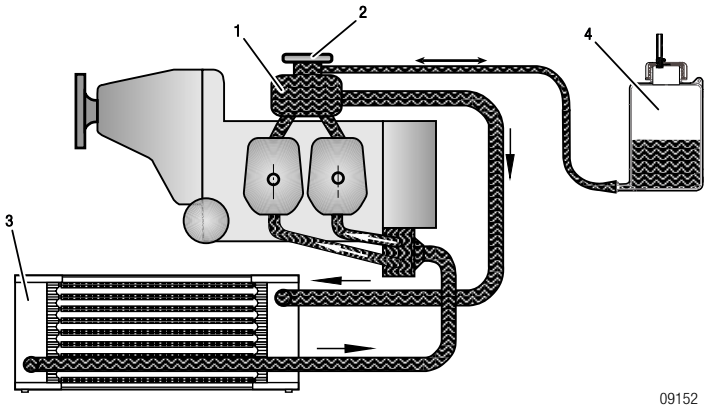


Figure 4: Cooling system (symbolic)

1 Expansion tank
2 Pressure cap
3 Radiator
4 Overflow bottle

6.3) Fuel system

Fuel

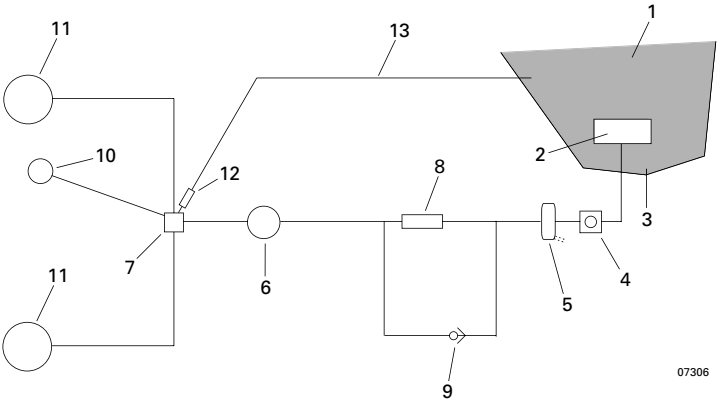
The fuel flows from the tank via a coarse filter the fuel shut-off valve and fine filter to the mechanical fuel pump. From the pump fuel passes on via the fuel manifold to the two carburetors.

Return line

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

NOTE

The return line serves to avoid formation of vapor lock.



1	*Fuel tank*	*2*	*Coarse filter*
3	*Drain valve*	*4*	*Fuel shut-off valve*
5	*Fine filter/water trap*	*6*	*Mechanical fuel pump (standard configuration)*
7	*Fuel manifold (not standard configuration)*	*8*	*Electrical fuel pump*
9	*1x check valve*	*10*	*Fuel pressure gauge*
11	*Carburetor*	*12*	*Restrictor jet*
13	*Return line from engine to tank*		

Figure 5: Fuel system

6.4) Lubrication system

The engines is provided with a dry sump forced lubrication system with a main oil pump with integrated pressure regulator. The airframe manufacturer is responsible for the main layout and the component selection for the lubrication system.

Lubrication

The main oil pump sucks the motor oil from the oil tank via oil radiator and forces it through the oil filter to the points of lubrication.

NOTE

The oil radiator is optional.

Crankcase

The surplus of 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 circuit vented

The oil circuit is vented via bore on the oil tank.

Oil temperature sensor

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

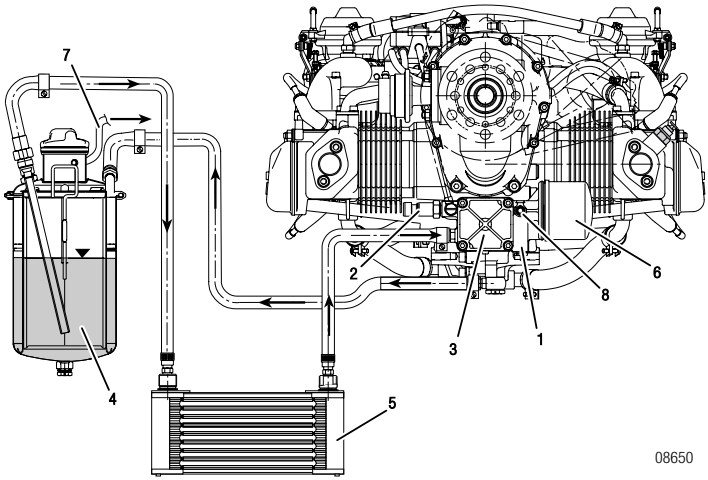


Figure 6: Lubrication system

1	*Pressure regulator*	*2*	*Oil pressure sensor*
3	*Oil pump*	*4*	*Oil tank*
5	*Oil radiator*	*6*	*Oil filter*
7	*Venting tube*	*8*	*Oil temperature sensor (oil)*

6.5) Electric system

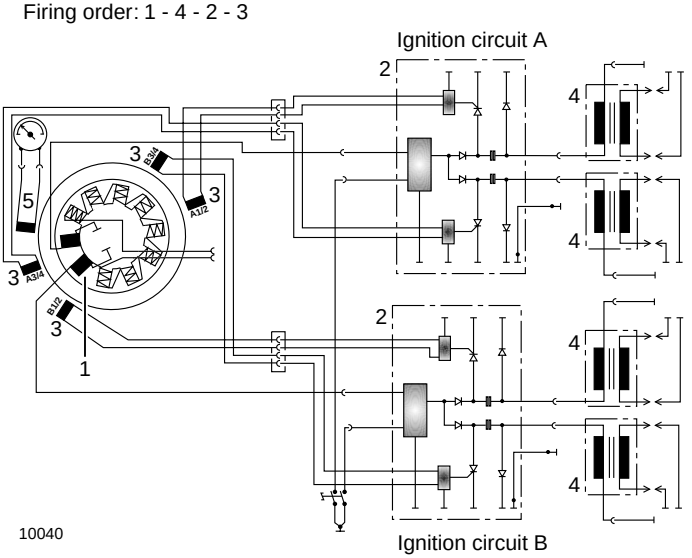
The ROTAX® 912 engine is equipped with a dual ignition unit of a breakeless, capacitor discharge design, with an integrated generator.
The ignition unit needs no external power supply.

Charging coils

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

NOTE

An additional trigger coil is provided for rev counter signal.



1	*Charging coils*	*2*	*Electronic modules*
3	*Trigger coils for ignition signal*	*4*	*Dual ignition coils*
5	*Trigger coil for speed signal*		

Figure 7: Ignition circuit

6.6) Propeller gearbox

Reduction ratio

For this engine one reduction ratio is available.

Reduction ratio	912 A/F/UL	912 S/ULS
crankshaft: propeller shaft	2.27:1	2.43:1
	2.43:1 (option)	

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.

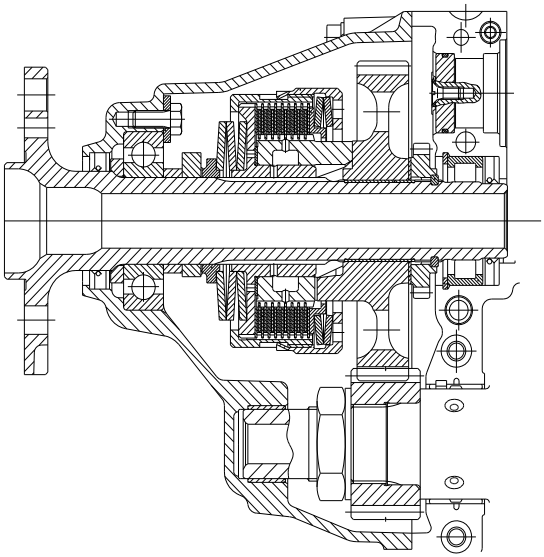


Figure 8: Overload clutch

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.

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 due to the built-in overload clutch it will remain harmless.

NOTE

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

See Service Letter SL-912-015

Vacuum pump or hydraulic governor

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.

6.7) Ignition system

Background information

The ROTAX® engines of 912 Series are equipped with a breakerless dual ignition system (DCDIDual Capacitor Discharge Ignition).

The ignition unit needs no external power supply. Each of the two independent charging coils located on the generator stator supplies one of two ignition circuits. The energy is stored in capacitors of the SMD-electronic modules. At the moment of ignition, 2 each of the 4 external trigger coils actuate the discharge of the capacitors via the primary circuit of the double ignition coil assy.

Additionally, an Advanced Start Module (ASM) System has been introduced with ignition module 966727 and later and flywheel hub 966872 and later. The Advanced Start Module System enables the optional easy-start function. In order to use the easy-start function the relevant connections to the starter relay (1) and ignition switch (2) need to be made.

The system is designed so that the ignition timing is automatically set to 3° after the piston's top dead center (ATDC) during engine start-up between 650 to 1000 engine RPM. Consequently the ignition timing is automatically changed to 26° before the piston's top dead center above the 650 to 1000 engine RPM.

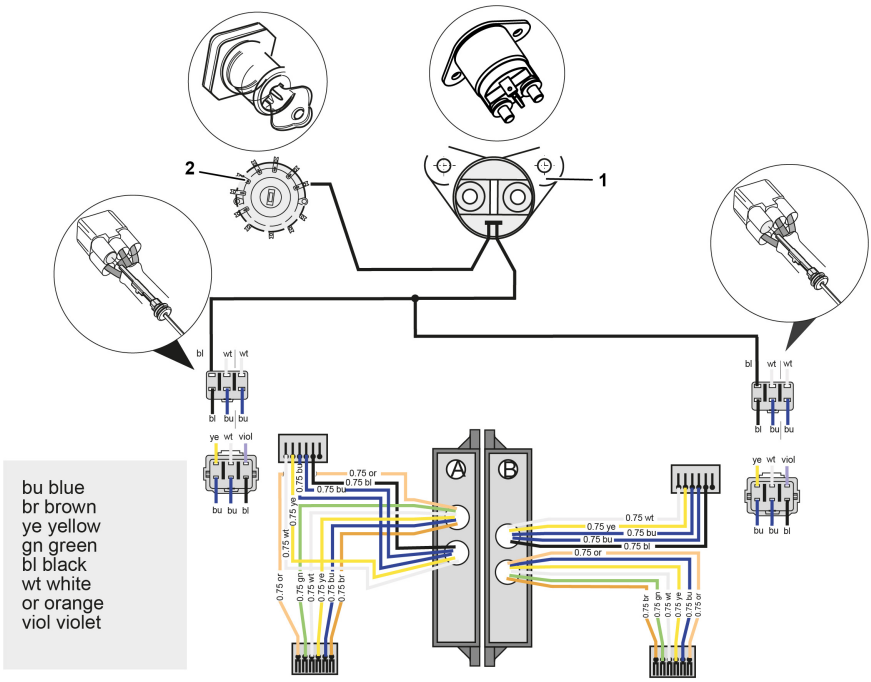


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Figure 9

1 starter relay *2 ignition switch*

For more detailed information about the Advanced Start Module (ASM) see current SI-912-028.

Respecting the limits below the ignition system is essentially single fault tolerant:

- High temperatures in the engine compartment.

The trigger coils and the electronic modules must not exceed component temperatures higher than 80 °C (176 °F) - see applicable Installation Manual (IM), Chapter 24-00-00, page 9.

- Gap of trigger coils.

Due to the operating principle of the ignition system the gap of the trigger coil has to be within limits - see latest Maintenance Manual Heavy (MMH), Chapter 24-20-00, page 16.

Intentional activation of the easy-start function is only possible when a minimum voltage of 2.8 V is applied at the advanced start terminals and they must therefore be grounded when not intended to be activated. See also Chapter 4.12

6.8) Intake Air System

General

The air intake system is determined essentially by the demands of engine and of the acceptable noise emission on the intake side. An airbox can be supplied by ROTAX® as an option.

NOTE

Non-approved modification of Genuine ROTAX® airbox components can lead to negative effects on engine operation like vibrations and power losses (see as well Chapter 6.3).
Low (cold) air temperature in the airbox is favorable for engine performance and reduces piston damage / pre-ignition and/or detonation tendency at combustion. Hot air conditions favor piston damage / pre-ignition and/or detonation effects.

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7) Preservation and storage

Topics in this chapter

Safety

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

As well as the maintenance and special checks, see latest Maintenance Manual Line (MML) for the respective engine type.

⚠ 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.

NOTE

Other useful information for service and airworthiness of your engine you'll find on www.FLYROTAX.com.

NOTICE

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

7.1) Engine preservation and storage

General

Environmental corrosion (on the external surfaces) is a naturally occurring process which can inevitably affect the continued airworthiness of the engine, engine mounted components and accessories. Susceptibility to corrosion is influenced by a number of factors, including but not limited to, geographical location, season and usage. All general preventive (technical) measures, identification, control and treatment of corrosive attack on aircraft structures and engine materials has to be carried out in accordance with Advisory Circular AC 43-4B from FAA and also in accordance with the information of the aircraft manufacturer´s Instruction for Continued Airworthiness. Furthermore the preservation procedures for stored and inactive aircraft (engines) provides an effective means for combating and minimizing the corrosion condition and should be adhered to.

Advisory Circular AC 43-4B

This advisory circular (AC) is a summary of the current available data regarding identification and treatment of corrosive attack on aircraft structures and engine materials. Corrosion inspection frequency, corrosion identification, and especially corrosion treatment continues to be the responsibility of the operator. These inspections should be accomplished per this AC, the manufacturer´s recommendations, or the operator's own maintenance program. The procedures in this AC are an acceptable means, but not the only acceptable means, of corrosion treatment. The information in this AC is applicable to aircraft for which the manufacturer has not published corrosion control information.

⚠ WARNING

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

Due to the special material of the cylinder wall, there is no need for extra protection against corrosion for ROTAX® aircraft engines. At extreme climatic conditions and/or 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	Shut-off engine.
3	Allow the engine to cool down.

Step	Procedure
4	Change oil.
5	Remove the top spark plugs and spray into openings with corrosion inhibiting oil.
6	Turn the propeller several times by hand in direction of the engine rotation, so that the corrosion inhibiting oil reaches all necessary points.
7	Install the spark plugs in accordance to the Maintenance Manual.
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.
10	Drain carburetor float chambers.

7.2) 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.

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8) Supplement

Topics in this chapter

According to the regulation of EASA part 21.A.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, a Customer Service Information Report (CSIR) should be filled out and sent to the responsible ROTAX® authorized aircraft engines distributor or their independent Service Center.

Authorized Distributor

Overview of ROTAX® authorized aircraft engines distributor or their independent Service Center.
Refer to the official ROTAX® AIRCRAFT ENGINES Website www.FLYROTAX.com.

8.1) Customer Service Information Report (CSIR)

Online CSIR

In case of any relevant occurrences that may involve malfunction of the engine, click here to fill out a Customer Service Information Report (CSIR):
www.flyrotax.com/p/service/customer-service-information-report

NOTE

This is valid for all ROTAX® Aircraft engines types (certified – according to the regulation of EASA part 21A.3 / FAR 21.3) and non-certified – ASTM compliant, etc.

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ROTAX®

Engine serial no.

Type of aircraft

Aircraft registration no.

Rotax® authorized distributor

FLYROTAX.COM

A BRP BRAND