



# MAINTENANCE MANUAL

(LINE MAINTENANCE) FOR ROTAX® ENGINE TYPE 912 SERIES

Ref. No.: MML-912



ROTAX® 912 ULS 3 WITH OPTIONS

part no.: 899735

### **⚠** WARNING

Before starting any maintenance work, please read the Maintenance Manual, as it contains important safety relevant onformation. Failure to do so may result in personal injuries including death. Consult the original equipment manufacturer's handbook for additional instructions!

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Other product names in this documentation are used purely for ease of identification and may be trademarks of the respective company or owner.

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

MAINTENANCE MANUAL

# Chapter: INTRO GENERAL NOTE

#### **Foreword**

Before carrying out maintenance work on the engine, read the Maintenance Manual (Line Maintenance) carefully.

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

#### **Chapter structure**

The structure of the Manual follows whenever it is applicable the structure of the ATA (Air Transport Association) standards. The Maintenance 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 00-00-00
Maintenance	Chapter 05-00-00
Time limits	Chapter 05-10-00
Scheduled maintenance checks	Chapter 05-20-00
Unscheduled maintenance checks	Chapter 05-50-00
Maintenance of the systems	Chapter 12-00-00
Replenishing operating fluids	Chapter 12-10-00
Scheduled maintenance	Chapter 12-20-00

MAINTENANCE MANUAL

**NOTES** 

#### MAINTENANCE MANUAL

# Chapter: LEP LIST OF EFFECTIVE PAGES

chapter	page	date	
INTRO	Title page 1 2	10 01 2009 10 01 2009	
LEP	1 2	10 01 2009 10 01 2009	
TOA	1 2	10 01 2009 10 01 2009	
00-00-00	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	10 01 2009 10 01 2009	
05-00-00	1 2 3 4 5 6 7 8 9	10 01 2009 10 01 2009	
05-10-00	1 2 3 4 5 6 7 8	10 01 2009 10 01 2009	

chapter	page	date
05-20-00	1	10 01 2009
	2	10 01 2009
	3	10 01 2009
	4	10 01 2009
	5	10 01 2009
	6	10 01 2009
	7	10 01 2009
	8	10 01 2009
	9	10 01 2009
	10	10 01 2009 10 01 2009
	11 12	10 01 2009
	13	10 01 2009
	14	10 01 2009
	15	10 01 2009
	16	10 01 2009
	17	10 01 2009
	18	10 01 2009
05-50-00	1	10 01 2009
	2	10 01 2009
	3	10 01 2009
	4	10 01 2009
	5	10 01 2009
	6	10 01 2009
	7	10 01 2009
	8	10 01 2009
	9	10 01 2009
	10	10 01 2009
	11	10 01 2009
	12	10 01 2009
	13	10 01 2009
	14	10 01 2009
	15	10 01 2009
	16	10 01 2009
	17 18	10 01 2009 10 01 2009
	19	10 01 2009
	20	10 01 2009
	21	10 01 2009
	22	10 01 2009
	23	10 01 2009
	24	10 01 2009
12-00-00	1	10 01 2009
	2	10 01 2009

Effectivity: 912 Series Edition 2 / Rev. 0

LEP

### MAINTENANCE MANUAL

chapter	page	date
12-10-00	1	10 01 2009
	2	10 01 2009
	3	10 01 2009
	4 5	10 01 2009 10 01 2009
	6	10 01 2009
	7	10 01 2009
	8	10 01 2009
	9	10 01 2009
	10	10 01 2009
12-20-00	1	10 01 2009
	2	10 01 2009 10 01 2009
	4	10 01 2009
	5	10 01 2009
	6	10 01 2009
	7	10 01 2009
	8	10 01 2009
	9 10	10 01 2009 10 01 2009
	10	10 01 2009
	12	10 01 2009
	13	10 01 2009
	14	10 01 2009
	15	10 01 2009
	16	10 01 2009
	17 18	10 01 2009 10 01 2009
	19	10 01 2009
	20	10 01 2009
	21	10 01 2009
	22	10 01 2009
	23	10 01 2009
	24	10 01 2009
	25 26	10 01 2009 10 01 2009
	27	10 01 2009
	28	10 01 2009
	29	10 01 2009
	30	10 01 2009
	31	10 01 2009
	32	10 01 2009
	33 34	10 01 2009 10 01 2009
	35	10 01 2009
	33	10 01 2000

chapter	page	date	
	36	10 01 2009	
	37	10 01 2009	
	38	10 01 2009	
	39	10 01 2009	
	40	10 01 2009	
	41	10 01 2009	
	42	10 01 2009	
	43	10 01 2009	
	44	10 01 2009	
	45	10 01 2009	
	46	10 01 2009	
	47	10 01 2009	
	48	10 01 2009	
	49	10 01 2009	
	50	10 01 2009	
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	58	10 01 2009	
	59	10 01 2009	
	60	10 01 2009	
	61	10 01 2009	
	62	10 01 2009	
	63	10 01 2009	
	64	10 01 2009	
	65	10 01 2009	
	66	10 01 2009	
	67	10 01 2009	
	68	10 01 2009	
	69	10 01 2009	
	70 Rear page	10 01 2009	
	riear page		



MAINTENANCE MANUAL

# Chapter: TOA TABLE OF AMENDMENTS

# \*Approval

The technical content is approved under the authority of DOA Nr. EASA.21J.048.

no.	chapter	page	date of change	remark for approval	date of ap- proval from authorities	date of issue	signature
0	INTRO	all	10 01 2009	DOA*			
0	LEP	all	10 01 2009	DOA*			
0	TOA	all	10 01 2009	DOA*			
0	00-00-00	all	10 01 2009	DOA*			
0	05-00-00	all	10 01 2009	DOA*			
0	05-10-00	all	10 01 2009	DOA*			
0	05-20-00	all	10 01 2009	DOA*			
0	05-50-00	all	10 01 2009	DOA*			
0	12-00-00	all	10 01 2009	DOA*			
0	12-10-00	all	10 01 2009	DOA*			
0	12-20-00	all	10 01 2009	DOA*			

MAINTENANCE MANUAL

**NOTES** 

MAINTENANCE MANUAL

Chapter: 00-00-00

GENERAL NOTE

Introduction

This section describes this maintenance of engine type ROTAX 912

Series.

NOTES: The ROTAX 912 Series includes all engines such as the

912 A, 912 F, 912 S, 912 UL, 912 ULS and 912 ULSFR.

**Table of contents** 

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

Subject	Page
General note	page 3
Abbreviations and terms used in this Manual	page 5
Conversion table	page 7
Safety notice	page 9
Safety information	page 10
Instruction	page 12
Maintenance Concept	page 13
Technical documentation	page 14
Use for intended purpose	page 16

MAINTENANCE MANUAL

**NOTES** 

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# 1) General note

#### **Purpose**

The purpose of this Maintenance Manual is to acquaint maintenance service staff approved by the local aviation authorities with some basic maintenance and safety information for service work.

#### **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.

#### ROTAX Distributors

ROTAX Authorized Distributors for Aircraft Engines.

See latest Operators Manual or on the Internet at the official Homepage www.rotax-aircraft-engines.com.

# 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 number (1) is on the ignition cover, on the left, opposite the electric starter. See Fig. 1.

Cyl. 1 Cyl. 3

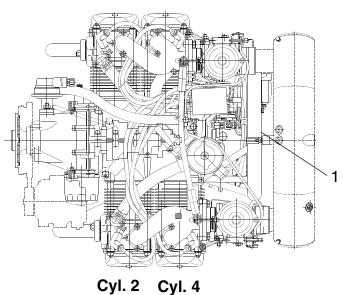


Fig. 1

MAINTENANCE MANUAL

**NOTES** 

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#### MAINTENANCE MANUAL

# 2) Abbreviations and terms used in this Manual

### **Abbreviations**

Abbreviation	Description
*	Reference to another section
•	center of gravity
0	The drop symbol indicates use of sealing agents, adhesives or lubricants. (only in the Illustrated Parts Catalog)
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
rpm	Revolutions per minute
912 A	see OM (Type designation)
912 F	see OM (Type designation)
912 S	see OM (Type designation)
912 UL	see OM (Type designation)
912 ULS	see OM (Type designation)
912 ULSFR	912 ULS Version France
914 F	see OM (Type designation)
914 UL	see OM (Type designation)
Α	Ampere
A/C	Aircraft
A/F	Across-flat dimension
ASB	Alert Service Bulletin
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
CW	Clockwise
CCW	Counter-clockwise
DCDI	Dual Capacitor Discharge Ignition
DOT	Department of Transport
DOA	Design Organisation Approval
EASA	European Aviation Safety Agency
IM	Installation Manual
ECU	Engine Control Unit
EGT	Exhaust Gas Temperature
INTRO	Introduction
EMS	Engine Management System

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Effectivity: 912 Series Edition 2 / Rev. 0

00-00-00

#### MAINTENANCE MANUAL

Abbreviation	Description
EN	European Norm
IPC	Illustrated Parts Catalog
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
ОМ	Overhaul Manual
hr.	hours
ОМ	Operators Manual
TOC	Table of Contents
ISA	International Standard Atmosphere
kg	kilograms
AD	Airworthiness Directive
MS	magneto side
MON	motor octane number
N	new part (only Illustrated Parts Catalog)
nB	as necessary (only Illustrated Parts Catalog)
n.a.	not available
NDT	non-destructive testing
Nm	newton meter
PSU	power supply unit
Rev.	Revision
ROTAX	is a trade mark of BRP-Powertrain GmbH & Co KG
RON	Research Octane Number
RV	Record of Revisions
S.V.	still valid (only IPC)
S/N	Serial Number
SB	Service Bulletin
SI	Service Instruction
SL	Service Letter
SMD	Surface Mounted Devices
part no.	Part number
TSN	Time Since New
TSO	Time Since Overhaul
V	Volt
VFR	Visual Flight Rules
LEP	List of Effective Pages
MM	Maintenance Manual
XXX	shows the serial component number

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#### MAINTENANCE MANUAL

# 2.1) Conversion table

Units of length:	Units of power:				
1 mm = 0.03937 in	1 kW = 1.341 hp				
1 in = 25,4 mm	1 hp = $0,7457 \text{ kW}$				
1 ft = 12 in	1 kW = 1,3596 PS				
= 0,3048 m	1 PS = 0,7355 kW				
Units of area:	Units of temperature:				
$1 \text{ cm}^2 = 0.155 \text{ sq in (in}^2)$	K = °C - 273,15				
1 sq in (in <sup>2</sup> ) = 6,4516 cm <sup>2</sup>	°C = (°F - 32) / 1,8				
	°F = (°C x 1,8) + 32				
Units of volume:	Units of velocity:				
$1 \text{ cm}^3 = 0.06102 \text{ cu in (in}^3)$	1 m/s = $3.6 \text{ km/h}$				
1 cu in $(in^3)$ = 16,3871 cm <sup>3</sup> $(in^3)$	1 ft/min = 0,3048 m/min				
1 dm <sup>3</sup> = 1 l	= 0,00508 m/sec				
$1 \text{ dm}^3 = 0.21997 \text{ gal (UK)}$	1 m/s = 196.85 ft/min				
1 gal (UK) = 4,5461 dm <sup>3</sup>	1 kt = 1,852 km/h				
1 dm <sup>3</sup> = 0.26417 gal (US)	1 km/h = 0,53996 kn				
1 gal (US) = 3,7854 dm <sup>3</sup>					
Units of mass:	spec. fuel consumption:				
1 kg = 2.2046 lb	1 g/kWh = $0.001644$ lb/hph				
1 lb = 0,45359 kg	1 lb/hph = 608,277 g/kWh				
Density:	Units of torque:				
$1 \text{ g/cm}^3 = 0.016018 \text{ lb/ft}^3$	1 Nm = 0.737 ft lb				
1 lb/ft <sup>3</sup> = 62,43 g/cm <sup>3</sup>	= 8.848 in lb				
	1 ft lb = 1.356 Nm				
	1 in lb = 0.113 Nm				
Units of force:	Cable cross-section:				
1 N = 0.224809 lbf	Conversion table - Wire Gauge:				
1 lbf = 4.4482 N	AWG-mm <sup>2</sup>				
Units of pressure:	<u> </u>				
$1 \text{ Pa} = 1 \text{N/m}^2$	AWG 4 6 8 10 12 14 16 18 20				
1 bar = 100 000 Pa (1000 hPa)	mm <sup>2</sup> 21 13 8,4 5,3 3,3 2,1 1,3 0,8 0,52				
1 bar = $14.5037  \text{lbf/in}^2  (\text{psi})$					
1 lbf/in <sup>2</sup> (psi) = 0,0689 bar					
1 in Hg = 33.8638 hPa					
<b>y</b>					

MAINTENANCE MANUAL

**NOTES** 

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#### MAINTENANCE MANUAL

# 3) Safety notice

#### **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.

#### Symbols used

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



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



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



Denotes an instruction which, if not followed, may severely damage the engine or other component.

#### NOTES:

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

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

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#### MAINTENANCE MANUAL

# 3.1) Safety notice

#### General note

This information relates to the preparation and use of ROTAX aircraft engines and has been utilized safely and effectively by BRP-Powertrain. However, BRP-Powertrain disclaims liability for all damage and/or injuries resulting from the improper use of the contents. BRP-Powertrain strongly recommend that any service be carried out and/or verified by a highly skilled professional mechanic See chap. 05-00-00 section 1.2)

#### Manual

This Manual has been prepared as a guide to correctly service and maintain all ROTAX 912 aircraft engines.

This edition was primarily published to be used by aircraft mechanics who are already familiar with all service procedures relating to ROTAX aircraft engines.

This Manual uses technical terms which may be slightly different from the ones used in the Illustrated Parts Catalog.

It is understood that this Manual may be translated into another language. In the event of any discrepancy the German version prevails.

#### Warning

It is your responsibility to be completely familiar with the safety instructions including warnings and cautions described in this Manual. These warnings and cautions advise of specific operating and servicing methods that, if not observed, can cause a serious engine malfunction or cause the engine to lose power in flight which can result in loss of life, injury or damage to equipment.

It is, however, important to understand that these warnings and cautions are not exhaustive. BRP-Powertrain could not possibly know, evaluate and advise the user of all conceivable ways in which service might be done or of the possible hazardous consequences of each way.

# Safety instruction

In addition to observing the instructions in our Manual, general safety and accident preventative measures, legal regulations and regulations of any aeronautical authority must be observed.

Where differences exist between this Manual and regulations provided by any authority, the more stringent regulation should be applied.

#### Illustration

The content depicts parts and/or procedures applicable to the particular product at its time of manufacture. It does not include dealer modifications, whether authorized or not by BRP-Powertrain, after manufacturing the product.

Effectivity: 912 Series Edition 2 / Rev. 0

00-00-00

#### MAINTENANCE MANUAL

**Locking devices** 

Locking devices (e.g. locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be replaced.

Torque wrench tightening



If not specified otherwise, the threads are not lubricated when fastened.

Torque wrench tightening specifications must be strictly adhered to.

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#### MAINTENANCE MANUAL

# 3.2) Instruction

#### General note

Engines require instructions regarding their application, use, operation, maintenance and repair.

Technical documentation and directions are useful and necessary complementary elements for personal instruction, but can by no means substitute theoretical and practical instructions.

These instructions should cover explanation of the technical context, advice for operation, maintenance, use and operational safety of the engine.

#### Safety notice

In this technical Manual passages concerning safety are especially marked. Pass on safety warnings to other users!

#### **Accessories**

This engine must only be operated with accessories supplied, recommended and released by BRP-Powertrain. Modifications are only allowed after consent by the engine manufacturer.

#### Spare parts

#### NOTICE

Spare parts must meet with the requirements defined by the engine manufacturer. This is only warranted by use of GENUINE ROTAX spare parts and/or accessories (see IPC) or suitable equivalent in the manufacturer's opinion otherwise, any limited warranty by BRP-Powertrain is null and void (see Warranty Conditions). Spare parts are available at the authorized ROTAX Distribution- and Service Center.

Any warranty by BRP-Powertrain becomes null and void if spare parts and or accessories other than GENUINE ROTAX spare parts and/or accessories are used (see latest Warranty Conditions).

#### Tools

#### NOTICE

In principle use only tools and appliances which are either cited in the Manual or in the Illustrated Parts Catalog.

#### Standstill

After engine standstill (longer than 2 months) observe without fail the instructions for engine "out of use". Protect fuel- and carburetor system against contamination.

#### Returning

When returning the engine or its components (e.g. propeller gearbox) to an authorized overhaul or repair company, ensure that the necessary documentation (log book, maintenance records etc.) are enclosed.

Effectivity: 912 Series Edition 2 / Rev. 0

00-00-00

#### MAINTENANCE MANUAL

# 3.3) Maintenance Concept

#### **General** note

The maintenance functions detailed in this Manual fall into two categories:

- Maintenance I (Line Maintenance)
- Maintenance II (Heavy Maintenance)

Repairs beyond the levels detailed in this Manual are not recommended as maintenance functions and must be done by an authorized overhaul facility.

### Maintenance I (Line Maintenance)

# Chapter 00,05 and 12

The scope of line maintenance consists of removal, installation and adjustment of engine components (including part wear). All procedures in this Manual are to be considered line maintenance.

NOTES: Where applicable, you will be referred to the Heavy Main-

tenance Manual for work above and beyond line mainten-

nace.

# Maintenance II (Heavy Maintenance)

#### separate Manual

Maintenance Manual II details removal, installation and repair of components or parts normally considered beyond the capabilities of the "Line Maintenance".

NOTES: This Manual can **only** be used in combination with Main-

tenance Manual I (Line Maintenance), as it builds up on it.

#### MAINTENANCE MANUAL

# 3.4) 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 Bulletin
- Service Bulletin
- Service Instruction
- Service Letter

#### **Status**

The status of the 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-WebSite: <a href="https://www.rotax-aircraft-engines.com">www.rotax-aircraft-engines.com</a>. 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 chapter LEP. The particular edition and revision number is given on the footer of each page.

Amendments and current versions can be downloaded free of charge.

#### Reference

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

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#### MAINTENANCE MANUAL

#### Illustrations

The illustrations in this Manual are mere sketches and show a typical arrangement. They may not represent in full detail or the exact shape of the parts which have the same or similar function. Therefore deduction of dimensions or other details from illustrations is not permitted.

NOTES:

The Illustrations and Documents in this Manual are stored in a document data file/graphic data file and are provided with a consecutive irrelevant number.

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

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#### MAINTENANCE MANUAL

# 3.5) Use for intended purpose

#### General note

**△** WARNING

Explosion hazard.

Bursting off parts can cause serious injuries. Never run the engine without propeller.

Use

The engine ROTAX 912 A/F/S is intended for use in certified aircraft. In case of doubt the regulations of the national authorities or the respective sportive federations have to be observed.

**Certified engine** 

Certified aircraft engine ROTAX 912 A/F/S is tested as per aeronautical standards for safety and time between overhaul. It was developed to conform to the latest technological standards and rigorously tested.

Non certified engine

Engine ROTAX 912 UL/ULS/ULSFR is not certified. These engines have not received any aeronautical standards or regulatory safety or durability testing, and conform to no aircraft standards. These engines are for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety.

NOTES:

These engines are technically equivalent to certified engines and have been manufactured by BRP-Powertrain using the same quality assurance system.

Engine stoppage The operator assumes all risk of use, and acknowledges by this use that he/she knows this engine is subject to sudden stoppage.

Maintenance and repair conditions Use for intended purpose also includes observation of the operational, maintenance and repair conditions prescribed by the manufacturer. This is a crucial factor concerning the reliability of the engine and can increase the durability of the engine.

MAINTENANCE MANUAL

Chapter: 05-00-00 MAINTENANCE

#### Introduction

The information given in the Maintenance Manual is based on data and experience which are considered to be applicable for a skilled aviation mechanic under normal working conditions

#### **Table of contents**

In this chapter the maintenance of engine ROTAX 912 Series is described. The description is subdivided into sections and description of function of the various systems. Some overlapping maintenance instructions are treated as generally valid information at the beginning of this section.

Subject	Page
Maintenance	page 3
General note	page 3
Authorized personnel	page 4
Procedure notes	page 5
Trouble shooting	page 6
Consumable materials	page 7
Acceptable methods	page 10

MAINTENANCE MANUAL

**NOTES** 

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# 1) Maintenance

### 1.1) General note

#### Safety notice



Non-compliance can result in serious injuries or death! Besides our instructions in the documentation supplied, also respect the generally valid safety and accident preventive directives and legal regulations.

# Procedures and limits

The procedures and limits in this Manual constitute the manufacturers official recommendation for engine maintenance and operation.

#### Instruction

The guidelines given in the Maintenance Manual are useful and necessary supplements to training. They, however, cannot substitute competent theoretical and practical personal instruction.

#### **Modifications**

Non-authorized modifications as well as the use of components and auxiliary components not corresponding to the installation instructions exclude any liability of the engine manufacturer.

# Parts and accessories

We particularly emphasize that parts and accessories not supplied as genuine BRP-Powertrain parts are not verified for suitability by BRP-Powertrain and thus are not authorized for use. Installation and/or use of such products may possibly change or negatively influence the constructive characteristics of the engine. For damages resulting from use of non-genuine parts and accessories manufacturer refuses any liability.

#### Special tools

Maintenance of engines and systems requires special knowledge and special tools. Use only the special tools recommended by BRP-Power-train when disassembling and assembling the engine.

#### MAINTENANCE MANUAL

# 1.2) Authorized personnel

#### General note

It is a requirement that all organizations or individuals possess the required special tooling, training or experience to perform all tasks outlined.

# Type-specific training

Any task outlined herein may be performed if the organization or individual has met the following conditions:

#### Requisite knowledge of the task as a result of:

- Type-specific training (for the applicable ROTAX aircraft engine) which is approved by the national aviation authority and/or BRP-Powertrain.

#### or

- Experience in performing the task and
- Formal instruction from a BRP-Powertrain authorized training facility or
- "On-the-job" instruction by a BRP-Powertrain or authorized BRP-Powertrain Distributor representative.

### Including:

- Suitable work environment to prevent contamination or damage to engine parts or modules.
- Suitable tools and fixtures as outlined in the ROTAX Maintenance Manual.
- Reasonable and prudent maintenance practices are utilized.
- And the Requirements of the applicable regulatory authority regarding maintenance procedures are met.

#### Information

Maintenance organizations and individuals are encouraged to contact BRP-Powertrain through its worldwide distribution network for information and guidance on any of the tasks outlined herein.

See chap. 00-00-00 section: 3.4).

#### MAINTENANCE MANUAL

# 1.3) Procedure notes

#### General note

**△WARNING** 

Non-compliance can result in serious injuries or death! When carrying out maintenance and service work, respect without fail the safety regulations.

#### Ignition "OFF"



Non-compliance can result in serious injuries or death! This precautionary measure serves to avoid any injuries in case of an unintentional start of the engine. Principally ensure the following at **each maintenance event** 

- Ignition "OFF" and system grounded,
- Disconnect battery and secure engine against unintentional operation.

#### **Ignition "ON"**



Risk of electric shock!

The ignition is **switched on**, as long as the ground-cable (P lead) is not properly connected to ground.

At maintenance work which requires ignition "ON" and battery connected, take care of the following:

- Secure the propeller against unintentional turning by hand and
- secure and observe propeller zone

# Handling of operating fluids



Failure to comply with this instruction may cause severe burns or scalding!

Hot engine parts!

Allways allow the engine to cool down to ambient temperature before starting work.

At maintenance of cooling-, lubricating and fuel system take care without fail that no contamination, metal chips, foreign material and/or dirt enters the system.

### Disassembly

At disassembly of the engine, mark the components as necessary to avoid any mix-up. Take care of these marks, don't ruin them.

#### MAINTENANCE MANUAL

Tool In order to avoid mechanical damages, never loosen NOTICE or tighten screws and nuts with pliers but only with the specified tools. Safety wiring If during disassembling/reassembling the removal of a **NOTICE** safety item (e.g. safety wiring, self-locking fastener, etc.) should be necessary, it must be always replaced by a new one. Cleaning of All metall and synthetic parts are generally washed **NOTICE** parts with suitable cleaning agents. Before using new and unknown cleaning agents check the compatibility of materials. Before re-using disassembled parts, clean, check and refit them as per Removed parts instructions. Use clean screws and nuts only and inspect face of nuts and thread for damage. Check the contact faces and threads for damages. In case of doubt, use new screws and nuts. Nuts

Once loosened, **always** replace self-securing nuts.

Sealing rings, O-rings

At reassembly of the engine, replace all sealing rings, gaskets, securing elements, O-rings and oil seals.

Re-assembly

Before re-assembly check components whether parts are missing. Only use adhesives, lubricants, cleaning agents and solvents indicated in the maintenance instructions. If not respected, damage may be the consequence.

#### Trouble shooting 1.4)

#### General notes

In the Operators Manual, possible problems are listed. At the same time, a brief description of the necessary remedial action is given.

See chapter 12 in the Operators Manual for engine type 912 (Series).

Effectivity: 912 Series Edition 2 / Rev. 0

05-00-0

# 1.5) Consumable Materials

#### General note

NOTICE

Use only the specified or **technically equivalent** materials from BRP-Powertrain for all maintenance work. When handling chemicals, comply with all the customary regulations and specifications of the producer, including the expiry date and instruction.

NOTES: To some extent product descriptions deviate in spite of

equivalent technical properties, i.e.: LOCTITE 221 and LOCTITE 222. If necessary contact the manufacturer concerning the comparability. In some cases information can be obtained from the local authorized distributors and ser-

vice partners for ROTAX engines.

NOTES: Respect the manufacturers instruction concerning the cur-

ing time and the expire date of the particular surface seal-

ing compound.

The materials specified have been tested for a long time and are suitable for all operating conditions indicated by the manufacturer.

No.	part no.	Description, Application	Qty.
1	899785	LOCTITE 221 violet, medium-duty screw securing agent	10 ml (0.003 gal (US))
2	897651	LOCTITE 243 blue, medium-duty screw securing agent	10 ml (0.003 gal (US))
3	899788	LOCTITE 648, high strength screw securing agent	5 ml (0.001 gal (US))
4	899789	LOCTITE 603 green, oil-tolerant grouting product, high-strength	10 ml (0.003 gal (US))
5	898241	LOCTITE 480 black, instant adhesive increased flexibility	20 ml (0.005 gal (US))
6	899784	LOCTITE 574 orange, surface sealing compound	50 ml (0.013 gal (US))
7	n.a.	LOCTITE 518 red, surface sealing compound, can be used instead LOCTITE 574	
8	899791	LOCTITE 5910 black, surface sealing compound, can be used instead LOCTITE 574 and LOCTITE 518	50 ml (0.013 gal (US))
9	297434	LOCTITE Anti-Seize 8151, for the prevention of fretting corrosion	50 g (0.11 lb)
10	297433	MOLYKOTE G-N, Lubricating paste	100 g (0.22 lb)
11	897166	MOLYKOTE 44 medium, long-term lubricant for shaft seals	100 g (0.22 lb)
12	897330	Lithium-base grease or Dow Corning, to prevent leakage current	250 g (0.55 lb)

Effectivity: 912 Series
Edition 2 / Rev. 0

05-00-00

#### MAINTENANCE MANUAL

No.	part no.	Description, Application	Qty.
13	897870	Filter oil for optimum filter efficiency and protection against moisture	14,8 ml (0.004 gal (US))
14	297368	SILASTIC 732, multi-purpose one-component silicon-based sealing compound	310 ml (0.082 gal (US))
15	897186	Application of the heat conduction compound will reduce heat transfer resistance. The grease-like, temperature-resistant silicon compound fills cavities between components and the cooling element (e.g.: spark plug-cylinder head), which otherwise do not contribute to heat conduction.	150 g (0.33 lb)
16	297710	PU-glue for shock absorption	310 ml (0.082 gal (US))
17	n.a.	Multi-purpose grease LZ Generally useable, neutrally colored multi-purpose grease, water resistant and highly adherent. Useable for temperatures from -35 °C to +120 °C (-31 °F to +248 °F) and can be subjected to mechanical loads.	
18	n.a.	Preservation oil Requirements: The preservation oil has excellent penetrating capabilities and reaches even tiny gaps, it's highly effective additives protect against corrosion of metal surfaces.	
19	n.a.	Very fine emery cloth SR 4600 A - very fine standard Is sold by the meter and used for Manual removal of smaller rust spots or oxidation, especially for optimum ground connections. It is highly suitable for removing LOCTITE from surfaces or threads to make them metallic clean. Before reapplying LOCTITE, clean surfaces with nitrothinner or degreasing agent (CASTROL ZA 30 or OMV-SOFT SOL). When using solvents, observe the safety regulations for persons and environment.	
20	898570	Screw securing paint seals screws	20 ml (0.005 gal (US))

d02874.fm

### MAINTENANCE MANUAL

No.	part no.	Description, Application	Qty.
21	n.a.	Cleaning agents  NOTICE  Use only approved cleaning agents (e.g. kerosine, varsol, etc.) for cleaning all metal parts.  Do not use lye-based cold cleaner or degreasing agents. Do not clean coolant or oil hoses with aggressive solutions. Clean off sealing compound residue with sealant remover.  Soak combustion chamber, piston and cylinder head with cleaning agent and remove combustion residues with a bronze brush. Very good results have been achieved with "Clenvex 2000". It is a solvent-cold cleaner, free of halogen, on the basis of selected fuel fractions with tensides and is biologically disposable.  Never use caustic or corrosive cleaning agents.	
22	n.a.	MICRONORM abrasive This abrasive is suitable for local and gradual very fine treatment of steel parts with rust film (propeller shaft). The MICRONORM abrasive contains no noxious matter, is approved by the relevant authorities and guarantees optimum cleaning. The granulates used are of sizes 40 to 60 μ. It is possible to achieve a surface roughness of 0,5 to 1μ, which represents fine processing of surfaces.	
23	n.e.	LOCTITE 7063  Degreasing fluid. For parts cleaning before applcation of adhesives and sealants.	

#### MAINTENANCE MANUAL

# 1.6) Acceptable methods, techniques and practice

General note

All general inspection, maintenance and repair has to be carried out in accordance with Advisory Circular AC 43.13 from FAA.

Advisory Circular

This Manual "Advisory Circular" AC describes maintenance methods, techniques and practice. These are recognized and authorized for inspection and repairs in non-pressurized areas for which there are no separate maintenance and repair instructions.

**Self-locking** 

NOTICE

Self-locking nuts, cotter pins, tab washers and safety wires must be replaced each time they have been removed.

Respect without fail all additional indications regarding securing and sealing means and lubrication of fixation elements. Adhere to specified tightening torques.

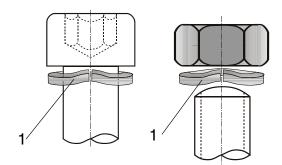
**Nut securing** 

When using a self-locking nut, take care that the polyamide insert ring on nuts according to DIN 985 as well as the securing element on nuts according to DIN 980 is positioned towards outside.

Lock washer

NOTES:

When fitting lock washers, the curved-up ends (1) must point towards the screw head or nut.



00144

MAINTENANCE MANUAL

Chapter: 05-10-00 TIME LIMITS

Introduction

These checks, related to limited periods of operation, are planned to help avoid engine troubles by the use of preventive maintenance.

**Table of contents** 

This chapter of the Maintenance Manual contains general information regarding TBO and time limits on rubber components.

Subject	Page
Definition of terms	page 3
Operating hours	page 3
Time limits	page 3
Life cycle	page 3
General Overhaul (TBO)	page 4
Time limit	page 5
Time limit for rubber parts	page 8
Time limit for the coolant	page 8
Annual inspection	page 8

MAINTENANCE MANUAL

**NOTES** 

d02875.fm

Effectivity: 912 Series Edition 2 / Rev. 0

05-10-00

#### MAINTENANCE MANUAL

## 1) Definition of terms

## 1.1) Operating hours

#### **Definition**

All of the maintenance intervals, such as the 100 hr. inspection and the engine TBO, relate to the number of operating hours of the engine.

The operating hours are defined as follows in order to prevent misunderstandings and to ensure safety:

- All time during which the engine is running is counted towards the total number of operating hours.
- The time is counted irrespective of the load factor of the engine, such as idling or take-off power.

NOTES:

A mechanical hour meter is directly coupled to the engine speed, the readings may deviate considerably from those given by electronic remitters (e.g. TCU, FlyDat). Maintenance and overhaul intervals are always dictated by the readings of the electronic hour meter.

 The planned inspections to be performed at certain intervals are based on experience from long test runs and field observations. They are intended as precautionary maintenance measures in order to ensure continued trouble-free operation of the engine.

# 1.2) Time limit

#### **Definition**

Time limits are predetermined time spans and intervals which are based either on calendar intervals or the number of engine operating hours. Once the time limits have been reached, the affected parts must either be replaced for a general overhaul, or maintenance work must be performed. These precautionary maintenance measures are designed to avoid engine malfunctions or defects and ensure continued airworthiness of the engine.

# 1.3) Life cycle

## **Definition**

The life cycle is always specified as an exact time span and is also quoted in flight hours.

NOTES:

Parts with a limited life cycle must be taken out of operation and overhauled if the specified time span or number of flight hours is reached (whichever comes first).

d02875.fm

#### MAINTENANCE MANUAL

# 1.4) General overhaul (TBO)

#### Definition

The time between overhauls (TBO) for all objects (such as the engine, component assemblies, add-on components) is the approved length of operation under normal operating conditions before it becomes mandatory to send in these objects for an overhaul.

Normal operating conditions are the conditions which comply with the manufacturer's and the aviation authority's recommendations for the certification of airworthiness.

# Maintenance of operation

The TBO values approved by the relevant authorities are based on performance tests and empirical values which have been gathered through operation of the engine and are required for the acceptance and certification of airworthiness. TBO values can be changed in response to possible upgrade/expansion programs.

# Legal obligation to keep

TBO values for the engine are always shown in operating hours and years. The user must record the operating hours in the engine log book.

# 2) Time limit

**General** 

NOTICE

A general overhaul is due after a defined period of operation or after a specified calendar life since initial start of operation (whichever comes first).

The time limit for engine operation will be specified by the TBO.

After reaching this time limit



After reaching this time limit, the engine has to be shipped to an authorized ROTAX overhaul facility.

For an overhaul, the engine must be removed from the aircraft, be cleaned, preserved and all openings to be closed to prevent entering of contaminants.

## MAINTENANCE MANUAL

Engine	engine affected	ТВО			
Type description	engine S/N	Time Between Overhaul			
912 A	up to and incl. 4,076.191	600 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 A	from 4,076.192 up to and incl. 4,410.065	1000 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 A	from 4,410.066 up to and incl. 4,410.471	1200 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 A	from 4,410.472 up to and incl. 4,410.856	1500 hr. or 12 years, whichever comes first <sup>(1</sup>			
912 A	from 4,410.857	2000 hr. or 15 years, whichever comes first <sup>(1</sup>			
912 F	up to and incl. 4,412.585	1000 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 F	from 4,412.586 up to and incl. 4,412.816	1200 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 F	from 4,412.817 up to and incl. 4,412.974	1500 hr. or 12 years, whichever comes first <sup>(1</sup>			
912 F	from 4,412.975	2000 hr. or 15 years, whichever comes first <sup>(1</sup>			
912 S	up to and incl. 4,922.776	1200 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 S	from 4,922.777 up to and incl. 4,923.889	1500 hr. or 12 years, whichever comes first			
912 S	from 4,923.890	2000 hr. or 15 years, whichever comes first <sup>(1</sup>			
912 UL	up to and incl. 4,152.666	600 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 UL	from 4,152.667 up to and incl. 4,404.717	1200 hr. or 15 years, whichever comes first <sup>(1</sup>			
912 UL	from 4,404.718 up to and incl. 4,409.715	1500 hr. or 15 years, whichever comes first <sup>(1</sup>			
912 UL	from 4,409.716	2000 hr. or 15 years, whichever comes first <sup>(1</sup>			
912 ULS	up to and incl. 4,427.532	1200 hr. or 10 years, whichever comes first <sup>(1</sup>			
912 ULS from 4,427.533 up to and incl. 6,775.789		1500 hr. or 12 years, whichever comes first			

d02875.fr

Effectivity: 912 Series Edition 2 / Rev. 0

05-10-00

#### MAINTENANCE MANUAL

Engine Type description	engine affected engine S/N	TBO Time Between Overhaul
912 ULS	from 6,775.790	2000 hr. or 15 years, whichever comes first <sup>(1</sup>
912 ULSFR	up to and incl. 4,429.714	1200 hr. or 10 years, whichever comes first <sup>(1</sup>
912 ULSFR	from 4,429.715 up to and incl. 6,775.789	1500 hr. or 12 years, whichever comes first
912 ULSFR	from 6,775.790	2000 hr. or 15 years, whichever comes first <sup>(1</sup>

For the TBO of the specific engine type/version refer to the table below.

# Authorized exceeding

Extension or exceeding of the TBO by 5 % or 6 months is allowed whichever comes first.

## **Shipment**

The shipment to an authorized ROTAX overhaul facility must include the following:

1	Engine log bool	ζ.
2		cords of the engine (i.e. all maintenance check lists, and reports maintenance, of findings and of oil analyses).
3	in the supply vol	embly as per supply volume. Additionally all added-on parts as ume such as carburetors, filters, fuel pump, external generator, n unit, electric starter, oil tank.
4		al engine operating hours (TSN) and where applicable, engine since a previous overhoul (TSO).
	NOTE:	This information must be supplied to allow the service history of components to be traced.
5	Data about the	type of aircraft used.
6	Useful remarks	and observations concerning the engine.

<sup>&</sup>lt;sup>(1)</sup> Extension of the TBO is possible and will be specified by a Service Bulletin (SB) for the respective engine type. For extensions already effective refer to the engine log book or release certificate.

#### MAINTENANCE MANUAL

## 2.1) Time limit for rubber parts

#### General note

NOTICE

This time limit must be followed **independently** and **in addition** to the visual inspections (see chap. 05-20-00 section: 5.1)) of the respective components.

#### **Time limit**

The following components and systems must be replaced every 5 years:

<ul> <li>venting hose of the carburetors</li> <li>all rubber hoses of the cooling system</li> <li>all rubber hoses of the fuel system (incl. teflon hoses)</li> <li>all rubber hoses of the lubrication system which are part of the engine supply volume and if they are not in the maintenance schedule of aircraft manufacturer</li> <li>carburetor sockets</li> <li>connecting hose of the air intake system</li> <li>diaphragm on both carburetors</li> <li>rubber hoses on compensating tube</li> </ul>		•	
- all rubber hoses of the fuel system (incl. teflon hoses)  - all rubber hoses of the lubrication system which are part of the engine supply volume and if they are not in the maintenance schedule of aircraft manufacturer  - carburetor sockets  - connecting hose of the air intake system  - diaphragm on both carburetors	-	venting hose of the carburetors	
teflon hoses)  - all rubber hoses of the lubrication system which are part of the engine supply volume and if they are not in the maintenance schedule of aircraft manufacturer  - carburetor sockets  - connecting hose of the air intake system  - diaphragm on both carburetors	-	all rubber hoses of the cooling system	
tem which are part of the engine supply volume and if they are not in the mainte- nance schedule of aircraft manufacturer  - carburetor sockets - connecting hose of the air intake system - diaphragm on both carburetors	-	• • • • • • • • • • • • • • • • • • • •	' '
- connecting hose of the air intake system - diaphragm on both carburetors	-	tem which are part of the engine supply volume and if they are not in the mainte-	
- diaphragm on both carburetors	-	carburetor sockets	
	-	connecting hose of the air intake system	
- rubber hoses on compensating tube	-	diaphragm on both carburetors	
	-	rubber hoses on compensating tube	
- V-belt	-	V-belt	

# 2.2) Time limit for the coolant

#### **General** note

Coolant must be replaced as per manufacturers instructions, at the latest during overhaul or when the engine is replaced.

# 2.3) Annual inspection

#### **General** note

A 100 hr. inspection is to be carried out periodically after every 100 hours of operation **or every 12 months**, whichever comes first. See chap. 05-10-00 section: 2).

d02875.fm

MAINTENANCE MANUAL

# Chapter: 05-20-00

## SCHEDULED MAINTENANCE CHECKS

#### Introduction

The owner and/or user is primarily responsible for the maintenance and airworthiness of the engine. This includes compliance with all applicable airworthiness directives.

This inspection protocol is not intended to be all-inclusive, for no such protocol can replace the knowledge and experience of a certified aircraft mechanic. As the party primarily responsible for the maintenance and airworthiness of the engine, the owner or user should only have the maintenance work carried out by qualified engineers.

# Documentation required

It is the responsibility of the owner and/or user to make sure that the aircraft mechanic performing the work on the engine has access to the previous Inspection Protocols and any other required documents.

#### **Table of contents**

This chapter of the Maintenance Manual contains general information regarding periodic maintenance and the maintenance check list.

Subject	Page
Scheduled maintenance checks	page 3
Unscheduled maintenance checks	page 5
Visual inspection	page 7
Maintenance schedule procedures	page 9
Check list/Maintenance schedule Maintenance schedule	page 11 page 13

MAINTENANCE MANUAL

**NOTES** 

d02876.fm

#### MAINTENANCE MANUAL

## 1) Scheduled maintenance checks

#### **Definition**

This section lists the periodic inspections which must be carried out after a specified periods of operation.

#### **Intervals**

Periodic inspections are those which must be performed at 50, 100, 200, 600 hr. intervals in accordance with chap. 05-20-00. section: 5.1).

This means for example that **every 100** hr. of operation a 100 hr. check and all 200 hr. additional checks as per maintenance check list must be carried out.

	Intervals - hours									
	25 hr	25 hr   100 hr   200 hr   300 hr   400 hr   500 hr   600 hr   700 hr								
100 hr	Χ	Х	Х	Х	Х	Х	Х	Х		
200 hr			Х		Х		Х			
600 hr							Χ			

to	2000
ıo	hr
	Х

## 100 hr. check

- In order to demonstrate continued airworthiness, an engine must be inspected after every 100 hours of operation.
- For the intervals between maintenance work, a tolerance of ±10 hr. is permissible, but these tolerances must not be exceeded. This means that if a 100 hr. check is actually carried out at 110 hr., the next check will be due at 200 hr. ±10 hr. and not at 210 hr. ±10 hr.
- If maintenance is performed before the prescribed interval, the next maintenance check is to be done at the same interval (e.g. if first 100 hr. check is done after 87 hours of operation, the next 100 hr. check must be carried out after 187 hours of operation).

#### Special hr. check

## NOTES:

This maintenance schedule contains a column for a 50 hr. check. This check is recommended by the manufacturer but not essential, with the exception of oil change when operating with leaded AVGAS.

# 25-hr. check

- In order to demonstrate continued airworthiness, an engine must be inspected after the first 25 hours of operation.
- The checks performed at the 25 hr. inspection are the same as for the 100 hr. inspection. This applies both to newly delivered engines and to overhauled engines.

d02876.fm

MAINTENANCE MANUAL

**NOTES** 

d02876.fm

Effectivity: 912 Series Edition 2 / Rev. 0

## 2) Unscheduled maintenance checks

# Operating limits exceeded

An inspection of the engine must be performed if the operating limits of the engine have been exceeded (e.g. overspeed, excessive temperature etc.), or if unusual operating conditions have occurred during operation (e.g. lightning strike). In such cases the engine must be inspected in accordance with the applicable unscheduled maintenance checks. (See chapter 05-50-00).

## Recommends inspections

The manufacturer also recommends the following inspections whenever maintenance is carried out (where not already prescribed by the airframe manufacturer, as possible malfunctions could have negative effects on engine operation.

part	inspection	possible danger	
Engine cowling	- for discoloring and warping.	Danger of overheating	
Exhaust fixation	re-tighten the exhaust fixation on the cylinder head after the first 2 hr. of operation.	Leakage	
Exhaust	<ul> <li>of the exhaust unit (where nec- essary, replaced application of LOCTITE Anti-Seize).</li> </ul>	Risk of fracture, wear. Smooth engine running.	
Fuel filter	of fuel filter on airframe side (for foreign bodies, sealing material and loose fragmented material).	Engine to misfire. Power loss. Engine running too lean (Engine malfunction and damage).	
Electr. fuel pump	- correct function.	Insufficient fuel supply. Engine running to lean (Engine malfunction and damage).	
Battery	- acid concentration for each cell Observe the manufacturers instruc- tion.	Starting problems	
<ul> <li>for oil contamination.</li> <li>analyse the oil (provides additional information on the condition of the engine).</li> </ul>		Possible engine wear	
- for damage check for discoloration - and cracks.		Danger of overheating	
Propeller	<ul> <li>undamaged and runs true</li> <li>carry out dynamically balancing including verification of propeller track.</li> </ul>	Engine damage, unusual vibrations	

d02876.fm

MAINTENANCE MANUAL

**NOTES** 

d02876.fm

Effectivity: 912 Series Edition 2 / Rev. 0

## MAINTENANCE MANUAL

# | 3) Visual inspection

General note	The scope of a visual inspection generally includes, but is not necessarily limited to, the following.
Moving parts	Normal operating condition, accurate alignment, leak-tightness, cleanliness, ease of movement, adjustment, mechanical stress, travel, catching, extreme wear, cracks, corrosion, deformation and other visually evident damage.
Parts	Secure seating, surface condition, cleanliness, deformation, cracks in welding seams or due to material fatigue or stress, corrosion and other visually evident damage.
Fuel-, Air- and Oil lines	Cracks, dents, kinks, required flexibility, collapsed lines/hoses, abrasion, cleanliness, secure seating and other visually evident damage.
Wiring	General cleanliness; loose, corroded or broken terminals; chafed, broken or worn insulation; secure seating, heat damage and other visually evident damage.
Screws and Nuts	Surface damage, secure seating, locking wire, securing paint and other visually evident damage.
Filter	Filters and screens must be inspected for contamination and potential blockages, cleaned and replaced as required.

MAINTENANCE MANUAL

**NOTES** 

d02876.fm

#### MAINTENANCE MANUAL

## 4) Maintenance schedule procedures (maintenance check list)

## Inspections

All stated checks are visual inspections for damage and wear, unless otherwise stated.

## Specified period

All listed work must be carried out within the specified period.

# Maintenance check lists

Checks are carried out as per the maintenance check lists, where type and volume of maintenance work is outlined in key words.

 The lists must be photocopied and filled out for each maintenance check.

## **Extra inspections**

- The respective check (e.g. 100 hr. check) must be noted on the top of each page of the maintenance check list.
- All the maintenance work carried out must be initialled in the "signature" area by the aircraft mechanic performing the task.

# Maintenance records

After maintenance, the completed check lists must be entered in the maintenance records. The maintenance must be confirmed in the log book.

# Discrepancies/remedial action

All discrepancies and remedial action must be recorded in a report of findings to be generated and maintained by the company authorized to carry out maintenance work. It is the responsibility of the aircraft operator to store and keep the records.

# Replacement of equipment

Replacement of equipment (e.g. fuel pump, governor....) and execution of SB (LTA) must be entered in the engine log book, stating S/N, TSN and date.

MAINTENANCE MANUAL

**NOTES** 

d02876.fm

## MAINTENANCE MANUAL

# 5) Check List/Maintenance Schedule

	Identification
AIRCRAFT	
Registration number	
Aircraft make	
Aircraft model and S/N	
Time since new	
Propeller brand	
Propeller model and S/N	
ENGINE	
Engine type	
Engine S/N	
TSN (time since new)	
TSO (time since overhaul)	
Used operating fluids:	
coolant	
- mixture ratio	
fuel	
oil	
AIRCRAFT OPERATOR	
Name	
Contact	
Address	
Telephone/Fax/E-mail	

d02876.fm

Effectivity: 912 Series Edition 2 / Rev. 0

## MAINTENANCE MANUAL

Identification						
MAINTENANCE FACILITY	MAINTENANCE FACILITY					
Maintenance workshop						
Address						
Telephone/Fax/E-mail						
Certificate						
This check is applicable (circle on)	25 hr.	50 hr.	100 hr.	200 hr.	600 hr.	
			l			
Next check due at:	hr.					
	(TS) (engine hr.)					

Effectivity: 912 Series Edition 2 / Rev. 0

#### MAINTENANCE MANUAL

# 5.1) Maintenance Schedule

General note Perform the following maintenance tasks at the intervals shown in the

maintenance check list. See chapter 05-20-00 25 hr. check.

Legend: X = do the task

blank = no task required

NOTES: If the points 1-3 in order to continue with the maintenance

schedule.

If one of the points 1-3 not OK, the engine must be checked and repaired in accordance with the BRP-Power-

train instructions for continued airworthiness.

Points of Inspection		Interval Operating hours		Signature
	as indicated	100 hr.		
1.) Visual inspe	ction of the engi	ne		
General visual inspection of the engine for damage or abnormalities. Check cooling air duct and cooling fins of the cylinders for obstruction, cracks, wear and good condition. Take note of changes caused by temperature influence.	recommended 50 hr.	X	12-20-00 sec. 3)	
Visual inspection of the temperature sensor and the oil pressure sensor. Inspect for tight fit and good condition.		X		
Inspect all coolant hoses for damage, including leakage, hardening from heat, porosity, loose connections and secure attachment. Verify routing is free of kinks and restrictions.		Х	12-20-00 sec. 9.1)	
Carry out visual inspection of leakage bore at the base of the water pump for signs of leakage.		Х	12-20-00 sec. 4)	
Inspect the expansion tank for damage and abnormalities. Check coolant level, replenish as necessary. Inspect radiator cap. Inspect protection rubber on expansion tank base for correct fit.		Х	12-20-00 sec. 9.1)	
Inspect the overflow bottle for damage and abnormalities.  Verify coolant level, replenish as necessary.  Inspect line from expansion tank to overflow bottle for damage, leakage and clear passage.  Inspect venting bore in cap of overflow bottle for clear passage.		Х	12-20-00 sec. 9.5)	

d02876.fm

Effectivity: 912 Series Edition 2 / Rev. 0

## MAINTENANCE MANUAL

Points of Inspection							Interval Operating hours		Signature
						as indicated	100 hr.		
Inspect all oil lines for damage, leakage, hardening from heat, porosity, security of connections and attachments. Verify routing is free of kinks and restrictions.					ns and at-		X	12-20-00 sec. 4)	
Inspect all fuel lines for damage, leakage, hardening from heat, porosity, security connections and attachments. Verify routing is free of kinks and restrictions. In the case of steel fuel lines (912 F, 912 S and/or optional), also check for any cracks and/or scuffing marks.					and attach- restrictions. S and/or op-		X	12-20-00 sec. 4)	
Inspect th damage a				ions for	secure fit,		X	12-20-00 sec. 14.1)	
					2.) Mag	netic plug			
Check the	magne	tic plug.					X	12-20-00 sec. 12)	
					3.) Compre	ession check			
method. Test press	·	hl	Pa (psi)		I pressure	every 200 hr.		12-20-00 sec. 5)	
				4.) Cł	necking the	engine suspens	sion		
	•	•			for secure ion, cracks.		X	12-20-00 sec. 3.1)	
					5.) Engine	external parts			
	Inspect screws and nuts of all external parts for tight fit. Inspect safety wiring, replace as necessary.					X			
					6.) Engir	e cleaning	•	•	
Engine cle	Engine cleaning					Х	12-20-00 sec. 1)		
					7.) Checkin	g the air filter	•		
Checking	the air f	ilter.					X	12-20-00 sec. 2)	

## MAINTENANCE MANUAL

Points of Inspection		Interval Operating hours		Signature	
	as indicated	100 hr.			
8.) Checking	the carburetors	•			
Checking the idle speed.		Х	12-20-00 sec.10.3.1)		
Checking the ventilation of the float chambers. Any trouble with the float chamber ventilation impairs engine and carburetor function and must therefore be avoided.  Check that the passage of the ventilation lines is free and that no kinks can arise.	200 hr.				
Check for free movement of the carburetor actuation (throttle lever and starting carburetor). Check that the bowden cable allows the full travel of the throttle lever from stop to stop.		Х	12-20-00 sec. 10.5)		
Removal/assembly of the two carburetors for carburetor inspection.	every 200 hr.		Heavy MM 73-00-00 sec. 3.1)		
Check carburetor synchronization. Mechanical or pneumatic synchronization.		Х	12-20-00 sec. 10.2)		
Inspect the float chamber assy. for contamination and corrosion.	annual inspection		12-20-00 sec. 10.5)		
9.) Inspecting carburetor sockets and drip tray					
Inspect the carburetor sockets for damage and abnormalities, checking for cracks, wear and good condition.  Take note of changes caused by temperature influence.	every 200 hr. <sup>(1</sup>		Heavy MM 73-00-00 sec. 3.4.3)		
<sup>(1</sup> See SB-912-030 - latest edition.					
10.) Spark p	lug connectors	•			
Check that resistance spark plug connectors fit tightly on the spark plugs.  Minimum pull-off force is 30 N (7 lb).	every 200 hr.				
11.) Spark plugs					
Remove all spark plugs, check the heat range designation, clean, check electrode gap and adjust if necessary. Check electrode gab and adjust as necessary. Replace as required.		X	12-20-00 sec. 14.2)		
Replacing spark plugs.	every 200 hr.	X <sup>(1</sup>	12-20-00 sec. 14.2)		
(1 use of leaded fuel more than 30% of operation.					

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## MAINTENANCE MANUAL

Points of Inspection		Interval Operating hours		Signature
	as indicated	100 hr.		
12.) Flushing t	he cooling syste	m		
Flushing the cooling system where conventional coolants are used.	when replacing the coolant		12-20-00 sec. 9.3)	
13.) Checking th	e propeller gear l	оох		
Check the friction torque in free rotation on gearboxes with overload clutch.  Actual friction torque Nm (in.lbs)		X	12-20-00 sec. 15)	
Gearboxes of series 3 (with overload clutch) and use of leaded fuel more than 30% of operation. Inspect overload clutch.	every 600 hr.		05-50-00 sec. 2) SB-912- 033	
Checking the propeller gearbox (with overload clutch).  (1 only applicable for engine type 912 S/ULS/ULSFR	every 1000 hr. <sup>(1</sup>		12-20-00 sec. 15.2)	
Checking the propeller gearbox (without overload clutch).  (2 only applicable for engine type 912 UL/ULS/ULSFR	every 600 hr. <sup>(2</sup>		12-20-00 sec. 15.2)	
14.) O	il change			
Remove old oil filter from engine and install new oil filter.	50 hr. <sup>(1</sup>	Х	12-20-00 sec. 11.3), 11.4))	
Cut old oil filter without producing any metal chips and inspect filter mat. Findings:	50 hr. <sup>(1</sup>	Х	12-20-00 sec. 11.5)	
Check oil tank. Refill oil tank with approx. 3 litres of oil. For oil quality, see Operators Manual and SI-912-016, latest edition.	50 hr. <sup>(1</sup>	X	12-20-00 sec. 11.2), 11.6)	
<sup>(1</sup> In the case more than 30% of operation with leader	d fuel e.g.: AVGAS	3 100 LL	12-20-00 sec. 11.2) SI-912-016	
	level check	1.,	1,0,10,00	
Verify oil level, replenish as necessary.		X	12-10-00 sec. 4.1)	
	the V-belt tensio	n		
On configurations with auxiliary generator, check the attachment and the V-belt tension.		Х	12-20-00 sec. 6)	

## MAINTENANCE MANUAL

d02876.fm

Effectivity: 912 Series Edition 2 / Rev. 0

MAINTENANCE MANUAL

**NOTES** 

d02876.fm

MAINTENANCE MANUAL

# Chapter: 05-50-00

# **UNSCHEDULED MAINTENANCE CHECKS**

### Introduction



In the course of special checks specify if **additional checks** for components (e.g. hydraulic governor) is applicable.

After each special check/repair work, an engine test run and a leakage check must be carried out.

NOTICE

Observe without fail all the specified instructions.

Special checks must be carried out immediately in the event of an engine fault (e.g. abnormal operation as defined in the Operators Manual) which impairs the airworthiness of the engine.

#### **Table of contents**

This chapter of the Maintenance Manual contains general information regarding unscheduled maintenance checks and their associated procedures.

Subject	Page
Engine check after propeller strike incidents	page 3
Propeller gearbox with integrated overload clutch	page 3
Propeller gearbox without integrated overload clutch	page 4
Checking of the overload clutch	page 5
Examination after engine failure	page 7
Returning engine to service after submerging in water	page 9
Inspection in extreme climatic conditions	page 9
Exceeding of max. admissible engine RPM	page 10
Exceeding of max. cylinder head temperature	page 11
Exceeding the max. permissible oil temperature	page 13
Oil pressure below minimum value	page 15
Oil specification not respected	page 17
Spark plug not in accordance with specification	page 19
Hard to turn over	page 20
Reporting	page 21

MAINTENANCE MANUAL

**NOTES** 

d02877.fm

Effectivity: 912 Series Edition 2 / Rev. 0

05-50-00

#### MAINTENANCE MANUAL

# 1) Engine check after propeller strike incidents

**Definition** 

A propeller strike is:

- Any incident while the engine is stationary or running which makes it necessary to perform repairs on the propeller.

See SL-912-015, SL-914-012, SL-2ST-009, current edition.

# 1.1) Propeller gearbox with integrated overload clutch

**General note** 

After any propeller strike the following inspections must be performed before operation can continue.

Step	Procedure
1	Inspect the engine for damage. If any damage is detected, inspect, repair or overhaul the whole engine in accordance with the BRP-Powertrain instructions for continued airworthiness.  Inspect all systems for correct functioning.
2	Inspect add-on components.
3	Observe the directives of the aircraft manufacturer.
4	Remove the gearbox and roller bearing of the propeller shaft.
5	The whole gearbox must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness - but not limited too
	<ul> <li>Carry out detailed inspection of all gearbox components.</li> <li>NDT for cracks on gearbox housing, propeller shaft and gear set.</li> </ul>
	- Inspect drive for governor and vacuum pump (if fitted).
6	Observe the manufactures instructions for the governor, vacuum pump and propeller.
7	Inspect the crankshaft on the power take off side for out-of-roundness. See chapter 72-00-00 section. 3.18) of the Heavy Maintenance Manual.

## MAINTENANCE MANUAL

# 1.2) Propeller gearbox without integrated overload clutch

Propeller strike

The following inspections must be performed before operation can continue.

Step	Procedure
1	Inspect the engine for damage. If any damage is detected, inspect, repair or overhaul the whole engine in accordance with the BRP-Powertrain instructions for continued airworthiness.  Inspect all systems for correct functioning.
2	Inspect add-on components.
3	Observe the directives of the aircraft manufacturer.
4	Remove the gearbox and roller bearing of the propeller shaft.
5	The whole gearbox must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness - but not limited too
	- Carry out detailed inspection of all gearbox components.
	- NDT for cracks on gearbox housing, propeller shaft and gear set.
	Inspect drive for governor and vacuum pump (if fitted).
6	Observe the manufactures instructions for the governor, vacuum pump and propeller.
7	Inspect the crankshaft on the power take off side for out-of-roundness. Propeller shock load - Inspection of crankshaft distortion on installed crankshaft. See chapter 72-00-00 section. 3.9) of the Heavy Maintenance Manual.

# 2) Checking of the overload clutch

General note

In the event of lead deposits and/or if slipping is suspected, it will be necessary to check the overload clutch.

NOTES: Slipping of overload clutch is apparent if at engine speed

rise, the propeller speed does not increase at the same

rate.

NOTES: The engine should be run for a short time just prior to the

test, otherwise there is the risk of the clutch "drying out",

resulting in a higher torque.

Step	Procedure				
1	Remove the propelle	Remove the propeller as per manufacturers instruction.			
2	Lock the crankshaft.	Lock the crankshaft. See chap. 12-20-00 section: 7)			
3	NOTICE	Danger of damage to the engine suspension!			
		Depending on the engine installation (e.g. in the case of extremely lightweight engine suspension), the gearbox must be removed and the test carried out on a suitable mounting attachment.			
	A specially prepared lever (e.g. length 1.5 m (4.92 ft.), see Fig.1) is fitted on the propeller flange and the breakaway torque measured with a suitable measuring tool.				
		Because of difficult measurement of the slipping torque he breakaway torque is measured.			

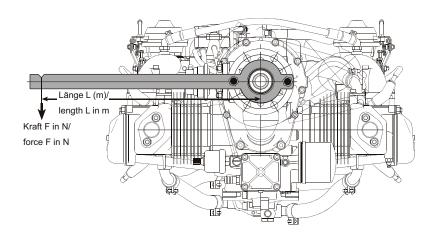


Fig. 1 08054

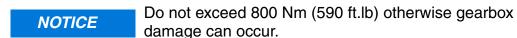
#### MAINTENANCE MANUAL

#### Measurement

Repeat the measurement several times to get a stable value.

The breakaway torque is calculated on the basis of the force (F) measured in N and the length of the lever arm (L) used at the normal distance from it in m (N x m = Nm).

#### **Obtained value**



The value determined must be between 600 and 800 Nm (442 and 590 ft.lb.).

If the value is greater or smaller than the limit value, the overload clutch must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.

Step	Procedure
4	Release the crankshaft, see chap. 12-20-00 section: 7).

#### MAINTENANCE MANUAL

# 3) Examination after engine failure

#### General note

In order to find possible causes of the failure, it is important to pass on all available data. Observations on the aircraft and the engine suspension can also be of help. It is important to pay particular attention to any of the following engine phenomena to facilitate troubleshooting.

## **Engine**

Engine runs erratically and misfires				
part	possible cause			
Fuel system	fuel supply vapour locks contamination float chamber venting false air intake due to defective carburetor flange carburetor icing			
Ignition system (shorting cable, electronic module, charging coil) Spark plug	malfunction grounding defect wrong spark plug connection			

## **Rough running**

Rough running engine			
part	possible cause		
Ignition	wiring (assignment fault)		
Carburetor	fuel supply contamination in float chamber or float needle valve float chamber venting false air intake due to defective carburetor flange incorrect synchronization of the carburetor		
Engine	engine temperature too low too lean carburetor jetting due to conditions pre- vailing in intake silencer		

## **Engine stoppage**

**NOTICE** 

Should one of the above mentioned points occur even for a short time then a detailed check of the engine is necessary. The fault needs to be located and corrected.

Unintended engine stoppage by seizing			
part	possible cause		
Oil system	oil pressure too low or no oil pressure oil shortage contamination incorrect venting		
Oil pump	defect		

Effectivity: 912 Series

d02877.fm

#### MAINTENANCE MANUAL

Unintended engine stoppage by seizing		
part		possible cause
Camshaft bearings/Conrod bearings		rather consequential damage wear (low oil pressure)
NOTICE	The entire assem paired.	bly must be dismantled, inspected and re-

- The whole engine must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.
- Inspect all systems for correct functioning.
- Detailed inspection of affected engine components.

## Cylinder head

A rise in cylinder head temperature above normal operating limits (see Operators Manual) is a clear signal for a failure in the cooling system.

Cylinder head temperature too high	
part	possible cause
Cooling system	not enough coolant bad venting
Return valve is not working	malfunction
Radiator	contaminated
Radiator cap	leaking
Pressure relief valve	malfunction
Water pump	malfunction

Effectivity: 912 Series

#### MAINTENANCE MANUAL

## 3.1) Returning engine to service after submerging in water

#### General note

NOTICE

The engine must be marked clearly "Engine submerged in water".

An engine which has been submerged in water must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.

- Inspect all systems for correct functioning.
- Carry out detailed inspection of affected engine components.

## 3.2) Inspection in extreme climatic conditions

#### **General note**



Every 25 hr. checks of air filter, coolant radiator and oil cooler are necessary.

Flying in deserts or areas with heavily contaminated or dusty air causes increased wear on all components. For this reason, shorter maintenance intervals are recommended.

Flying in areas with extreme climatic conditions or in extreme altitudes requires adjustment of the carburetor jetting and of the cooling system. To do this, it is necessary to contact the aircraft manufacturer and an authorized ROTAX distributor.

#### MAINTENANCE MANUAL

# 3.3) Exceeding of max. admissible engine RPM

General note

NOTES:

Any exceeding of the max. admissible engine RPM must be entered by the pilot into the engine log book stating duration extent of overspeeding and pertinent detail.

up to 6200 rpm max. 1 min.

## If the limit was exceeded for max. 1 minute up to 6200 rpm

Step	Procedure
1	Check that the push-rods are straight.

max. 6200 rpm more than 1 min.

### If the limit was exceeded for more than 1 minute

Step	Procedure
1	The whole engine must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.
2	Check that the push-rods are straight.
3	Inspect the crankshaft for out-of-roundness. See chapter 72-00-00 section 3.9) of the Heavy Maintenance Manual).
4	Inspect all systems for correct functioning.
5	Detailed inspection of affected engine components.

more than 6200 rpm

## If the speed of 6200 rpm was exceeded

Step	Procedure
1	The whole engine must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.
2	Check that the push-rods are straight.
3	Replace the crankshaft.
4	Inspect all systems for correct functioning.
5	Detailed inspection of affected engine components.

## 3.4) Exceeding of max. cylinder head temperature

#### General note

NOTICE

If the maximum cylinder head temperature is exceeded, other limits are also often exceeded, e.g. oil temperature. Please observe the relevant instructions.

NOTES:

Any exceeding of the max. admissible cylinder head temperature must be entered by the pilot into the engine log book, stating duration extent of excess temperature and pertinent detail.

## Graphic

## Overview and proceed:

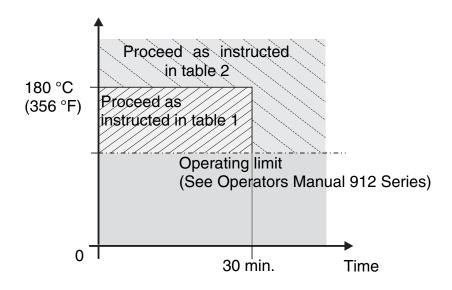


Fig. 2

# Exceeded up to 180 °C (356 °F)

## Table 1.

Max. temperature exceeded up to 180 °C (356 °F) - briefly		
Step	Procedure	
1	The whole cooling system must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.	
2	Inspect all further systems for correct functioning.	
	Carry out detailed inspection of the affected engine components such as.	
	- Leakage check on the cooling system.	
	<ul> <li>Check that the cylinder head attachment is fitted securely. If the cylinder head nut is loose, proceed as instructed in sec. "Excess temperature of over 180 °C (356 °F) and/or for longer than 30 min."</li> <li>Check all coolant fittings (feed/outflow) for secure fit.</li> </ul>	

d02877.fm

## MAINTENANCE MANUAL

Exceeded of over 180 °C (356 °F)

Table 2.

Excess	Excess temperature of over 180 °C (356 °F) and/or for longer than 30 min.	
Step	Procedure	
1	The whole cooling system must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.	
2	Inspect all further systems for correct functioning.	
3	Carry out detailed inspection of the affected engine components.	
4	Check compression by carrying out a differential pressure check.	
5	All cylinder heads and cylinders must be removed and subjected to a detailed check including hardness testing. See chap. 72-00-00 in the Heavy Maintenance Manual.	

# 3.5) Exceeding the max. permissible oil temperature

#### General note

# NOTICE

If the max. permissible oil temperature is exceeded, other limits are often exceeded, too, e.g. the cylinder head temperature. Please observe the relevant instructions.

NOTES:

Any exceeding of the max. admissible oil temperature must be entered by the pilot into the engine log book, stating duration extant of excessive temperature and pertinent detail.

#### Graphic

## Overview and proceed;

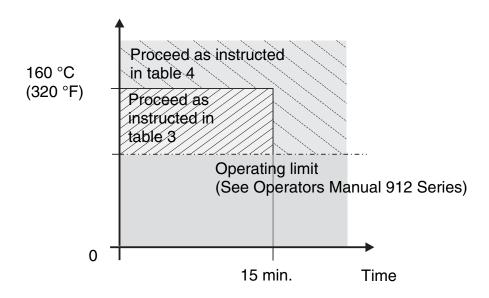


Fig. 3

# Exceeding up to max. 160 °C (320 °F)

## Table 3.

	Excess temperature up to max. 160 °C (320 °F) max. 15 min.							
Step	Procedure							
1	The whole oil system must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.							
2	Inspect oil level in the oil tank.							
3	Inspect oil cooler for contamination and check the entire oil circuit for correct functioning.							
4	Check that oil lines are routed correctly and undamaged.							
5	Cut oil filter housing and inspect filter mat for foreign matter.							
6	Carry out oil change.							
7	Inspect all further systems for correct functioning.							

## MAINTENANCE MANUAL

# Exceeding over 160 °C (320 °F)

# Table 4.

Excess temperature over 160 °C (320 °F) for longer than 15 min.								
Step	Procedure							
1	The whole engine must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.							
2	Inspect all further systems for correct functioning.							
3	Carry out detailed inspection of the affected engine components.							
4	The whole oil system (oil cooler, oil lines) must be inspected.							
5	Cut oil filter housing and inspect filter mat for foreign matter.							

# 3.6) Oil pressure below minimum value

#### General note

NOTICE

If the oil pressure falls below the minimum value, other limits are often exceeded, e.g. the oil temperature.

Please observe the relevant instructions.

NOTES:

Any exceeding of the min. admissible oil pressure must be entered by the pilot into the engine log book, stating duration extent of excessive pressure and pertinent details.

## Graphic

Overview and instruction

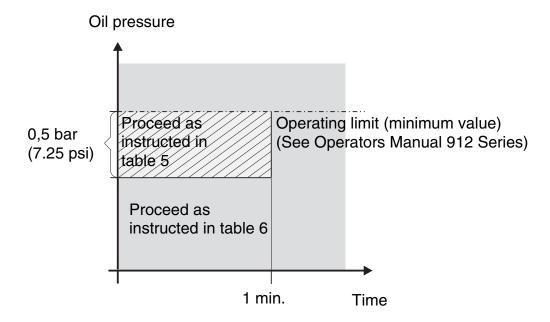


Fig. 4

# Minimum oil pressure on the ground

# Oil pressure below minimum oil pressure on the ground

If noticed **on ground**, immediately stop the engine and determine the cause.

- Inspect the complete lubrication system, trace cause and rectify. See SI-912-005, latest issue.

#### MAINTENANCE MANUAL

Minimum oil pressure falls below 0.5 bar (7.25 psi) max. 1 min. in flight If the oil pressure falls below the minimum value up to max. 0,5 bar (7.25 psi) and for max. 1 min., the cause must be determined. Table 5.

Oil pressure below minimum permissible oil pressure up to max. 0.5 bar (7.25 psi) max. 1min. in flight								
Step	Procedure							
1	Inspect all oil lines for restrictions and clear passage.							
2	Verify oil quantity.							
3	Inspect pressure sensor.							
4	Inspect indicating instrument to specifications of the manufacturer, replace as required.							
5	Inspect crankcase pressure (See Installation Manual 912 Series, latest issue.)							
6	If no cause for the low oil pressure is found after the above checks, carry out an oil change.							
7	If after the previous checks and oil change the oil pressure is still too low, repair or overhaul the engine in accordance with the BRP-Powertrain instructions for continued airworthiness.							
8	Inspect all systems for correct functioning.							
9	Carry out detailed inspection of the affected engine components.							

NOTICE

Replace the oil cooler and oil lines. Before the reinstallation of the engine the complete lubrication system (inclusive oil tank) must be flushed.

Minimum oil pressure in flight more then 0.5 bar (7.25 psi) Consequent damage can be expected if the oil pressure falls below the minimum value more than 0.5 bar (7.25 psi). Table 6.

Oil pressure below minimum permissible value more than 0.5 bar (7.25 psi) in flight							
Step	Step Procedure						
1	The whole cooling system must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.  - Replace the crankshaft.						
2	Carry out detailed inspection of the affected engine components.						
3	Cut oil filter housing and inspect filter mat for foreign matter.						
4	Inspect all further systems for correct functioning.						

#### MAINTENANCE MANUAL

# 3.7) Oil specification not respected

**General note** 

NOTES:

An entry by the pilot in the engine log book of all pertinent details is required.

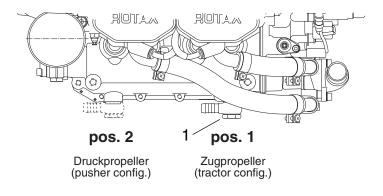
If by error engine was serviced with oil, which does not correspond with oil specification in the Operators Manual and the engine has been in operation for **less than 5 hours**, the following measures must be taken:

less than 5 hr.

Oil specification not respected									
Step	Procedure								
1	Oil change.								
2	Remove the lowest positioned banjo screw (1) (banjo bolt, plug screw or screw socket) and drain the remaining oil from the crankcase. Screw in banjo bolt or plug screw.  Tightening torque see Installation Manual 912 Series.								
3	Replace oil filter.								
4	Drain oil completely from oil cooler.								
5	Drain oil from oil tank.								
6	Refill oil tank with oil as specified, refer to Operators Manual.								
7	Purge air from oil system. See chap. 12-20-00, section: 11.7).								
8	Run engine for approx. 1 hour and replace oil and oil filter once more, as stated above.								

#### Graphic

## Position of the plug screw



Part	Function
1	plug screw

Fig. 5

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## MAINTENANCE MANUAL

## longer than 5 hr.

If the engine has been operated **longer than 5 hours** with engine oil not corresponding with specification in the Operators Manual the following work is required.

Oil specification not respected							
Step	Procedure						
1	Remove propeller gearbox.						
2	The gearbox must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.						
3	Carry out detailed inspection of the affected engine components.						
4	Oil change.						
5	Remove the lowest positioned banjo screw (1) (banjo bolt, plug screw or screw socket) and drain the remaining oil from the crankcase. Screw in banjo bolt or plug screw.  Tightening torque see Installation Manual 912 Series.						
6	Replace oil filter.						
7	Drain oil completely from oil cooler.						
8	Drain oil from oil tank.						
9	Refill oil tank with oil as specified, refer to Operators Manual.						
10	Purge air from oil system. See chap. 12-20-00, section: 11.7).						
11	Run engine for approx. 1 hour and replace oil and oil filter once more, as stated above.						

# 3.8) Spark plug not in accordance with specification

#### **General note**

If by error any of the spark plugs were installed which are not according to specification of the engine manufacturer and/or not genuine ROTAX parts, the following verification will be necessary.

	Spark plug not in accordance with specification								
Step	Procedure								
1	Mark position of the spark plugs (e.g. cyl. 1 top) and remove all spark plugs.								
2	Inspect the spark plugs for damage (formation of melt beads, burn off). At heavy melt beads or bad burn off, inspect the piston dome and cylinder wall by periscope. If parts are damaged, the engine must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.								
3	Inspect all systems for correct function.								
4	Detailed inspection of affected engine components.								
5	Inspect spark plug thread for damage (especially at bad burn off).								
6	Differential pressure check. See chap. 12-20-00 section: 5).								
7	Change oil and oil filter.								

•

#### MAINTENANCE MANUAL

# 3.9) Hard to turn over

**General** note

See Fig. 6.



Risk of electric shock!

Ignition "OFF" and system grounded! Disconnect negative terminal of aircraft battery.

## Inspection

Carry out inspection only on cold engine and before 1st start.

Engine runs sluggishly								
Step	Procedure							
1	Remove spark plug connector and remove 1 spark plug from each cylinder.							
2	Torque must be determined with a suitable jig. To do this, determine the maximum occurring torque on the propeller shaft necessary to move the whole crank drive. The torque must be max. 150 Nm (110.64 ft.lb).							
3	Carry out detailed inspection of the affected gearbox components.							
4	Carry out detailed inspection of crank drive.							

# Graphic

## Measuring torque required to turn crank drive

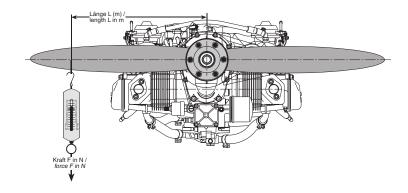


Fig. 6

#### MAINTENANCE MANUAL

# 3.10) Reporting

#### General note

According to the regulation of EASA part 21A.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.

NOTES: The form is also available from the official ROTAX AIR-

CRAFT ENGINES Homepage in electronic version.

www.rotax-aircraft-engines.com
Register: Document type/Diverses

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MAINTENANCE MANUAL

**NOTES** 

d02877.fm

## MAINTENANCE MANUAL

## Form

									(	)	:R38ML	ONE N	TELEPHO	
OPERATOR DESIGNATOR												ED BA:	SUBMITT	
	DISTRIC OFFICI		HER		СОММ	ACG	IFG		XAT AIA	СН		ОРЕЯ		REP. S
8. Comments (Describe the malfunction or defect and the circumstances under which it occurred. State probable cause and recommendations to prevent recurrence.)													Optional Information:	report is related to an aircraft  Incident; Date
			SERIAL NUMBER					Part/Defect Location			Serial Number		7. Date Sub.	
OPER. Control No.	ATA Code	1. A/C Reg. No.	MODEL/SERIES				JBLE	Serial No.		part)	Model or Part No.		Engine Condition	
ΓΔΧ	<b>ROTAX</b> ®		MANUFACTURER		ROTAX		SPECIFIC PART (of component) CAUSING TROUBLE	MFG. Model or Part No.		ENGINE COMPONENT (Assembly that includes part)	Manufacturer		Engine TSO	
			Enter pertinent data	2. AIRCRAFT	3. POWERPLANT	4. PROPELLER	5. SPECIFIC PART (of o	Part Name		6. ENGINE COMPONEN	Engine/Comp. Name		Engine TSN	

d02877.fm

Effectivity: 912 Series Edition 2 / Rev. 0

05-50-00

MAINTENANCE MANUAL

**NOTES** 

d02877.fm

MAINTENANCE MANUAL

Chapter: 12-00-00

# **MAINTENANCE OF THE SYSTEMS**

#### Introduction

The section "Maintenance of the systems" is associated with other sections. It serves only as a supplement to and further explanation of the maintenance check list (See 05-20-00).

NOTES:

For reasons of clarity, only headlines and keywords are listed in the Maintenance Schedule. Please refer to the

following pages for further explanation if needed.

As far as possible, the content has been arranged accord-

ing to system.

#### **Table of contents**

This chapter of the Maintenance Manual contains the most common maintenance procedures.

Subject	Chapter
Introduction	12-00-00
Replenishing operating fluids	12-10-00
Scheduled maintenance	12-20-00

MAINTENANCE MANUAL

**NOTES** 

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12-00-00

MAINTENANCE MANUAL

# Chapter: 12-10-00

# **REPLENISHING OPERATING FLUIDS**

Introduction

The engine should always be in a horizontal position before checking the fill levels.

**Table of contents** 

This chapter covers the steps required to replenish all operating fluids on the engine and also provides an overview of the fill capacities.

Subject	Page
General note	page 3
Fluid capacities	page 5
Cooling system Coolant check/replenish	page 7 page 7
Lubrication system Oil level check/replenish	page 9 page 9

MAINTENANCE MANUAL

**NOTES** 

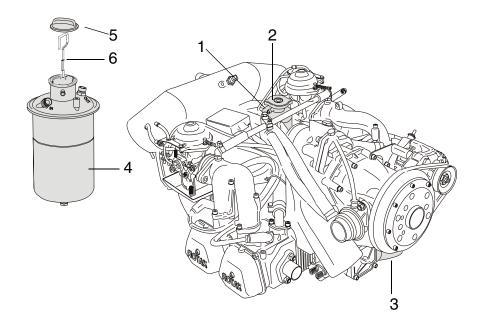
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12-10-00

# 1) General

# Servicing points on the engine



Part	Function
1	Expansion tank
2	Radiator cap
3	Oil filter
4	Oil tank
5	Oil tank cover
6	Oil dipstick

Fig. 1

MAINTENANCE MANUAL

**NOTES** 

d02879.fm

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#### MAINTENANCE MANUAL

# | 2) Fluid capacities

#### **General note**

# NOTICE

The operation of the engine may be adversely affected if non-approved or contaminated fuel, oil or coolant are used. Any mixing of different manufacturers and types should be avoided. The use of additives may result in damage.

## **System**

## Overview

System	Fill capacity	Details about the operating fluids
Fuel system	Refer to the relevant specifications provided by the aircraft manufacturer	Refer to the corresponding chapter in the Flight Manual
Cooling system	approx. 1.5 I (0.4 US gal.)	Refer to the corresponding chapter in the Installation Manual
Oil system	MIN mark corresponds to 2.5 I (0.66 US gal.) and MAX mark corresponds to 3.0 I (0.8 US gal.)	Refer to the corresponding chapter in the Installation Manual

MAINTENANCE MANUAL

**NOTES** 

d02879.fm

Effectivity: 912 Series Edition 2 / Rev. 0

12-10-00

#### MAINTENANCE MANUAL

# 3) Cooling system

# 3.1) Coolant check/replenish

#### **General note**



Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.



Risk of Burns!

Never open the radiator cap when the cooling system is hot. For safety's sake, cover cap with a rag and open slowly. Sudden opening of the cap could provoke the escape of boiling coolant and result in scalding.

#### Instruction

## See Fig. 2.

To refill the coolant the following steps are necessary.

Step	Procedure	
1	Open the radiator cap (1) on the expansion tank (2).	
2	Check the coolant level. The coolant level must be filled up to the top (see Sketch).	
3	Inspect coolant with densimeter or glycol tester. Strongly discolored or thickened coolant must be replaced.	
4	NOTICE  Use only coolant as recommended in the current Operators Manual.  If necessary, replenish with coolant of same composition.	
5	Tighten the radiator cap by hand.	
	NOTE: The radiator cap must be tightened until the stop lug is contacted.	

## Engine test run

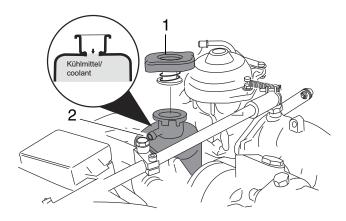
## Engine test run is necessary:

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 - 160 °F).
2	Switch the engine OFF.
3	Allow the engine to cool down.
4	Check for leaks.
5	Check the coolant level and top up with coolant as required.

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## MAINTENANCE MANUAL

# Graphic Coolant check/replenish



Part	Function	
1	Radiator cap	
2	Expansion tank	

Fig. 2

# 4) Lubrication system

# 4.1) Oil level check/Replenish

#### General note

**AWARNING** 

Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.

**△** WARNING

Risk of electric shock!

Ignition "OFF" and system grounded! Disconnect negative terminal of aircraft battery.

**Preparatory tasks** 

Before checking the oil level, make sure that there is not excess residue oil in the crankcase.

Instruction

See Fig. 3.

For checking and before replenish proceed as follows.

Step	Procedure	
1	Prior to oil level check, turn the propeller several times by hand in direction of engine rotation to pump all the oil from the engine to the oil tank.	
2	This process is completed when air flows back to the oil tank. This air flow can be perceived as a murmur (gurgling) when the oil tank cover (1) of the oil tank is removed.	
3	Pull out the oil dipstick (2).	
4	The oil level in the oil tank should be between the two marks (max./min.) on the oil dipstick, but must never fall below the min. mark. See Service Bulletin SB-912-040, "Introduction of a new oil dipstick", latest issue.	
5	NOTICE For longer flights replenish oil to max. mark to warrant more oil reserve.	
	During standard engine operation, the oil level should be mid-way between the max. and min. marks, as at higher oil level (over servicing), oil will escape via the venting passage see also SI-27-1997, "oil level check", latest issue. Difference between "max." and "min" mark = 0,45 I (0.95 liq.pt)	
6	Replenish oil as required.	
	Only use brand name oil in accordance with the latest Operators Manual and SI-912-016, "Selection of suitable operating fluids" latest issue.	
7	Check oil level - Marks on the oil dipstick.	
8	Fit the oil dipstick and tighten the oil tank cover (1) by hand.	

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## MAINTENANCE MANUAL

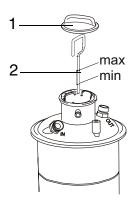
# Engine test run

# Engine test run is necessary:

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 - 160 °F).
2	Switch the engine OFF.
3	Allow the engine to cool down.
4	Check for leaks.
5	Check the oil level and top up with oil as required.

# Graphic

# Oil level check/Replenish



Part	Function	
1	Oil tank cover	
2	Oil dipstick	

Fig. 3

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## Introduction

This chapter relates in particular to the maintenance work mentioned in the Maintenance Schedule for the various engine systems and covers the work in more detail.

## Table of contents

This chapter contains information which is required to perform scheduled servicing on the engine.

Subject	Page
Introduction	page 1
Engine cleaning	page 3
Checking the air filter Cleaning the dry air filter Replacing the dry air filter	page 5 page 5 page 7
Visual inspection Checking the engine suspension Corrosion	page 9 page 9 page 10
Leakage check	page 11
Checking the compression Checking the compression for fault-tracing	page 13 page 15
Checking the V-belt tension	page 17
Locking the crankshaft	page 19
Test run of engine	page 21
Cooling system Checking the cool system Replacing the coolant Flushing the cooling system Expansion tank, Radiator cap Overflow bottle Accessories	page 23 page 23 page 24 page 26 page 27 page 29 page 29
Fuel system Carburetor synchronization Mechanical synchronization Pneumatic synchronization Idle speed check Operating range check Checking of the float chamber Idle speed adjustment Checking the carburetor actuation	page 31 page 31 page 32 page 34 page 38 page 39 page 41 page 43 page 44

## MAINTENANCE MANUAL

Subject	Page
Lubrication system	page 47
Oil change	page 49
Oil filter replacement	page 50
Install oil filter	page 51
Inspection of the oil filter insert	page 52
Cleaning the oil tank	page 54
Purging the oil system	page 56
Inspecting the magnetic plug	page 57
Installation of the magnetic plug	page 58
Flushing the oil circuit	page 59
Electric system	page 61
Check of wiring	page 62
Inspection and replacement of spark plugs	page 63
Inspection of spark plugs	page 64
Installation of spark plug	page 65
Propeller gearbox	page 67
Checking the friction torque in free rotation	page 67
Checking the propeller gearbox	page 69

#### MAINTENANCE MANUAL

## 1) Engine cleaning

#### General note

## NOTICE

Do not use easily inflammable liquids or caustic cleaning agents for cleaning the engine.

## NOTICE

When cleaning the engine, the dissolved residues of fuel, oil and other environment-contaminating agents are rinsed off. Collect the cleaning water and dispose of it in accordance with applicable environmental regulations.

#### Cleaning agents

Use of a commercially available cold cleaning agent for the engine is recommended. See chap. 05-00-00 section: 1.5).

#### Cleaning

## NOTICE

Never clean an engine with a high pressure cleaner. This is detrimental to the electrical installations and shaft seals. Oxidation of the various components and their failure are the consequence.

## NOTICE

Before cleaning, all openings through which cleaning agents and/or dirty water could enter the engine must be closed off. Failure to do this may result in engine damage!

NOTES: Always clean engine in cold state.

If necessary, the engine must be cleaned with due care. Repair leaks as required before cleaning.

## After each cleaning

After each cleaning procedure, dry all electrical components such as

- Battery
- Ignition unit
- Spark plug connector
- Clamp connections etc.

by use of compressed air to prevent leakage current.

MAINTENANCE MANUAL

**NOTES** 

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Effectivity: 912 Series Edition 2 / Rev. 0 12-20-00

#### MAINTENANCE MANUAL

## 2) Checking air filter

#### General note

NOTICE

In the event of dust formation, clean air filter at correspondingly shorter intervals. If filter mat is damaged, replace air filter.

NOTICE

A dirty filter insert will not only reduce the engine performance but might also promote premature wear of the engine.

Carry out visual inspection of dry air filter after prescribed maintenance interval. Clean dirty air filter as described in aircraft manufacturers Maintenance Manual.

# 2.1) Cleaning the dry air filter

#### General note

**NOTICE** 

Never use gasoline, steam, caustic liquids, strong detergents, particle cleaning agents or high pressure cleaners during this step.

NOTICE

Do not dry over naked flame, with compressed air or with hot air gun.

#### Cleaning

To clean the dry filter the following steps are necessary: See Fig. 1 and Fig. 2.

Step	Procedure
1	Lightly tap and brush off surface dirt (A).
2	Spray K&N filter cleaner onto filter surface and leave to soak for approx. 10 min. ( <b>B</b> ).
3	Rinse air filter with low pressure water from inside to outside and let element dry naturally ( <b>C</b> ).

## MAINTENANCE MANUAL

# Graphic Cleaning of the filter

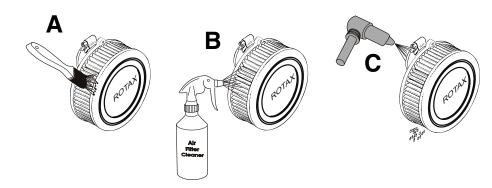
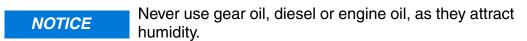


Fig. 1

## After cleaning



NOTES: Each filter pleat must be sprayed with oil.

After 5 to 10 min. the filter will be soaked with oil, noticeable by the uniform red coloring.



Fig. 2

# 2.2) Replacing the dry air filter

## **General note**

See Fig. 3.



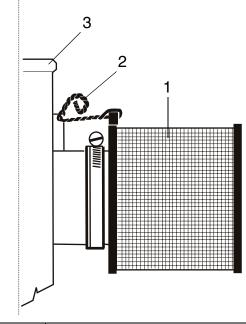
Each air filter must be secured by clamp attachment and a wire securing element. See chap. 05-00-00 section: 1.6). Filter connection must be free of oil.



Attach new air filter, free of grease, at connection faces, and wire-secure against loss.

## Graphic

Only use dry type air filters which are specified by the aircraft manufacturer and from ROTAX.



Part	Function
1	Air filter
2	Safety wire
3	Carburetor

Fig. 3

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MAINTENANCE MANUAL

**NOTES** 

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#### MAINTENANCE MANUAL

## 3) Visual inspection

#### General note

General visual inspection of the engine for damage or abnormalities. For definition and scope of visual inspection (See chap. 05-20-00 section: 3).

#### **Abnormalities**

Take note of changes caused by temperature influence.

During a visual inspection you should focus on the following points in particular:

- Exhaust system
- Engine suspension frame
- Heat shrink sleeve
- Pressure sensor, temperature sensor
- Heat protection plates
- Wiring harness
- Venting hoses (carburetor, oil tank)

# 3.1) Checking the engine suspension

#### **General** note



Exactly observe the tightening torques for screws and nuts. Overtightening or too loose connection could cause serious engine damage.

# Checking the engine suspension

Step	Procedure
1	Verify the engine suspension points on the crankcase for tight fit and damage including cracks.
2	Inspect the surroundings of engine attachment on crankcase and gearbox. If there is discoloration of the crankcase around the attachment points (black ring), there may be loose attachments.
3	Inspect engine isolating mounts including for heat damage, wear and cracks.

#### MAINTENANCE MANUAL

# 3.2) Corrosion

#### **Definition**

Corrosion is a natural process which attacks and potentially damages metals via an electro-chemical reaction. For more detailed information about different types of corrosion and corresponding methods for dealing with corrosion refer to the FAA Advisory Circular AC 43.13. See chapter "AC 43.13-1B Maintenance and Repair".

#### MAINTENANCE MANUAL

## 4) Leakage check

#### **General note**

NOTICE

Leaking connections can lead to engine problems or engine failure!

Visual inspection of the whole engine for leaks. If leaks are visible, locate the cause and remedy the fault.

#### Instruction

NOTES:

If a leak is suspected, then the following check is possible:

Step	Procedure
1	Cleaning the engine.
2	Operate the engine until the temperatures have stabilized for a period of 5 min (engine oil temperature between 50 to 70 °C (122 - 160 °F).
3	Switch off ignition and secure engine against unintentional operation. Secure aircraft against unauthorized operation.
4	After shut down of engine no liquid must drip down.

## Water pump

Checking water pump for leaks.

If the leakage bore, located at the base of the ignition housing, is dripping oil, the oil seal on the water pump shaft may be defective and must be replaced. In the case of coolant drips at the leakage bore, the coolant mechanical seal must be replaced (inspect the quality of the coolant).

#### **Fuel lines**

Inspect fuel lines, their connections and screw fasteners. Look for scuffing marks.

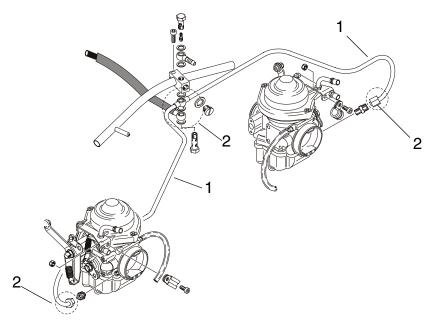


Avoid overstretching the fixing elements. Always comply with the specified torque!

Detailed visual inspection specially on steel fuel lines in the area of connections (fittings) (2) for leaks and cracks is necessary. See Fig. 4.

#### MAINTENANCE MANUAL

## Graphic Connections and fuel lines



Part	Functions
1	Fuel lines (Steel)
2	Connections (Fittings)

Fig. 4

## Fuel pump

Inspect isolating flange of fuel pump for leaks.

#### **Coolant hoses**

Check coolant hoses and connections and fittings for leakage. Examine the surrounding area to see if there are any leaks!

## Oil lines

Inspect all oil feed lines from the oil tank to the oil cooler and to the engine. Also inspect the oil return line from the crankcase to the oil tank. Check the pressure oil line from the oil pump to the governor flange of the governor and the suction oil line from the turbocharger to the oil pump (especially in the area of the fixation screw).

# Hose clamps, kinks

Check all hoses, particularly in the area of the hose clamps and hose connections, for porosity, damage and kinks. If damage is detected, replace hose immediately.

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#### MAINTENANCE MANUAL

# 5) Checking the compression

**General** note

See Fig. 5.

**△** WARNING

Risk of electric shock!
Ignition "OFF" and system grounded!

## **Special tools**

To measure the compression pressure the following special tools and equipment are necessary.

Part number	Description
n.a.	Compressed air approx. 6 bar (87 psi).
n.a.	2 pressure gauges.
n.a.	Orifice jet*, of 1mm (0.04 in) inner diameter and 3 mm (0.12 in) length.  * or equivalent e.g. orifice diameter 0.040 in., long 0.0250 in., 60° degree approach angle according to AC43.13, latest issue.
n.a.	Adapter to spark plug thread.
n.a.	Connect line.

## Instruction

Testing is carried out using the **differential pressure test procedure**.

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 - 160 °F).
2	Started with cylinder head 1 move piston to TDC position.
3	Remove the upper spark plugs. Prevent dirt or other foreigner particles from penetrating the engine (A).
4	Screw adaptor (1) into the spark plug thread and connect up the two pressure gauges (2) with the orifice jet (3) between them ( <b>B</b> ).
5	Now put constant pressure, between 5,5-6 bar (80-87 psi) on the line and take readings at pressure gauge ( <b>C</b> ).
6	Repeat this proceeding at all 4 cylinder heads.

#### Value

The maximum permissible pressure drop is 25 %, e.g. from 6 to 4.5 bar (87 psi to 65 psi) (**D**).

If the pressure loss is less than 25% then the valve seats and piston rings are working properly. The spark plug has to be installed according to chap. 12-20-00 section: 14.2).

If the value is over 25% inspection, repair or overhaul must be carried out in accordance with the BRP-Powertrain instructions for continued airworthiness.

- Detailed inspection of affected engine components.

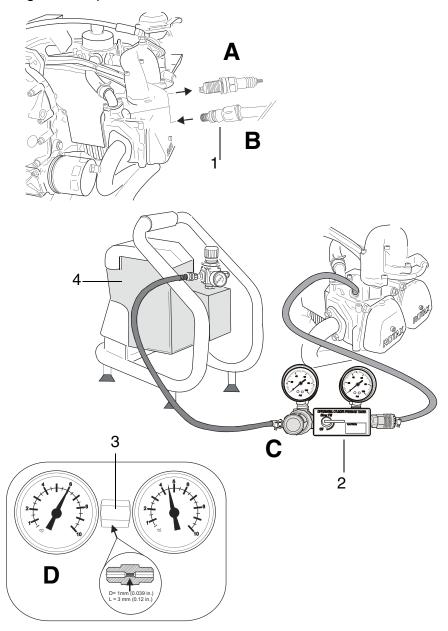
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Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

# MAINTENANCE MANUAL

# Graphic Checking the compression.



Part	Function
1	Adaptor
2	Manometer/Test gauges set
3	Orifice jet
4	Compressor

Fig. 5

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Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

#### MAINTENANCE MANUAL

# 5.1) Compression check for fault-tracing

#### **General** note

In the course of fault-tracing a **compression check** can also be performed.

A compression tester is required to check compression. The compression should be between 9 and 12 bar (130 and 174 psi).

#### Instruction

Compression check for fault-tracing.

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 - 160 °F).
2	Unscrew and remove top spark plugs.
3	Press compression tester (1) over the spark plug hole and use the starter to turn the engine over with open throttle until maximum pressure is reached.
4	Successively take readings on all four cylinders and compare results.

#### Measurement

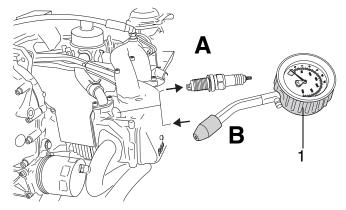
Individual readings for the cylinder must not differ by more than 2 bar (29 psi).

If the value is below 6 bar (87 psi), inspection, repair or overhaul must be carried out in accordance with the BRP-Powertrain instructions for continued airworthiness.

- Detailed inspection of affected engine components.

## Graphic

# Compression check for fault-tracing



Part	Function
1	Compression tester

Fig. 6

MAINTENANCE MANUAL

**NOTES** 

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Edition 2 / Rev. 0

# 6) Checking the V-belt tension

**General note** 

See Fig. 7.

In the case of configurations with additional auxiliary generator, inspect attachment and V-belt tension.

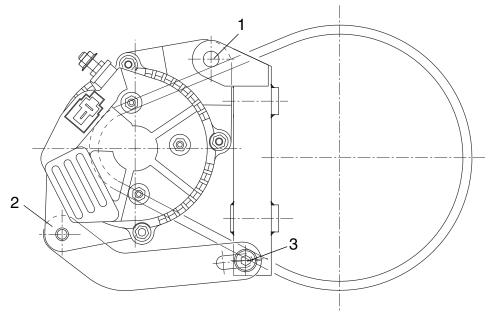
**Belt tension** 

To adjust the belt tension:

Step	Procedure
1	Loosen the hex. screw (1) M10 and the two M8 allen screw (2) and (3).
2	Press the alternator upwards and tighten allen screw (3).
3	Then tighten hex. screw (1) M10 with tightening torque 40 Nm (30 ft.lb) and allen screw M8 (2) with tightening torque 22 Nm (195 in.lb).

Graphic

# Checking the V-belt tension



Part	Function
1	Hex. screw M10
2, 3	Allen screw M8

Fig. 7

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Effectivity: 912 Series Edition 2 / Rev. 0

# MAINTENANCE MANUAL

Checking the Vbelt tension Inspect V-belt tension as per drawing below.

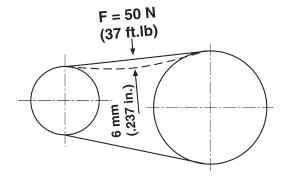


Fig. 8

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Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

## MAINTENANCE MANUAL

# 7) Locking the crankshaft

General note

See Fig. 9.

NOTES:

The thread bolt for crankshaft locking is part of the stan-

dard tool kit supplied with each engine.

Locking the crankshaft



Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient tempera-

ture before start any work.

The following work procedures are to be accomplished:

Step	Procedure
1	Remove the plug screw (1) M8x20 and sealing ring from the crankcase half (cyl. 2/4).
2	Turn crankshaft/propeller shaft until the piston of cyl. no. 1 and no. 2 are in TDC position and lock crankshaft in this position with the thread bolt (2) part no. 240880.
	NOTES: Turn crankshaft for relief the position indification until the trig ger boss (3) is between the both trigger coil (4, 5) at the position.
	The required recess position of the crankshaft can be additionally verified by looking through the crankcase recess (6 with a flash light.
3	Screw the thread bolt (2) into the crankcase. While doing so, move the crank shaft to and fro slightly with the ring spanner until the locking screw engages in the recess (6) of the crankshaft, and tighten to 10 Nm (88.48 in.lb).

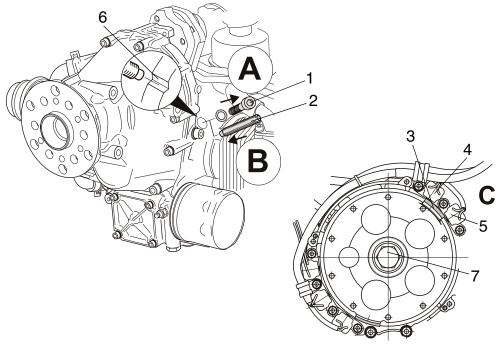
# Loosen the crankshaft

# After completion of work/check:

Step	Procedure
1	Remove the thread bolt (2) and refit crankshaft plug screw M8x20 (1) along with a new sealing ring with a torque of 15 Nm (133 in.lb).
2	To check, use wrench 24 mm (15/16 inch.) to rotate the crankshaft at hex. screw (7) on the magneto side.

# MAINTENANCE MANUAL

# Graphic Locking the crankshaft



Part	Function
1	Plug screw M8x20
2	Thread bolt
3	Trigger boss
4,5	Trigger coils
6	Crankshaft
7	Hex. screw M16x1,5x40

Fig. 9 08530,08531

#### MAINTENANCE MANUAL

# 8) Test run of engine

#### **General note**



Danger of life threatening injuries caused by the propeller, rotating and stressed parts of the engine! Always observe the engine from a safe place while it is running. Check that the cockpit is occupied by a competent operator.

# Preparation

Preparation of the engine for test run:

- Ensure that all the operating fluids (engine oil, coolant, fuel) are replenished to the specified level.
- Make sure that no loose objects (e.g. tools) are left in the engine compartment.
- Inspect tight fit of the propeller.
- Anchor the aircraft suitably to the ground and fix wheel chocks. Ensure that the propeller zone is clear and safe before starting the engine.

### Test run

# Test run as follows:

Step	Procedure
1	Establish fuel supply (open fuel cock).
2	Activate choke.
3	Throttle lever to idle position.
4	Master switch "ON".
5	Ignition for both ignition circuits "ON".
6	Press starter switch for max. 10 sec. (followed by a cooling period of 2 min.).
7	After engine start, observe oil pressure. Oil pressure has to be built up within 10 sec.
8	Let engine run for approx. 2 min. at 2000 rpm. Then first use the throttle lever to bring the engine to approx. 2500 rpm and then run through warming up period, until the oil temperature reaches 50 °C (122 °F).
9	Check temperatures and oil pressure: At a steady oil temperature above 50 °C (122 °F) and oil pressure above 2 bar (29 psi) engine speed may be increased.
10	Ignition check as per the current Operators Manual.
11	Conduct a short full throttle run and check that the engine reaches the max. full power speed. Consult the pilot's operating handbook for maximum speed, as it depends on the propeller used.
12	After full-load run, conduct a short cooling run to prevent formation of vapour lock in cylinder heads. This is necessary to prevent steam locks in the cooling and fuel system after shut-down.
13	Shut engine down.
	NOTE: On switching off the engine switch off ignition and withdraw the ignition key.

d02880.fm

Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

#### MAINTENANCE MANUAL

Engine oil and coolant



Risk of Burns!

Never open the radiator cap when the cooling system is hot. For safety's sake, cover cap with a rag and open slowly. Sudden opening of the cap could provoke the escape of boiling coolant and result in scalding.

Replenish engine oil and coolant as required once engine has cooled down.

Oil filter



If the oil filter has been replaced, re-tighten by hand after the trial run on a cold engine.

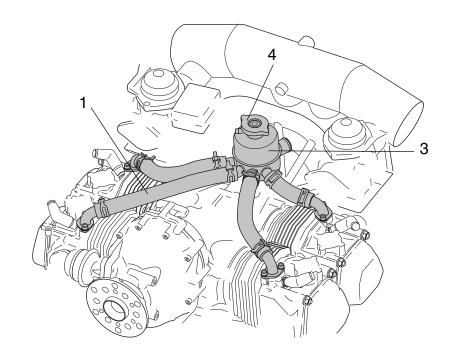
**Check of leaks** 

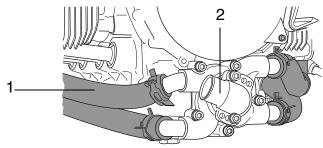
Inspect the engine for oil, fuel or coolant leaks and repair as necessary.

# 9) Cooling system

# 9.1) Checking the cooling system

# Overview





Part	Function
1	Coolant lines
2	Water pump
3	Expansion tank
4	Radiator cap with gasket

Fig. 10

#### MAINTENANCE MANUAL

General note

**⚠** WARNING

Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.

See Fig. 10.

**Coolant hoses** 

Carry out visual inspection of all coolant hoses (1) for damage, leaks, hardening as a result of heat and porosity.

Water pump

Inspect all connections on the top and bottom of the cylinder head and on the water pump (2).

**Expansion tank** 

Inspect expansion tank (3) for damage. Inspect protection rubber at the bottom of the tank for tight fit.

Radiator cap

Inspect the gasket of the radiator cap (4) and check the pressure release valve and return valve for proper operation.

See chap. 12-20-00 section: 9.4).

#### 9.2) Replacing the coolant

General note



Risk of Burns!

Never open the radiator cap when the cooling system is hot. For safety's sake, cover cap with a rag and open slowly. Sudden opening of the cap could provoke the escape of boiling coolant and result in scalding.

**NOTICE** 

Use only coolant as recommended in the current Operators Manual.

See Fig. 11.

Instruction

To replace the coolant the following steps are necessary:

Step		Procedure
1	Open the rac	liator cap on the expansion tank.
2	Remove the (2).	bottom attachment screw (1) (with sealing ring) of water pump
3	Drain the engine coolant.	
	NOTES:	If the radiator is located below the engine, also detach the lowest positioned coolant hose.
4	Fit attachme to 10 Nm (90	nt screw (stainless steel) along with a new sealing ring. Tighten 0 in.lb).

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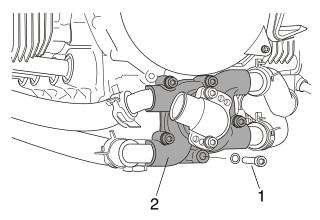
October 01/2009

# MAINTENANCE MANUAL

Step		Procedure
5		peing replaced with a different type, (conventional coolant, it) the cooling system must be flushed. See chap. 12-20-00
6		d coolant into the expansion tank (highest point of the cooling ap. 12-10-00 section: 3.1).
7	Fit radiator cap.	
8	NOTES:	Run the engine briefly and replenish with clean coolant as required.

# Graphic

# Replacing the coolant



Part	Function
1	Attachment screw (stainless steel)
2	Water pump

Fig. 11

## MAINTENANCE MANUAL

# 9.3) Flushing the cooling system

## **General** note



Hot steam can cause scalds in the face and on hands! Never open the radiator cap when the cooling system is hot. For safety's sake, cover cap with a rag and open slowly.

# Instruction

To flush the coolant the following steps are necessary:

Step		Procedure
1	The system is	flushed using pure water at a pressure of 2 bar (29 psi).
	NOTICE	Where water-free coolant is used, the cooling system must be drained of water correspondingly after flushing. The residual water must not exceed the max. permissible limit prescribed by the coolant manufacturer.
	NOTES:	For the flushing, open the lowest located coolant hose (either at water pump or radiator).
2		xed coolant into the expansion tank (highest point of the cooling chap. 12-10-00 section: 3.1).
3	Fit radiator cap	0.
4	NOTES:	Run the engine for a minute and replenish coolant as required.

# 9.4) Expansion tank, radiator cap

#### **General note**

See Fig. 12.

To equalize pressure in the cooling system, an expansion tank is required. If the pressure in the system rises above 1.2 bar (17.4 psi) as the coolant warms up, the pressure relief valve (1) opens and the coolant can flow into the expansion tank via the line (5). When the coolant cools down, the return valve (2) opens and the coolant is sucked back.

NOTES:

On older engines a radiator cap with opening pressure of 0.9 bar (13.0 psi) can be installed. See SI-912-020 "Running Modification", latest issue.

## Radiator cap

Inspect the rubber seal (3), the pressure spring (4) and the two valves incorporated in the radiator cap for damage and leaks. If necessary, replace with a new original radiator cap with 1.2 bar (17.4 psi) (6) opening pressure.

NOTES:

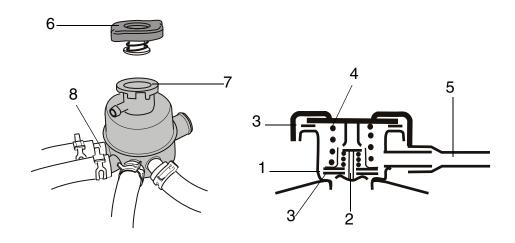
The radiator cap must be tightened fully on the expansion tank.

#### **Expansion tank**

Inspect sealing surface (7) and tube connection (8) of the expansion tank. Carry out visual inspection of tank for damage and scuffing marks.

#### Graphic

Checking Expansion tank, radiator cap.



Part	Function
1	Pressure relief valve
2	Return valve
3	Rubber seal

Effectivity: 912 Series
Edition 2 / Rev. 0

# MAINTENANCE MANUAL

Part	Function
4	Pressure spring
5	Connection to overflow bottle
6	Opening pressure of the radiator cap
7	Sealing surface
8	Tube connections

Fig. 12 08534,07620

## MAINTENANCE MANUAL

# 9.5) Overflow bottle

**General note** 

See Fig. 13.

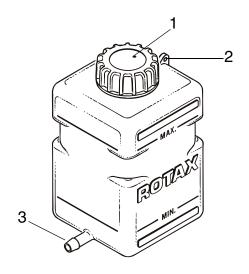
Instruction

Checking overflow bottle.

Step	Procedure
1	Inspect the bottle for damage.
2	Check the venting bore (1) in the screw cap (see Service Bulletin SB-912-039, "Modification of the overflow bottle", latest issue).
3	Inspect bracket (2) for the safety wire.
4	Check hose connection (3).

# Graphic

Overflow bottle



Part	Function
1	Venting bore
2	Bracket
3	Hose connection

Fig. 13

08536

# 9.6) Accessories (including radiator, radiator hoses, hose clamps, cooling air ducts)

**General note** 

NOTICE

Equipment is to be inspected in accordance with the Maintenance Manual of the aircraft manufacturer.

MAINTENANCE MANUAL

**NOTES** 

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# 10) Fuel system

# 10.1) Carburetor synchronization

# Idle speed

# Checking the synchronization at idle speed

See Fig. 14.

For smooth idling, synchronization of the throttle valves is necessary. When synchronizing, slacken both bowden cables (throttle lever lies close on the adjustment screw).

# Instruction

To synchronize when idling the following steps are necessary.

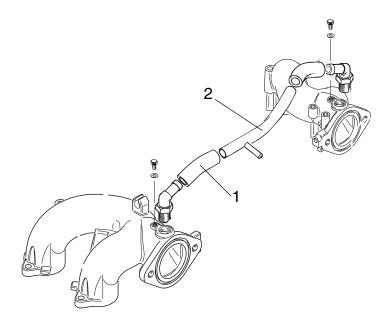
Step	Procedure
1	Detach the resonator hose (1) of the compensating tube (2) to separate the two air intake systems. In this condition, a slight difference in the engine running should be noticeable.

NOTES:

First the mechanical synchronization and then only the pneumatic synchronization has already been carried out.

## Graphic

Synchronization at idle speed



Part	Function
1	Resonator hose
2	Compensating tube

Fig. 14

#### MAINTENANCE MANUAL

# 10.2) Mechanical synchronization

#### General note

See Fig. 15.



Danger of life threatening injuries caused by the propeller, rotating and stressed parts of the engine! Always observe the engine from a safe place while it is running.

# Basic throttle adjustment

For synchronous basic throttle adjustment proceed as follows.

Step	Procedure
1	Remove cable fixation (4) on throttle lever (1).
2	Return the throttle lever (1) to its idle stop position (3) by hand. There should be no resistance during this procedure.
3	Unscrew idle speed adjustment screw (2) until it is free of the stop.
4	Insert a 0.1 mm (0.004 in.) feeler gauge (gap X) between the idle speed adjustment screw (2) and the carburetor idle stop (3), then gently turn the idle screw clockwise until contact is made with the 0.1 mm (0.004 in.) feeler gauge.
5	Pull out the feeler gauge and then turn each idle speed adjustment screw (2) 1.5 turns counter clockwise.
6	Gently turn each idle mixture screw (6) (clockwise) until it is fully inserted and then reopen by 1.5 turns counter clockwise.
7	Check that the throttle valve opens fully automatically.
8	Adjust the two bowden cables for simultaneous opening of the throttle valves.

Carry out the above procedure on both carburetors.

# **Synchronization**

You must at this point place the throttle lever in the cockpit to the idle stop position. It is an advantage at this point to enlist the help of an assistant to ensure that the throttle lever remains in this position during the next steps of the synchronization process.

Step	Procedure
1	As soon as the throttle lever in the cockpit remains is in the idle stop position, check the throttle valve lever (1) to the carburetor idle stop position (3).
2	Using the cable fixation (4), secure the bowden cable accordingly.
3	As soon as the two carburetor bowden cables are installed (throttle lever in cockpit in idle position), you must check that the idle speed adjustment screw (2) rests fully on the idle stop (3) without pressure.

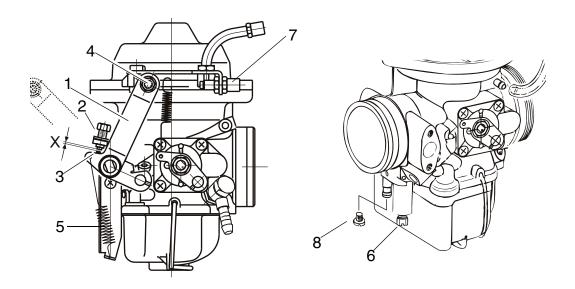
# MAINTENANCE MANUAL

Step		Procedure
4	NOTICE	An idle speed which is too low can result in gearbox wear, and if the idle speed is too high, the engine is harder to start.
		and verify the idle speed. If the idle speed is too high or too rdingly with idle speed adjustment screw (2).
5	Check the true running of the engine. If necessary, adjust with the idle mixture screw (6). See chap. 12-20-00 section: 10.5).	

Carry out the above procedure on both carburetors.

# Graphic

# Mechanical synchronization



Part	Function
1	Throttle valve lever
2	Adjustment screw
3	Idle stop position
4	Cable fixation
5	Return spring
6	Idle mixture screw
7	Idle adjustment
8	Plug screw M3.5x5

Fig. 15

#### MAINTENANCE MANUAL

# 10.3) Pneumatic synchronization

General note

See Fig. 16 to Fig. 19.

**△** WARNING

Danger of life threatening injuries caused by the propeller, rotating and stressed parts of the engine! Always observe the engine from a safe place while it is running.

NOTES:

Perform a mechanical synchronization before attempting a pneumatic synchronization.

Special tool

The two carburetors are adjusted to equal flow rate at idling with a suitable flow meter or vacuum gauge(s).

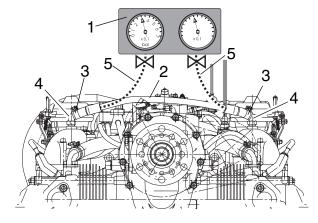
Connection

Possible connection methods.

Option 1		
Step	Procedure	
1	Remove the compensating tube (2) from the push on angular tube (4) after removing the two clamp (3).	
2	Using the push on angular tube (4) and compensating tube (2) install a flexible rubber hose (5) leading to the vacuum gauge (1).	

Graphic

Option 1



Part	Function
1	Vacuum gauge
2	Compensations tube
3	Clamp
4	Angular tube
5	Rubber hose

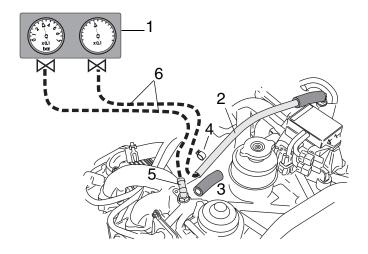
Fig. 16

# MAINTENANCE MANUAL

Option 2		
Step	Procedure	
1	Remove one end of the compensating tube (2) and tube (3) from the push on angular tube (5) after removing the two tension clamp (4).	
2	Using the push on angular tube (5) and compensating tube (2) install a flexible rubber hose (6) leading to the vacuum gauge (1).	

# Graphic

# Option 2



Part	Function
1	Vacuum gauge
2	Compensating tube
3	Tube
4	Clamp
5	Angular tube
6	Rubber hose

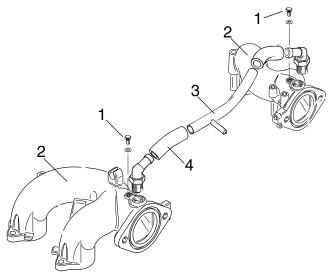
Fig. 17

# MAINTENANCE MANUAL

	Option 3		
Step	Procedure		
1	Remove hex. screw (1) M6x6 from intake manifold (2) and connect the vacuum gauge.		
2	Remove the compensating tube (3) with attached tubes (4) (connection between intake manifolds) and plug the fittings in the intake manifolds.		
3	After synchronization tightened the screw M6x6 (1) with LOCTITE 221.		

# Graphic

# Option 3



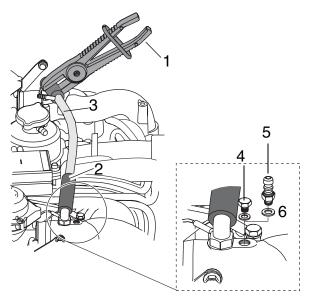
Part	Function
1	Hex. screw M6x6
2	Intake manifold
3	Compensating tube
4	Tube

Fig. 18

# MAINTENANCE MANUAL

Option 4		
Step	Procedure	
1	Install the vacuum gauge.	
2	Clamp the tube (2) with hose clamping pliers (1). Observe the position! The compensation tube (3) must not removed.	
3	Unscrew the screw (4).	
4	Install the hose nipple M6 (5) with the sealing ring (6).	
5	After synchronization tightened the screw M6x6 (4) with LOCTITE 221.	

# Graphic Option 4



Part	Function
1	Clamping pliers
2	Tube
3	Compensation tube
4	Screw
5	Hose nipple
6	Sealing ring

Fig. 19

#### MAINTENANCE MANUAL

# 10.3.1) Idle speed check

#### General note

Before proceeding, secure the aircraft on the ground using wheel chocks and ropes.



Risk of life threatening injuries caused by propeller! Secure the propeller region before test run watch it. Secure a safe area around propeller during test run.

Start the engine and verify the idle speed. If necessary correct as per chap. 12-20-00 section: 10.5).

## Setting of more than 1/2 turn

If a setting of more than 1/2 turn is required, repeat mechanical synchronization to prevent too high a load on the idle stops. If the idle speed is too high, the maximum the idle screw can be unscrewed is complete turn.

# No satisfactory result

If an unsatisfactory result is achieved, inspect the idle jets for contamination and clean if necessary.



Also check for translucent, jelly-like contamination. Inspect for free passage.

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#### MAINTENANCE MANUAL

# 10.3.2) Operating range check

#### General note

Once the proper idling speed has been established, it is necessary to check the **operating range above the idle speed**.

First establish that the engine is developing full take-off performance or take-off rpm when selected in the cockpit. Then the setting of the operating range (idle to full throttle) can be checked or adjusted.

#### **Procedure**

To control the operating range above idling the following steps are necessary. See Fig. 20.

Step		Procedure	
1	that both	warm up engine (See Operators Manual). Select full power and check pressure gauges are registering the same readings. The reading is not made on both gauges.	
	Step	Procedure	
	1	Shut down the engine.	
	2	Check that carburetor actuation effects full travel and that starting carburetors (choke) are in the full off position.	
	3	If necessary, fit/modify the carburetor actuation as required to achieve full power on both carburetors.	
2	Once full	power has been established on both carburetors, retard the throttle	
_	and observe the pressure gauge settings. The pressure gauges should street the same reading for both carburetors.		
	NOTES: Discrepancies must be compensated for by adjusting the of idle adjustment (1).		
	Step	Procedure	
	1	Shut down the engine.	
	2	Loosening the locknut on the bowden cable and adjusting the off idle adjustment.	
	3	Tightening the locknut.	
	4	Re-testing the engine.	
3	Final idle speed adjustment may be required by resetting the idle speed adjustment screws (2).		
4	Equal adj	Equal adjustment must be made on both carburetors.	
5	Any major adjustments required necessitate replaced verification of all parameters mentioned in this procedure.		

#### MAINTENANCE MANUAL

# **Assembly**

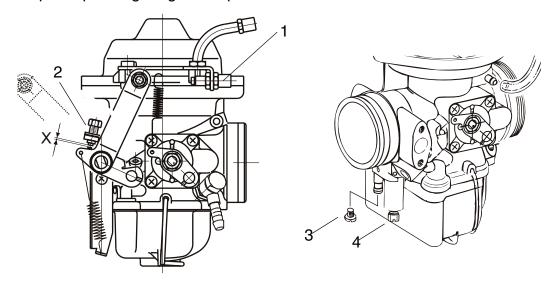
# **NOTICE**

Follow the instructions of the instrument manufacturer.

- Install compensation tube assy. on engine in reverse sequence of removal. Any minor differences in balance at idle speed will be compensated for.
- Refit the screw plug M3.5 (3) and hex. screws M6x6 with gasket (pos. 1 Fig. 18).

# Graphic

# Inspect operating range/idle speed



Part	Function
1	Idle adjustment
2	Idle speed adjustment screw
3	Screw plug M3.5x5
4	Idle mixture screw

Fig. 20

#### MAINTENANCE MANUAL

# 10.4) Checking of the float chamber

**General** note

See Fig. 21.



Risk od Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.

#### Instruction

To check of the float chamber the following steps are necessary:

Step	Procedure
1	Remove drip tray (1).
2	Open spring clip (2).
3	Remove float chamber (3) with gasket (4) and both float.
4	Remove both float (5) from the float chamber.
5	Inspect the float chamber for contamination and corrosion.

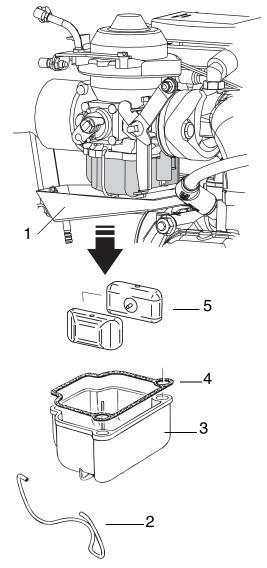
# NOTICE

If any contamination on float chamber the find out what the cause is and take corresponding action to rectify the problem. Inspect and clean the complete fuel system including carburetor.

Step	Procedure	
6	Assembly at the float chamber should be carried out analogously the disassembly.	
7	Adjust with the idle speed adjustment. See chap. 12-20-00 section: 10.5).	

# MAINTENANCE MANUAL

# Graphic Float chamber



Part	Function
1	Drip tray
2	Spring clip
3	Float chamber
4	Gasket
5	Float

Fig. 21

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Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

#### MAINTENANCE MANUAL

# 10.5) Idle speed adjustment

#### General note

See Fig. 20.



If satisfactory idle speed adjustment cannot be achieved, inspection of the idle jet or additional pneumatic synchronization will be necessary. See chap. 12-20-00 section: 10.3).

# Idle adjustment

Always carry out idle speed adjustment when the engine is warm.

 Basic adjustment of the idle speed is first effected using the idle speed adjustment screw (2) of the throttle valve.
 See chap. 12-20-00 section: 10.2).

# Optimizing engine running

Necessary only if not taken care of at synchronization.

Step	Procedure	
1	Close idle mixture screw (4) by turning clockwise to screw in fully and then opening again by 1.5 turns counter clockwise.	
2	Starting from this basic adjustment, the idle mixture screw (4) is turned until the highest idle speed is reached.	
3	The optimum setting is the middle between the two positions at which an rpm. drop is noticed.	
4	Then readjustment of the idle speed is carried out using the idle speed adjustment screw (2) and if necessary, by slightly turning the idle mixture screw again.	
	NOTES:	Turning the idle mixture control screw in clockwise direction results in a leaner mixture and turning counter clockwise in a richer mixture.

#### MAINTENANCE MANUAL

# 10.6) Checking the carburetor actuation

#### General note

See Fig. 22.

Route bowden cables in such a way that carburetor actuation will not be influenced by any movement of engine or airframe, thus possibly falsifying idle speed setting and synchronization.

NOTES:

Each carburetor is actuated by two bowden cables. At position (1) connection for throttle valve, and at position (2) connection for choke actuation.

**⚠ WARNING** 

Risk of life threatening injuries caused by propeller! Adjust bowden cables so that the throttle valve and the choke actuation of the starting carburetor can be fully opened and closed. Bowden cables and lever must not jam!

**△WARNING** 

Risk of life threatening injuries caused by propeller! With carburetor actuation not connected, the throttle valve is fully open. The initial position of the CD carburetor is **full throttle**! So never start the engine with the actuation disconnected.

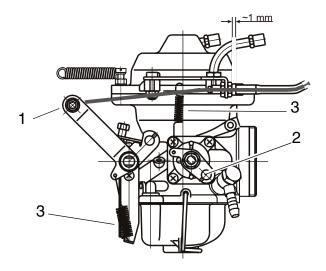
#### **Procedure**

To test the carburetor actuation the following steps are necessary:

Step	Procedure
1	Inspect bowden cables and levers for free movement.
2	Bowden cable must allow full travel of lever from stop to stop.
3	Adjust throttle cables to a clearance of 1mm (0.04 in).
4	Inspect and lubricate linkage on carburetor and carburetor joints with engine oil.
5	Inspect return springs (3) and inspect engagement holes for wear.

# MAINTENANCE MANUAL

# Graphic Checking the carburetor actuation



Part	Function
1	Connection for throttle valve
2	Connection for choke actuation
3	Return springs

Fig. 22

MAINTENANCE MANUAL

**NOTES** 

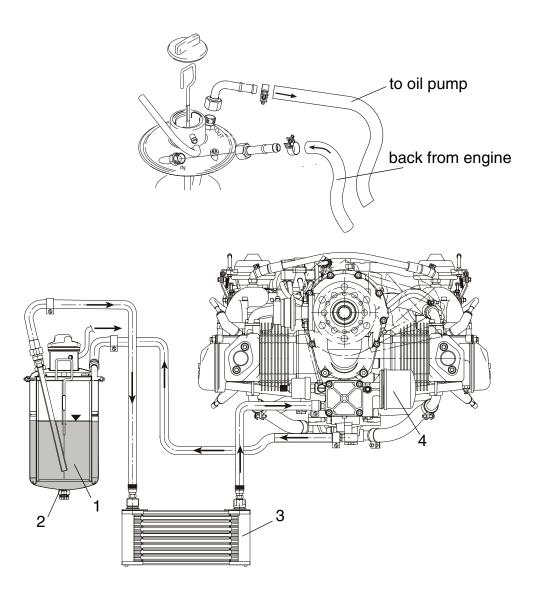
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# 11) Lubrication

# 11.1) General

## Overview



Part	Function
1	Oil tank
2	Drain screw M12x12
3	Oil cooler
4	Oil filter

Fig. 23

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#### MAINTENANCE MANUAL

#### General note

For detailed information see SI-912-010 "oil change", latest issue, and Fig. 23.



Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.



Risk of electric shock!

Switch off ignition and remove key! Disconnect negative terminal of aircraft battery.

NOTES:

It is advisable to check the oil level prior to an oil change as

it informs about oil consumption. See chap. 12-10-00 section: 4.1).

#### Observe!



Observe the following to prevent possible unintentional voiding of the oil system and damage to the valve drive:

- Draining the suction lines, oil cooler and return line is not necessary and must be avoided, as it results in air entering the oil system.
- Replacement of the oil filter and the oil change should be effected quickly and without interruption to prevent a draining of the oil system and the hydraulic tappets.

# Oil lines, Oil connections

Oil lines and other oil connections are not normally removed.

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#### MAINTENANCE MANUAL

# 11.2) Oil change

**Procedure** 

NOTES:

Run engine to warm oil before beginning oil change pro-

cedure.

To change the oil the following steps are necessary:

Step	Procedure
1	Crank engine by hand to transfer the oil from the crankcase. See chap. 12-10-00 section: 4.1).
2	Remove safety wire and oil drain screw from the oil tank, drain the used oil and dispose of as per environmental regulations.
3	Replace oil filter at each oil change and inspect the filter insert. See chap. 12-20-00 section: 11.5).
4	Dispose of oil filter according to environmental regulations.
5	Pour in approx. 3I (0.8 gal (US)) of fresh oil.

NOTICE

Only use brand name oil in accordance with the latest Operators Manual and SI-912-016, "Selection of suitable operating fluids" latest issue.

**NOTICE** 

The engine must not be cranked when the oil system is open. Attention must also be paid to this before first commissioning (e.g. when assembling the propeller after correct venting of the oil system).

Step	Procedure
6	Install oil drain screw with safety wire.
7	After carrying out the oil change, the engine should be cranked by hand in the direction of engine rotation (approx. 20 turns) to completely refill the entire oil circuit.
8	Compressed air must not be used to blow through the oil system (or oil lines, oil pump housing, oil bores in the housing).

#### MAINTENANCE MANUAL

# 11.3) Oil filter replacement

#### General note

**⚠WARNING** 

Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.

NOTICE

To ensure correct functioning of the oil circuit and the forced flow lubrication, use genuine ROTAX oil filter only. Only these filters will ensure correct pressure in the by-pass valve.

At every oil change, unscrew the oil filter and cut open using special tool taking care not to produce chips.

### Special tool

To carry out the procedure the following steps are necessary:

part number	Description
part no. 877620*	(1) Oil filter wrench
part no. 877670*	(2) Cutting tool
* or equivalent	

### Graphic

### Special tool

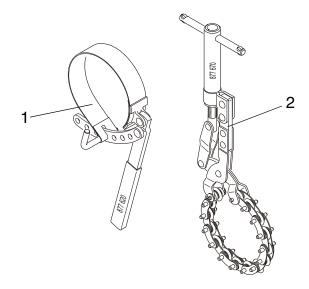


Fig. 24

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#### Procedure

Unscrew the oil filter.

Step	Procedure
1	Unscrew the oil filter with the oil filter wrench

Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

### MAINTENANCE MANUAL

# 11.4) Install oil filter

General note See Fig. 25.

NOTICE

After test run inspect tight fit of oil filter.

#### **Procedure**

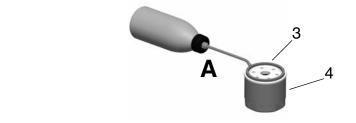
To mount the oil filter the following steps are necessary:

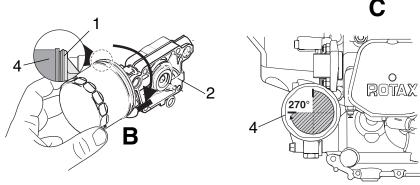
Step	Procedure
1	Clean the contact surface (1) of the oil pump housing (2) with a clean cloth.
2	Apply thin film engine oil on the gasket (3) of the oil filter (4).
3	Install the oil filter on the engine.
4	Screw on oil filter until oil filter gasket is seated solidly.
5	Tighten oil filter with 3/4 turn (270°).

Inspect all systems for correct function.

### Graphic

Install oil filter.





Part	Function
1	Contact surface
2	Oil pump housing
3	Gasket
4	Oil filter

Fig. 25

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Effectivity: 912 Series Edition 2 / Rev. 0

12-20-00

#### MAINTENANCE MANUAL

### 11.5) Inspection of the filter insert

#### General note

NOTICE

The filter insert must be inspected carefully for metal chips.

This inspection is important as it allows conclusions to be drawn regarding the internal condition of the engine and provides information about the possible cause of any damage.

#### **Procedure**

To carry out the procedure the following steps are necessary:

Step	Procedure
1	Oil filter cut open using special tool taking care not to produce chips.
2	Remove filter insert.
3	Cut top and bottom edges off the mat with a knife.
4	Remove filter mat, fold up and press remaining oil out.
5	Unroll and inspect it for metal chips, foreign matter, contamination and abrasion.
6	Pass over matt with a clean magnet and inspect for metal.

# Possible foreign matter

## Possible foreign matter:

- Steel chips
- Bronze chips
- Aluminium chips
- Sliver of bearing material
- Remains of sealing compound

### Increased foreign matter

If an increased amount of metal particles is found, such as brass- or bronze chips or sliver from bearing abrasion, repair or overhaul the engine in accordance with the BRP-Powertrain instructions for continued airworthiness. If the filter mat is clogged by foreign matter, the lube oil reaches the bearing points unfiltered via the by-pass valve in the oil filter.

#### **Unclear findings**

In the case of unclear findings:

Step	Procedure
1	Flush the oil circuit.
2	Fit a new oil filter.
3	Engine test run. See chap. 12-20-00 section: 8).
4	Inspect the oil filter once more.

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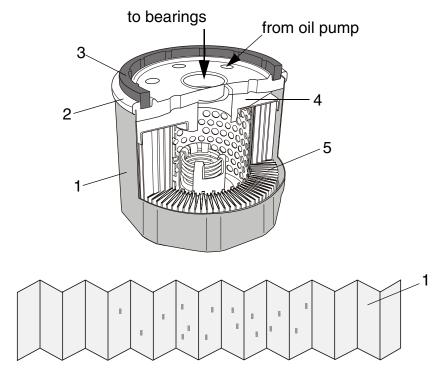
#### Contaminated

NOTICE

If the oil circuit is contaminated, replace the oil cooler and flush the oil circuit. See chap. 12-20-00 section: 13). Proper judgement requires years of experience in repair of piston engines.

### Graphic

Oil filter



Part	Function
1	Filter housing
2	Filter cover
3	Gasket ring
4	Filter element
5	Filter mat

Fig. 26

#### MAINTENANCE MANUAL

# 11.6) Cleaning the oil tank

See Fig. 27.

#### **General** note

NOTES:

This procedure is optional and requires venting of the oil

system. See chap. 12-20-00 section: 11.7).

It is only necessary to clean the oil tank and the inner parts

if there is heavy oil contamination.

#### **Procedure**

### Procedure to clean the oil tank:

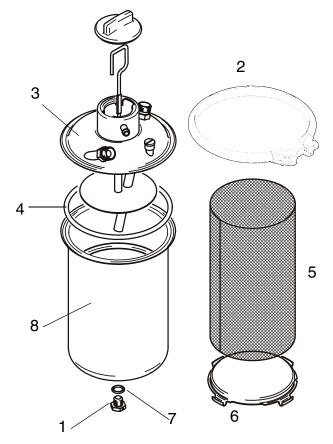
Step	Procedure
1	Detach the profile clamp (2) and remove the oil tank cover (3) together with the O-ring (4) and the oil lines.
2	Remove the inner parts of the oil tank such as the baffle insert (5) and the partition (6).
3	Clean oil tank (8) and inner parts (5, 6) and check for damage.

NOTICE

Incorrect assembly of the oil tank components can engine faults or engine damage.

Step	Procedure
4	Fit drain screw (1) M12x12 with a new gasket ring. Tighten to 25 Nm (18.5 ft.lb).
5	Safety wire.
6	Reassemble the oil tank by following the same steps in reverse order.

# Graphic Cleaning the oil tank



Part	Function
1	Drain screw
2	Profile clamp
3	Oil tank cover
4	O-ring
5	Baffle insert
6	Partition
7	Gasket ring
8	Oil tank

Fig. 27

#### MAINTENANCE MANUAL

# 11.7) Purging the oil system

#### General note

### NOTICE

Purging of the oil system is extremely important for operation and service life of the engine and therefore the procedure must be followed meticulously. It must be carried out in accordance with SI-912-018, "Purging the lubrication system", latest issue.

#### **Procedure**

Purging the oil system is necessary:

- before each first start up
- after reinstallation (e.g. after overhaul)
- after maintenance work during which the lubrication system was opened and voided.

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#### MAINTENANCE MANUAL

## 12) Inspecting the magnetic plug

General note See Fig. 28.

NOTES: The magnetic plug is located on the crankcase between

cylinder 2 and gearbox.

This inspection is important because it allows conclusions to be drawn on the internal condition of the gearbox and engine and reveals information

about possible damage.

**Procedure** Remove the magnetic plug and inspect it for accumulation of chips.

Steel chips in low numbers

Steel chips in low numbers as depicted in Fig. 28 can be tolerated if the accumulation is below 3 mm (0.125 in).

Steel chips in larger numbers

If there are larger accumulations of metal chips on the magnetic plug, the engine must be repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.

**Unclear findings** 

In the case of unclear findings:

Step	Procedure	
1	Flush the oil circuit.	
2	Fit a new oil filter.	
3	Engine test run. See chap. 12-20-00 section: 8).	
4	Inspect the oil filter once more.	

#### Contamination



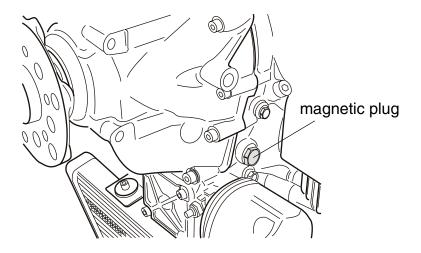
If the oil circuit is contaminated, replace the oil cooler and flush the oil circuit.

See chap. 12-20-00 section: 13). Detailed inspection of affected engine components.

Trace the cause and remedy.

### MAINTENANCE MANUAL

# Graphic Inspecting the magnetic plug.





not acceptable

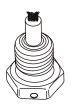






Fig. 28

08565,08566,08564,08563

# 12.1) Installation of the magnetic plug

Install

The following steps are necessary:

Step	Procedure	
1	Clean the magnetic plug.	
2	Refit the magnetic plug. Tightening torque 25 Nm (18.5 ft.lb).	
3	Safety wire the plug.	

Inspect all system for correct function. Detailed inspection of affected engine components.

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#### MAINTENANCE MANUAL

### 13) Flushing the oil circuit

General note

**△** WARNING

Risk of electric shock!

Switch off ignition and remove key! Disconnect negative terminal of aircraft battery.

Oil lines

Dismantle and flush oil lines as per instructions of the aircraft manufacturer.

Oil tank

Clean the oil tank.

Temporary oil lines

Temporary oil lines (only for flushing) must be fitted so that the oil cooler is not connected. The return line is routed into a separate, clean receptacle and not back to the oil tank.

NOTES:

Otherwise, metal chips could penetrate the radiator or oil tank during flushing.

**Filling** 

Fill the oil tank with approx. 3 I (0.8 gal (US)) of engine oil.

**Procedure** 

The following steps have to be carried out after refilling:

NOTICE

The oil level in the tank must not drop below the end of suction pipe, otherwise air will be sucked in again.

Step	Procedure
1	Turn engine by hand in direction of engine rotation to return the oil from the oil from the oil tank into the engine and into the collection container. The procedure is complete when no more contamination can be discovered.
2	Control the oil captured during the rinsing process. The rinsing process is complete when no more contamination can be discovered.
3	Install cleaned oil lines and oil cooler according to the manufacturers instruction.
4	Install new oil filter and refill with oil.

Reconnect negative terminal of aircraft battery.

Purging of the oil system, see chap. 12-20-00 section: 11.7).

**Equipment** 

NOTICE

Inspect all the equipment in accordance with the Maintenance Manual of the aircraft manufacturer.

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MAINTENANCE MANUAL

**NOTES** 

d02880.fm

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# 14) Electric system

### Overview

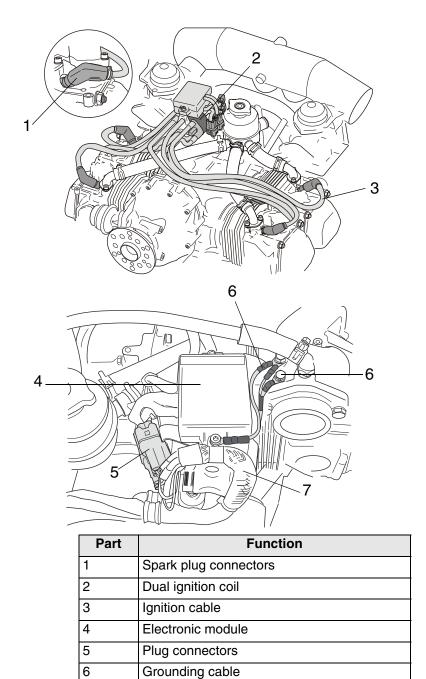


Fig. 29 08552,08553

Protection hose

#### MAINTENANCE MANUAL

# 14.1) Check of wiring

### **General note**

AWARNING

Risk of electric shock!

Switch off ignition and remove key!



Risk of Burns! Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.

#### **Procedure**

# The following steps have to be carried out:

Step	Procedure			
1	Inspect all cable connectors and their connections for tight fit, good contact, corrosion or damage and replace as necessary.			
2	Inspect all ground connections for corrosion and damage, replace if necessary.			
3	Inspect plug connections between pick-up cable, electronic module, charging and shorting cables for corrosion or damage and replace as required.			
4	Inspect plug connections between electronic module and ignition coils for corrosion or damage and replace if necessary.			
5	Verify plug connections of alternator cables with rectifier-regulator and connections of all cables on rectifier-regulator for good contact, tight fit, corrosion or damage and replace if necessary.			
6	Inspect grounding cables for tight fit, corrosion or damage and replace if necessary.			
7	Verify shielding of cable assemblies for corrosion or damage, good ground contact and tight fit, inspect the attachment of the shielding and replace if necessary.			
8	Inspect all 8 ignition cables to spark plug connector for corrosion or damage and tight fit and replace if necessary.			

#### MAINTENANCE MANUAL

### 14.2) Inspection and replacement of spark plugs

#### General note

See Fig. 30.



Use of incorrect spark plugs can result in ignition problems and pre-ignition and consequent engine damage. See chap. 05-50-00 section: 3.8).

Because of the differing thermal load, particular spark plugs have been specified for each engine type.

In numerous tests the best possible heat range has been determined to make sure that the spark plug will burn off deposits but will not overheat.

#### Renewal intervals

NOTES:

Operation with leaded fuels (e.g. AVGAS 100LL) can result in increased wear of the spark plugs. Reduce renewal intervals accordingly.

#### Special tool

Ensure that the following spark plugs corresponding to engine type are employed and that the correct spark plug socket is used:

Engine	Part no.	Designation	Size of socket
912 A/F/UL	897255	DCPR 7E	16 mm (0.63 in)
912 S/ULS	297940	DCPR 8E	16 mm (0.63 in)

# 14.2.1) Remove the spark plugs

#### Remove

Remove the spark plugs and store them according to cylinder and position. Always replace both spark plugs of a cylinder and do not interchange spark plugs between cylinders.

#### MAINTENANCE MANUAL

# 14.2.2) Inspection of spark plugs

Heat range Check heat range and adjust electrode gap correspondingly.

Visual check Inspect all spark plugs for mechanical damage.

Electrode gap

Electrode gap			
New	Wear limit		
0,6 - 0,7 mm (0.023 - 0.027 in)	0,9 mm (0.035 in)		

NOTES: Inspect the electrode gap also on use of new spark plugs.

The distance can changed by improper handling.

Spark plug face

Spark plug face reveals the following about the operating condition of the engine:

Spark plug face	Information		
light coloured to brown	plug and calibration of the engine are correct		
velvet black	Indicates the following:		
	- mixture too rich		
	- insufficient air intake (clogged air filter)		
	- engine operating temperature too low		
oily, glossy coating	Indicates the following:		
	- damaged valve stem seal		
	- misfiring		
	- too much oil in combustion chamber		
	- worn cylinder and piston rings		
white with formation of	Indicates the following:		
melt beads	- mixture too lean		
	- leaking valves		

# 14.2.3) Installation of spark plug

### Cleaning



Eyes and skin irritation!

Rinse off with water in the case of contact with eyes or skin. May be harmful if swallowed.

Before every installation, the spark plug thread and the spark plug seat at the cylinder head should be cleaned (e.g. to remove residue of heat conduction compound).

#### Installation



Always replace both spark plugs of a cylinder and do not interchange spark plugs between cylinders.



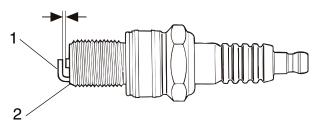
Heat conduction compound at the ground electrode (1) or the head area (2) can lead to ignition problems. Apply heat conduction compound sparingly and do not apply to the first three threads.

Apply small amount of heat conduction compound to spark plug thread and tighten spark plug to 20 Nm (177 in.lb) on the **cold** engine.

### Graphic

spark plugs

### Electrode gap



Part	Function		
1	Ground electrode		
2	Head area		

Fig. 30

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MAINTENANCE MANUAL

**NOTES** 

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#### MAINTENANCE MANUAL

### 15) Propeller gearbox

General note

NOTES:

The following "free rotation check" and "friction torque check" are necessary only on engines with the overload

clutch as optional extra.

Engine without the overload clutch

Engines without the overload clutch (slipper clutch) have no free rotation. For this reason the friction torque method cannot be applied on engines without overload clutch.

## 15.1) Checking the friction torque in free rotation

**General note** 

See Fig. 31.



Risk of electric shock! Switch off ignition and remove key! Disconnect negative terminal of aircraft battery.

#### **Test procedure**

The following steps are necessary for the testing procedure:

Step	Procedure			
1	Fit the crankshaft locking pin. See chap. 12-20-00 section: 7).			
2	With the crankshaft locked, the propeller can be turned by hand 15 or 30 degrees depending on the profile of the dog gears installed.  This is the maximum amount of movement allowed by the dog gears in the torsional shock absorption unit.			
3	Turn the propeller by hand back and forth between ramps, taking into consideration the friction torque. No odd noises or irregular resistance must be noticeable during this moment.			
4	Attach a calibrated spring scale to the propeller in distance (L) from the center of the propeller. Measure the force required to pull the propeller through the 15 or 30 degree range of free rotation.			
5	Calculate friction torque (Nm) by multiplying the force (N) obtained on the spring scale by the distance the scale is attached from the center of the propeller (L).  The friction torque must be between 30 Nm and max. 60 Nm (22 to 44.3 ft.lb) See calculation example.  If the above mentioned friction torque is not achieved, in spect, repair or overhaul the gearbox in accordance with			
	the ROTAX instructions for continued airworthiness.			
6	Remove crankshaft locking pin. See chap. 12-20-00 section: 7).			

### MAINTENANCE MANUAL

# Graphic Checking the friction torque.

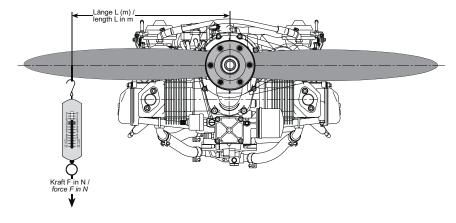


Fig. 31 05694

#### MAINTENANCE MANUAL

# 15.2) Checking the propeller gearbox

#### General note

The gearbox must be inspected, repaired or overhauled in accordance with the BRP-Powertrain instructions for continued airworthiness.

Detailed inspection of the affected gearbox components in accordance chap. 72-00-00 section: 3.9) in the Heavy Maintenance Manual.

Crack testing of the propeller shaft is not normally planned, but can be carried out if cracks are suspected.

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MAINTENANCE MANUAL

**NOTES** 

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