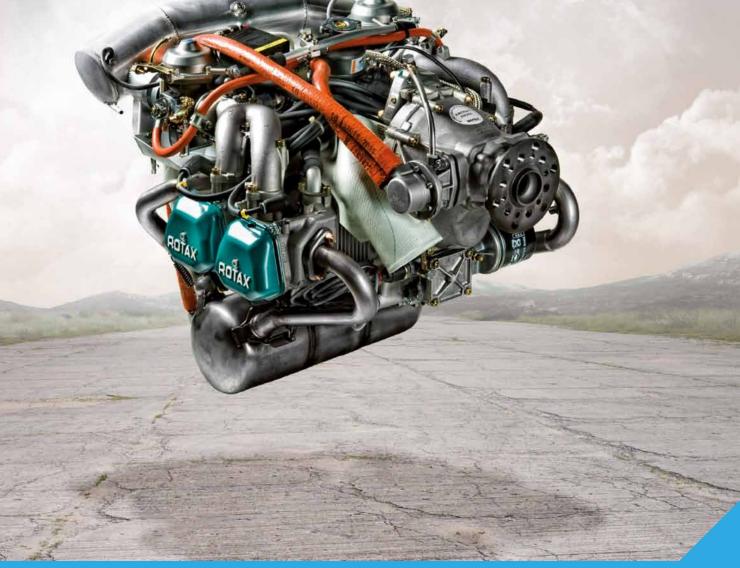


# INSTALLATION MANUAL FOR ROTAX® ENGINE TYPE 912 SERIES



picture: ROTAX<sup>®</sup> 912 ULS with options

# 

Before starting with engine installation, please read the Installation Manual completely as it contains important safety relevant information.

Before starting with engine installation, please read the Installation Manual completely as it contains important safety relevant information.

This Installation Manual for ROTAX® aircraft engines should only be used as a general guide for the installation of ROTAX® engines into airframes. It does not represent an instruction for the installation of a ROTAX® aircraft engine in a specific type of airframe or airplane. BRP-Powertrain GmbH & Co KG does not assume any warranty or liability in this context.

This Installation Manual shall in no event be used without fully complying with the specific instructions and/or requirements of the manufacturer of an airframe or airplane ("Manufacturer"). For verification and/or release of the engine installation, the respective Manufacturer must be contacted. Any modifications or adaptations to the airframe or airplane shall be carried out and/or be verified and released by the Manufacturer only.

Improper use of the Installation Manual and/or non compliance with the installation requirements of the Manufacturer can cause personal injury or property damage. BRP-Powertrain GmbH & Co KG disclaims any liability for any and all damage and/or injuries (including death) resulting from the improper use of this Installation Manual and/or non compliance with the installation requirements of the Manufacturer.

This technical data and the information contained herein is the property of BRP-Powertrain GmbH & CO KG and shall not be disclosed in whole or in part to any third parties without prior written approval of BRP-Powertrain GmbH & Co KG. This text must be included on any reproduction of these data, in whole or in part. This Installation Manual must remain with the engine/aircraft in case of sale.

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Approval of translation has been done to our best knowledge and judgement - in any case the original text in English language shall prevail.

INSTALLATION MANUAL

# Chapter: INTRO GENERAL NOTE

**Foreword** Before starting with the engine installation, read this Installation Manual carefully. The Manual will provide you with basic information on correct engine installation, a requirement for safe engine operation.

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

BRP-Powertrain GmbH & Co KG (hereinafter "BRP-Powertrain") wishes you much pleasure and satisfaction flying your aircraft powered by this ROTAX aircraft engine.

**Chapter structure** The structure of the Manual follows whenever it is possible the structure of the ATA (Air Transport Association) standards. The aim is the compatibility with the aircraft manufacturer's documentation, which means they must then adapt the documentation to their standard. The Installation 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
Storage and Installation	Chapter 10-10-00
Electric system	Chapter 24-00-00
Propeller drive	Chapter 61-00-00
Engine	Chapter 72-00-00
Fuel system	Chapter 73-00-00
Cooling system	Chapter 75-00-00
Engine management	Chapter 76-00-00
Exhaust system	Chapter 78-00-00
Lubrication system	Chapter 79-00-00
Electric starter	Chapter 80-00-00

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**INTRO** 

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# Chapter: LEP LIST OF EFFECTIVE PAGES

	chapter	page	date		chapter	page	date
		Title page			24-00-00	1	08 01 2012
	INTRO	1	08 01 2012			2	08 01 2012
		2	08 01 2012			3	08 01 2012
						4	08 01 2012
	LEP	1	02 01 2015			5	08 01 2012 08 01 2012
		2	02 01 2015			6 7	08 01 2012
L		3	02 01 2015			8	08 01 2012
		4	08 01 2012			9	08 01 2012
	TOA	1	02 01 2015			10	08 01 2012
•		2	08 01 2012			11	08 01 2012
1		3	02 01 2015			12	08 01 2012
•		4	08 01 2012			13	08 01 2012
						14	08 01 2012
	00-00-00	1	08 01 2012			15	08 01 2012
		2	08 01 2012	L		16	02 01 2015
		3	08 01 2012			17	02 01 2015
1		4	02 01 2015 08 01 2012			18	08 01 2012
		5 6	08 01 2012			19	08 01 2012
		7	08 01 2012	I		20	02 01 2015
		8	08 01 2012		61-00-00	1	08 01 2012
		9	08 01 2012		01 00 00	2	08 01 2012
		10	08 01 2012			3	08 01 2012
1		11	02 01 2015	I		4	02 01 2015
•		12	08 01 2012	•		5	08 01 2012
		13	08 01 2012			6	08 01 2012
		14	08 01 2012			7	08 01 2012
		15	08 01 2012			8	08 01 2012
		16	08 01 2012		70.00.00	4	00.01.0010
	10-10-00	1	08 01 2012		72-00-00	1 2	08 01 2012 08 01 2012
	10-10-00	2	08 01 2012			2 3	02 01 2012
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		4	02 01 2012			5	02 01 2015
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chapter	page	date	chapter	page	date		
73-00-00	1 2 3 4 5 6 7 8 9 10 10A 10B	08 01 2012 08 01 2012 02 01 2015 02 01 2015 02 01 2015 02 01 2015 02 01 2015 08 01 2012 02 01 2015 02 01 2015 02 01 2015 02 01 2015 02 01 2015	75-00-00	17 18 19 20 21 22 23 24 25 26 27 28	02 01 2015 02 01 2015 08 01 2012 02 01 2015 02 01 2015		
	11 12 13 14 15 16 17 18 19 20 21 22 23 24	08 01 2012 08 01 2012 08 01 2012 02 01 2015 08 01 2012 08 01 2012	76-00-00	1 2 3 4 5 6 7 8 9 10 11 12 1	02 01 2015 08 01 2012 02 01 2015 02 01 2015		
	25 26 27 28 29 30	08 01 2012 08 01 2012	6         08 01 2012           7         08 01 2012           8         08 01 2012           9         08 01 2012           0         08 01 2012	26         08 01 2012           27         08 01 2012           28         08 01 2012           29         08 01 2012           30         08 01 2012	78-00-00	2 3 4 5 6 7	08 01 2012 08 01 2012 08 01 2012 08 01 2012 08 01 2012 08 01 2012 02 01 2015
75-00-00	1 2 3 4 5	08 01 2012 08 01 2012 02 01 2015 08 01 2012 02 01 2015		8 9 10 11 12	02 01 2015 08 01 2012 08 01 2012 08 01 2012 08 01 2012 08 01 2012		
	6       08 01 2012         7       02 01 2015         8       02 01 2015         9       02 01 2015         10       02 01 2015         11       02 01 2015         12       02 01 2015         13       02 01 2015         14       02 01 2015         15       02 01 2015	02 01 2015 02 01 2015	702 01 2015802 01 2015902 01 20151002 01 20151102 01 20151202 01 20151302 01 20151402 01 20151502 01 2015	79-00-00	1 2 3 4 5 6 7 8 9 10 11	02 01 2015 08 01 2012 08 01 2012	

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chapter	page	date
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	13	08 01 2012
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	30	08 01 2012
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# Chapter: TOA TABLE OF AMENDMENTS

### Approval\*

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

no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclusion	sign.
0	INTRO	all	08 01 2012	DOA*			
0	LEP	all	08 01 2012	DOA*			
0	TOA	all	08 01 2012	DOA*			
0	00-00-00	all	08 01 2012	DOA*			
0	10-10-00	all	08 01 2012	DOA*			
0	24-00-00	all	08 01 2012	DOA*			
0	61-00-00	all	08 01 2012	DOA*			
0	72-00-00	all	08 01 2012	DOA*			
0	73-00-00	all	08 01 2012	DOA*			
0	75-00-00	all	08 01 2012	DOA*			
0	76-00-00	all	08 01 2012	DOA*			
0	78-00-00	all	08 01 2012	DOA*			
0	79-00-00	all	08 01 2012	DOA*			
0	80-00-00	all	08 01 2012	DOA*			
1	LEP	1-3	02 01 2015	DOA*			
1	TOA	1,3	02 01 2015	DOA*			
1	00-00-00	4,11	02 01 2015	DOA*			
1	10-10-00	4,10	02 01 2015	DOA*			
1	24-00-00	16,17,20	02 01 2015	DOA*			
1	61-00-00	4	02 01 2015	DOA*			
1	72-00-00	3-6, 9	02 01 2015	DOA*			
1	73-00-00	3-6,8-10,	02 01 2015	DOA*			
1		10A,10B,14	02 01 2015	DOA*			
1	75-00-00	3,5,7-25,27,28	02 01 2015	DOA*			
1	76-00-00	1,3-12	02 01 2015	DOA*			
1	78-00-00	1,7-8	02 01 2015	DOA*			
1	80-00-00	4	02 01 2015	DOA*			

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#### INSTALLATION MANUAL

# Chapter: TOA SUMMARY OF AMENDMENTS

Current No.	chapter	page	date of change	Comment
0	all	all	08 01 2012	New Layout
0	24-00-00	6	08 01 2012	Graphic change, modify legend
0	61-00-00	4	08 01 2012	chap. 1.2) Wording of max. moment of inertia
0	73-00-00	6	08 01 2012	chap. 1.3) Requirements of the fuel system
0	73-00-00	14	08 01 2012	chap. 2.1.2) Drainage piping to the carburetor
0	73-00-00	22	08 01 2012	CO-Measurement for configuration with not
				GENUINE-ROTAX airbox
0	75-00-00	24	08 01 2012	chap. 4.1) Note added
0	78-00-00	3	08 01 2012	chap. 1) Caution added
0	78-00-00	11	08 01 2012	chap. 4.1) Muffler graphic change
1	10-10-00	4	02 01 2015	change of warranty for corrosion protection
1	24-00-00	16,17,20	02 01 2015	change of specification of capacitor (electric pump)
1	61-00-00	4	02 01 2015	change of graphic
1	72-00-00	3-6, 9	02 01 2015	change of position of temperature sensor, new
				cylinder head
1	73-00-00	3-6,8-10, 10A,	02 01 2015	change of text, new text
		10B,14		
1	75-00-00	3,5,7-25,27,28	02 01 2015	change from CHT to CT, new radiator
1	76-00-00	1,3-12	02 01 2015	change from CHT to CT
1	78-00-00	1,7,8	02 01 2015	new illustration of whole exhaust system

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

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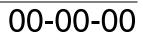
# Chapter: 00-00-00 GENERAL NOTE

IntroductionThis section describes the installation of engine type ROTAX 912 Series.NOTE:The ROTAX 912 Series includes all engines such as the<br/>912 A, 912 F, 912 S, 912 UL and 912 ULS.

Table of contentsThis chapter of the Installation Manual contains general and safety infor-<br/>mation concerning the operation and maintenance of the aircraft engine.

Subject	Page
General note	Page 3
Type description	Page 4
Standard version	Page 5
Abbreviations and terms used in this Manual	Page 7
Conversion table	Page 9
Safety notice	Page 10
Safety information	Page 11
Instruction	Page 13
Technical documentation	Page 14

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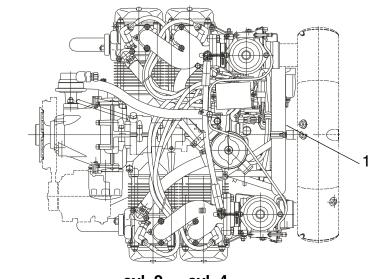
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### INSTALLATION MANUAL

# 1) General note

Purpose	The purpose of this Installation Manual is to acquaint maintenance ser- vice staff (iRMT) approved by the local aviation authorities with some basic installation and safety information for service work.
Documentation	For more detailed information regarding, installation, maintenance, safety- or flight operation, consult the documentation provided by the air-craft manufacturer and/or dealer.
	For additional information on engines, maintenance or parts, you can also contact yout nearest authorized ROTAX-aircraft engine distributor.
ROTAX Distributors	For ROTAX Authorized Distributors for Aircraft Engines see latest Opera- tors Manual or on the Internet at the official Website www.FLYROTAX.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 serial number (1) is on the ignition cover, on the left, opposite the electric starter. See Fig. 1.





cyl. 2 cyl. 4

Fig. 1

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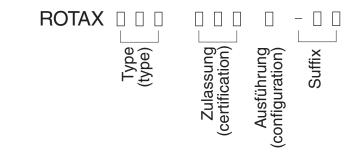
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### INSTALLATION MANUAL

# 2) Type description

e.g. ROTAX 912 The type description is made up the following.



### Designation

Designation		Description
Туре	912	4-cyl. horizontally opposed, normal aspirated engine.
Certification	Α	Certified to JAR 22 (TC No. EASA.E.121).
	F, S	Certified to FAR 33 (TC No. E00051 EN) JAR-E (TC No. EASA.E.121).
	UL, ULS	Non-certified aircraft engines.
Configuration	2	Prop shaft with flange for fixed prop.
	3	Prop shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller.
	4	With prop flange for fix pitch propeller, but prepared for retro-fit of hydraulic governor for constant speed prop (not supplied by manufacturer anymore.
Suffix	-XX	Explanation of the type designation suffix, see SB-912- 068

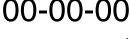
### Options

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

	External alternator	Vacuum- pump	Drive for rev counter/ hour meter	Governor
for configuration 2	yes	yes	yes	no
for configuration 3	yes	no	yes	yes
for configuration 4	yes	yes	yes	no

NOTE: Conversion of the configuration 2/4 to configuration 3 may be accomplished by ROTAX Authorized Distributors or their Service Center.



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### INSTALLATION MANUAL

# 2.1) Standard version

Serial production	<ul> <li>4 stroke, 4 cyl. horizontally opposed, spark ignition engine, tral camshaft hydraulic tappets - push rods - OHV</li> <li>Liquid cooled cylinder heads</li> <li>Ram air cooled cylinders</li> <li>Dry sump forced lubrication</li> <li>Dual ignition of breakerless, capacitor discharge design</li> <li>2 constant depression carburetors</li> <li>Mechanical fuel pumps</li> <li>Electric starter (12 V 0.7 kW), 912 S/ULS (12 V 0.9 kW)</li> <li>Integrated AC generator with external rectifier regulator</li> <li>Propeller drive via integrated gearbox with mechanical shocl</li> </ul>	
	NOTE:	The overload clutch is installed on all <b>serial production</b> aircraft engines which are certified and non-certified aircraft engines of the configuration 3.
Optional	<ul><li>External alter</li><li>Vacuum put</li></ul>	ter (12 V 0.9 kW) ernator (12 V 40 A DC) mp (only for configuration 1, 2 and 4 possible) onstant speed propeller governor (only for configuration 3)

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Auxiliary equip-NOTE:The following equipment is not included as part of the stan-<br/>dard engine version!

**NOTICE** Any equipment not included as part of the standard engine version and so does not be part of the engine is not in the scope of supply. Components especially developed and tested for this engine are readily available at BRP-Powertrain.

# The following auxiliary equipment has been tested on ROTAX engine type 912 for safety and durability to the standards of aviation.

The furnishing of proof in accordance to the latest FAR or EASA has to be conducted by the aircraft manufacturer.

- Airbox
- External alternator
- Engine suspension frame
- Vacuum pump (feasible on configuration 2 and configuration 4 only)
- Drive for rev counter/hour-meter
- Oil cooler with connections
- Coolant radiator
- Coolant overflow bottle

### Auxiliary equipment not tested on ROTAX engine type 912 for safety and durability to the standards of aviation.

Non-compliance can result in serious injuries or death! The user assumes all risks possibly arising by utilizing auxiliary equipment.

The furnishing of proof in accordance to the latest FAR or EASA has to be conducted by the aircraft manufacturer.

- Exhaust system
- Intake filter
- Flydat
- Mechanical rev counter
- Electric rev counter
- Shock mount

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# 3) Abbreviations and terms used in this Manual

#### Abbreviations

Abbreviation	Description
*	Reference to another section
•	center of gravity
٥	The drop symbol indicates use of sealing agents, adhesives or lubricants (only in the Illustrated Parts Catalog).
O°	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)
A	Ampere
a.c.	alternating current
Ah	Ampere hour
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
ΑΤΑ	Air Transport Association
AWG	American Wire Gauge
CAN	Controller Area Network
CAN/CGSB	Canadian General Standards Board
CSA	Constant Speed Actuator
CW	Clockwise
CCW	Counter-clockwise
DCDI	Dual Capacitor Discharge Ignition
d.c.	direct current
DOT	Department of Transport
DOA	Design Organisation Approval
EASA	European Aviation Safety Agency
iRMT	independent ROTAX Maintenance Technician
IM	Installation Manual
EGT	Exhaust Gas Temperatur



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### INSTALLATION MANUAL

Abbreviation	Description
INTRO	Introduction
EMS	Engine Management System
EN	European Norm
IPC	Illustrated Parts Catalog
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
ОМ	Overhaul Manual
hr.	hours
ОМ	Operators Manual
ТОС	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	newtonmeter
Rev.	Revision
ROTAX	is a trade mark of BRP-Powertrain GmbH & Co KG
RON	Research Octane Number
RV	Record of Revisions
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
TSNP	Time Since New Part
ТВО	Time Between 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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# 3.1) 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  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 km/h
$1 \text{ cu in (in}^3) = 16.3871 \text{ cm}^3 (in^3)$	1 ft/min = 0.3048 m/min
$1 \text{ dm}^3 = 1 \text{ l}$	= 0.00508 m/sec
1 dm <sup>3</sup> = 0.21997 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:
$1 0/cm^2 = 0.016018 lb/ft^2$	-
$1 \text{ g/cm}^3 = 0.016018 \text{ lb/ft}^3$ $1 \text{ lb/ft}^3 = 62.43 \text{ g/cm}^3$	1 Nm = 0.737 ft lb.
$1 \text{ g/cm}^3 = 0.016018 \text{ lb/ft}^3$ $1 \text{ lb/ft}^3 = 62.43 \text{ g/cm}^3$	1 Nm = 0.737 ft lb. = 8.848 in lb.
	1 Nm = 0.737 ft lb.
$1 \text{ lb/ft}^3 = 62.43 \text{ g/cm}^3$	1 Nm = 0.737 ft lb. = 8.848 in lb. 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm
1 lb/ft <sup>3</sup> = 62.43 g/cm <sup>3</sup> Units of force:	1 Nm = 0.737 ft lb. = 8.848 in lb. 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm Cable cross-section:
1 lb/ft <sup>3</sup> = 62.43 g/cm <sup>3</sup> Units of force: 1 N = 0.224809 lbf	1 Nm = 0.737 ft lb. = 8.848 in lb. 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm Cable cross-section: Conversion table-Wire Gauge:
1 lb/ft <sup>3</sup> = 62.43 g/cm <sup>3</sup> Units of force: 1 N = 0.224809 lbf 1 lbf = 4.4482 N	1 Nm = 0.737 ft lb. = 8.848 in lb. 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm Cable cross-section:
1 lb/ft <sup>3</sup> = 62.43 g/cm <sup>3</sup> Units of force: 1 N = 0.224809 lbf 1 lbf = 4.4482 N Units of pressure:	1 Nm = 0.737 ft lb. = 8.848 in lb. 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm Cable cross-section: Conversion table-Wire Gauge:
1 lb/ft <sup>3</sup> = 62.43 g/cm <sup>3</sup> Units of force: 1 N = 0.224809 lbf 1 lbf = 4.4482 N Units of pressure: 1 Pa = $1N/m^2$	1 Nm       = 0.737 ft lb.         = 8.848 in lb.         1 ft lb       = 1.356 Nm         1 in lb       = 0.113 Nm         Cable cross-section:         Conversion table-Wire Gauge:         AWG       4       6       8       10       12       14       16       18       20
1 lb/ft <sup>3</sup> = 62.43 g/cm <sup>3</sup> Units of force: 1 N = 0.224809 lbf 1 lbf = 4.4482 N Units of pressure: 1 Pa = 1N/m <sup>2</sup> 1 bar = 100000 Pa/1000 hPa/ 100 kPa	1  Nm = 0.737  ft lb. $= 8.848  in lb.$ $1  ft lb = 1.356  Nm$ $1  in lb = 0.113  Nm$ Cable cross-section: Conversion table-Wire Gauge: AWG-mm <sup>2</sup>
$1 \text{ lb/ft}^3 = 62.43 \text{ g/cm}^3$ Units of force: 1  N = 0.224809  lbf $1  lbf = 4.4482  N$ Units of pressure: $1 \text{ Pa} = 1\text{N/m}^2$ $1 \text{ bar} = 100000 \text{ Pa/1000 hPa/}$	1 Nm       = 0.737 ft lb.         = 8.848 in lb.         1 ft lb       = 1.356 Nm         1 in lb       = 0.113 Nm         Cable cross-section:         Conversion table-Wire Gauge:         AWG       4       6       8       10       12       14       16       18       20



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# 4) Safety notice

General note	promotes the under	ng of such information does not eliminate the hazard, it erstanding and application of the information contained f the engine. Always use common workshop safety
	Manual are correct policy of continuou	d components system descriptions contained in this at the time of publication. BRP-Powertrain maintains a s improvement of its products without imposing upon to install them on its products previously manufac-
Revision		serves the right at any time, and without incurring obli- replace or discontinue any design, specification, feature
Measure	Specifications are parenthesis.	given in the SI metric system with the USA equivalent in
Symbols used	This Manual uses the following symbols to emphasize particular informa- tion. 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.
	NOTICE	Denotes an instruction which, if not followed, may severely damage the engine or other component.
	NOTE: In ne	dicates supplementary information which may be eded to fully complete or understand an instruction.
	ENVIRONMENT	NOTE
	Environment note tion.	gives you tips and behaviors to environmental protec-
		revision bar outside of the page margin indicates a ange to text or graphic.

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### INSTALLATION MANUAL

# 4.1) Safety information

Use for intended purpose

Non-compliance can result in serious injuries or death!

Only certified technicians (iRMT, see also Maintenance Manual Line) and trained on this product are qualified to work on these engines.

Non-compliance can result in serious injuries or death!

Never fly the aircraft equipped with this engine at locations, airspeeds, altitudes, of other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage.

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

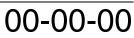
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Non-compliance can result in serious injuries or death!

For each use of DAY VFR, NIGHT VFR or IFR in an aircraft, the applicable legal requirements and other existing must be adhered to.

- 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.

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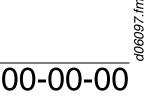
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### INSTALLATION MANUAL

- For continuing airworthiness see Maintenance Manual Line.
- Unauthorized modifications of engine or aircraft will automatically exclude any liability of the manufacturer for sequential damage.
- This engine may be equipped with an other than the GENUINE-ROTAX vacuum pump. The safety warning accompanying the air pump must be given to the owner/operator of the aircraft into which the air pump is installed.

#### Engine run

- In the interest of safety, the aircraft must not be left unattended while the engine is running.
  - To eliminate possible injury or damage, ensure any loose equipment or tools are properly secured before starting the engine.
  - When in storage protect the engine and fuel system from contamination and exposure.
  - Never operate the engine and gearbox without sufficient quantities of lubricating oil.
  - Never exceed the maximum permitted operational limits.
  - Allow the engine to cool at idle for several minutes before turning off the engine.
  - Propeller and its attachment with a moment of inertia in excess of the specified value must not be used and releases engine manufacturer from any liability.
  - Improper engine installation and use of unsuitable piping for fuel-, cooling- and lubrication system releases engine manufacturer from any liability.



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### INSTALLATION MANUAL

# 4.2) Instruction

4. <i>Z</i> ) 113	
General note	Engines require instructions regarding their installation, application, use, operation, maintenance and repair.
	Technical documentation and directions are useful and necessary com- plementary elements for personal instruction, but can by no means sub- stitute 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, recom- mended 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 Distributor and their 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	<b>NOTICE</b> In principle use only tools and appliances which are either cited in the Manual or in the Illustrated Parts Catalog.
State of delivery	<b>WARNING</b> Engine and gearbox are delivered in "dry" conditions (without oil). Before putting engine in operation it must be filled with oil. Use only oil as specified (consult Operators Manual and SI-912-016 "Selection of suitable operating fluids" current issue).

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### INSTALLATION MANUAL

# 4.3) Technical documentation

General no	t
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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 authorized mechanics (iRMT, see Maintenance Manual Line) 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



StatusThe status of the Manuals can be determined with the aid of the table of<br/>amendments. The first column indicates the revision state.This figure should be compared with the revision provided on ROTAX-Air-

craft Engines Website: www.FLYROTAX.com.

Amendments and current versions can be downloaded free of charge.

Replacement<br/>pagesFurthermore the Manual is constructed in such a way that single pages<br/>can be replaced instead of the complete document. The list of effective<br/>pages is given in the chapter LEP. The particular edition and revision num-<br/>ber is given on the footer of each page.



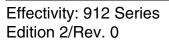
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### INSTALLATION MANUAL

Reference	NOTICE	This Manual for engine installation is only part of the Technical Documentation and will be supplemented by the respective Operators Manual, Maintenance Manu- al and Illustrated Parts Catalog. Pay attention to references to other documentation, found in various parts of this Manual.
	•	a document refers to the latest edition issued by if no stated otherwise.
Illustrations	arrangement. The the parts which ha	n this Manual are mere sketches and show a typical ey may not represent in full detail or the exact shape of ave the same or similar function. Therefore deduction of her details from illustrations is not permitted.
	b v	The Illustrations in this Manual are stored in graphic data ase system and are provided with a consecutive irrele- ant number. This number (e.g. 00277) is of no signifi- ance for the content.
Installation draw- ings		ngs and a DMU-model for (virtual) installation analysis n the ROTAX Authorized Distributors or their Service

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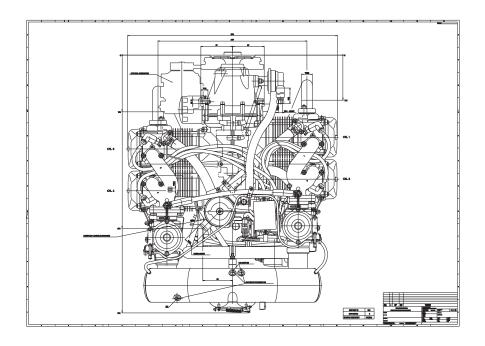


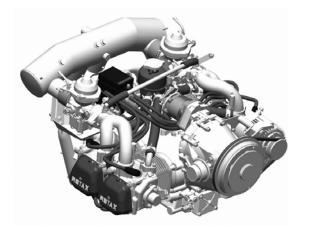


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#### INSTALLATION MANUAL

# Graphic Installation drawing





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Fig. 2

INSTALLATION MANUAL

# Chapter: 10-10-00 STORAGE AND INSTALLATION

NOTICE

Introduction

The stated directives are measures that must be observed during every engine installation to prevent any accidents and engine damage.

Table of contents

This section of the Installation Manual contains state of delivery, transport, storage and aircraft engine installation.

Subject	Page
Preparations for engine installation	Page 3
State of delivery	Page 3
Unpacking/handling of the engine	Page 3
Preservation and storage of the engine	Page 4
Protective coverings	Page 5
Engine suspension and installation position	Page 6
Engine suspension instructions	Page 6
Attachment points	Page 8
Definition of attachment points	Page 9
Permissible installation positions	Page 12
Preparations for trial run of engine	Page 14
Conduct test run	Page 14
Verification of the throttle lever detent for max. continuous power	Page 14

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INSTALLATION MANUAL

NOTES





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### INSTALLATION MANUAL

# 1) Preparations for engine installation

1.1) State of delivery

Attachment



Risk of consequential damage to engine and aircraft as a result of corrosion and damage. Under no circumstances is a corroded or damaged engine to be installed in an aircraft! The attachment screws are only for transport and must not be used in the aircraft.

The engine can be attached with steel angles anchored on a timber plate.

- When the engine is delivered, check that the GENUINE-ROTAX packing is not damaged.
- If the packing is damaged, contact the authorised sales and service partner for ROTAX aircraft engines.

# 1.2) Unpacking/handling of the engine

Unpacking the engine

To unpack a new engine, proceed as follows:

Step	Procedure
1	Remove the wooden cover.
2	Remove the protective packaging.
3	Remove the protective film around the engine.

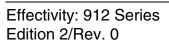
After unpacking

To check the state of delivery, proceed as follows:

Step	Procedure
1	Check that the serial number and engine type designation on the type plate are identical to those shown on the delivery note.
2	Check the engine for damage or corrosion. If everything is deemed "OK", the engine can be accepted.

Suspension point The engine to be lifted by two hooks or straps around the middle (A) of the intake manifolds. See chapter engine views, numbering of cylinders and definitions of main

axes.





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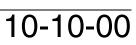
### INSTALLATION MANUAL

# **1.3)** Preservation and storage of the engine

I

General note	The engine is preserved at BRP-Powertrain thus guaranteeing proper pro- tection against corrosion damage for at least 12 months after the date of delivery from BRP-Powertrain.
Warranty	This warranty is subject to the following conditions:
	<ul> <li>The engine must be stored in the GENUINE-ROTAX packing as sup- plied by BRP-Powertrain.</li> </ul>
	- The covers on various openings must not be removed.
	<ul> <li>The engine must be stored in a suitable place (at min40 °C/-40 °F and max. +80 °C/176 °F).</li> </ul>
	- The flat bag (blue) surrounding the engine must not be damaged or removed, as it protects the engine from corrosion and oxidation.
Storage	If the engine is stored for a period longer than 12 months (not stored in the GENUINE-ROTAX packing) then maintenance tasks must be carried out every 3 months as per the currently valid Maintenance Manual, section "Preservation of a new engine".

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### INSTALLATION MANUAL

# 1.4) Protective covering

NOTICE

**General note** 

Protective coverings are only for use during transport and engine installation. They must be removed before the engine is operated.

All openings are protected against ingress of contamination and dampness. It is recommended to leave the protective plugs in place until installation of the specific feed line.

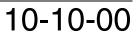
NOTE: The transport equipment and plugs must be reattached if the engine will be sent to the manufacturer or distributor.

Protective cover-

List of protective covering:

Installation place	Number
Exhaust socket	1x cone plug
Connection for manifold pressure	1x cap
Airbox	2x cap
Fuel pump inlet	1x cap
Connection for fuel return	1x plug
Connection for fuel pressure	1x plug
Oil supply and oil discharge	1x each cap
Supply and discharge of coolant	1x each cone plug
Propshaft on configuration 3	1x disk plug
Carburetor (if not equipped with an airbox)	2x disk plug

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# 2) Engine suspension and installation position

General note	<b>NOTICE</b> During engine installation take into account the total engine weight and ensure careful handling.
Engine suspen- sion	The engine suspension is essentially determined by the aircraft design. Eight attachment points are provided (4 on engine and 4 on engine frame).
Engine suspen- sion frame	<b>NOTICE</b> If the engine suspension frame is not used or if modified, certification in accordance with the latest regulations, such as FAR or EASA, must be conducted by the aircraft manufacturer.

The engine is supplied with a tested and certified suspension frame for the fireproof bulk head. Installation in the aircraft is carried out using standard captive rubber mounts which also isolate vibration and noise from the aircraft frame.

# 2.1) Engine suspension instructions

General note	NOTICE	The rubber mounts for neutralising vibrations and all engine suspension components not in the scope of de- livery must be ground run tested at the specified loads and tested for vibration behaviour. Certification to the latest regulations, such as FAR and EASA, must be conducted by the aircraft manufactur- er.
Noise emmision and vibration	NOTICE	The engine suspension must be designed to prevent excessive engine movement and to minimise noise emission and vibration on the airframe.
	NOTICE	If the GENUINE-ROTAX engine suspension frame is not being used, a vibration test must be carried out.
		See SL-912-010.

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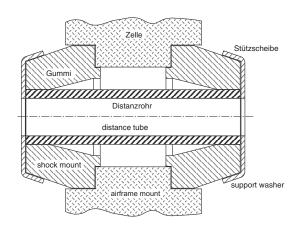
### INSTALLATION MANUAL

NOTE: With suspension on the 4 top lugs L3, R3, L4 and R4 only, the tilting moment due to the pull of the propeller will be avoided while, if attached on the bottom lugs only, the moment of tilting has to be taken care of accordingly.

Standard aircraft industry damping elements (e.g. Lord) are suitable. See Fig. 1.

Graphic

Engine suspension



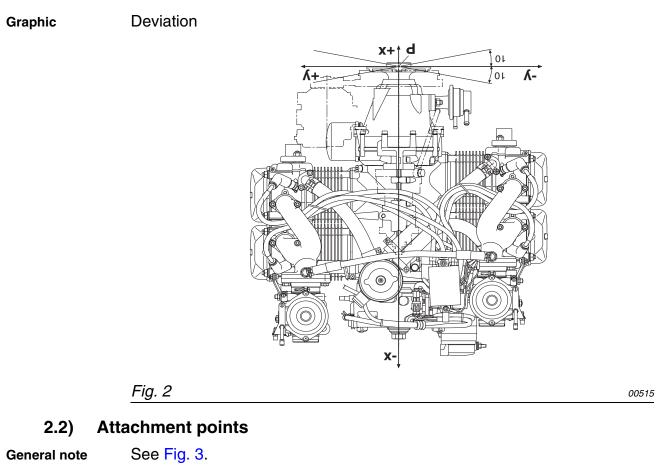
	NOTE:	The illustration shows Lord J 3608-1 or J 3608-2. rubber mounts. Consult the manufacturer for the dimensions of the rubber mounts.
	Fig. 1	07600
Vibration neutral- isation	The vibration and acoustic insulation factor is dependent on the cell man- ufacturer. Perform the determination as described in SL-912-010.	
Damping ele- ments	NOTICE	All elements for neutralising vibrations must be cap- tive.
Vertical axis	The y-axis must be perpendicular to the longitudinal axis of the aircraft.	
Deviation	Permissible deviation from perpendicular: $\pm 10^{\circ}$ . See Fig. 2.	

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### INSTALLATION MANUAL



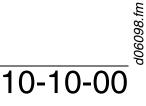


The hex. screws M10x60 in the attachment points are for transport only and must not be used for engine suspension.

It is recommended that the 4 stated attachment points R2, L2, R3 and L3 of the engine suspension frame are used.



A minimum of 4 attachement points must be used. These must be distributed symmetrically between the left (L) and right (R) sides.



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INSTALLATION MANUAL

## 2.3) Definition of attachment points

General note See Fig. 3.

Non-compliance can result in serious injuries or death!

The aircraft or fuselage manufacturer must design the engine suspension so that it can safely carry the maximum occurring operational loads without exceeding the max. allowable forces and bending moments on the engine housing and attachment points.

Tighten all engine suspension screws as specified by the aircraft manufacturer.



Attachment points

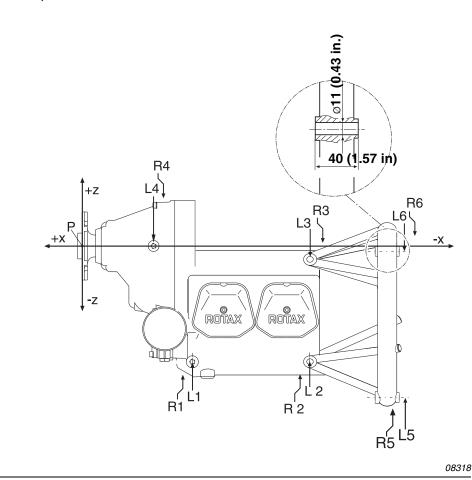


Fig. 3

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#### INSTALLATION MANUAL

attachment points	x-axis mm/in	y-axis mm/in	z-axis mm/in
L1	-200,8/-7.90 in.	71,0/2.80 in.	-211,0/-8.31 in.
R1	-200,8/-7.90 in.	-71,0/-2.80 in.	-211,0/-8.31 in.
L2	-414,3/-16.31 in.	71,0/2.80 in.	-211,0/-8.31 in.
R2	-414,3/-16.31 in.	-71,0/-2.80 in.	-211,0/-8.31 in.
L3	-414,3/-16.31 in.	75,0/2.96 in.	-22,0/-0.87 in.
R3	-414,3/-16.31 in.	-75,0/-2.96 in.	-22,0/-0.87 in.
L4	-128,3/-5.05 in.	87,0/3.43 in.	0
R4	-128,3/-5.05 in.	-87,0/3.43 in.	0
L5	-564,0/-22.20 in.	105,0/4.13 in.	-277,0/-10.91 in.
R5	-564,0/-22.20 in.	-105,0/-4.13 in.	-277,0/-10.91 in.
L6	-564,0/-22.20 in.	105,0/4.13 in.	-7,0/-0.28 in.
R6	-564,0/-22.20 in.	-105,0/-4.13 in.	-7,0/-0.28 in.

attachment points	max. permissible forces (secure load) in (N) lbf x, y and z axis	max. permissible bending mo- ment (secure load) in (Nm) ft.lb x, y and z axis
L1	5000 N/1124 lbf	77 Nm /56.8 ft.lb
R1		
L2	5000 N/1124 lbf	77 Nm/56.8 ft.lb
R2		
L3	5000 N/1124 lbf	77 Nm/56.8 ft.lb
R3		
L4	1900 N/427 lbf	39 Nm/28.8 ft.lb
R4		

	max. permissible forces (secure load) in (N) lbf			max. permissible bending moment (secure load) in (Nm) ft.lb
attach- ment points	x axis	y axis	z axis	x, y, and z axis
L5	5000 N/	2000 N/	3000 N/	100 Nm/ 73.75 ft.lb
R5	1124 lbf	450 lbf	674 lbf	
L6				
R6				

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#### INSTALLATION MANUAL

attachment point	thread size	max. usable thread length mm/in.
L1	M10	25 mm/0.98 in.
R1		
L2	M10	25 mm/0.98 in.
R2		
L3	M10	25 mm/0.98 in.
R3		
L4	M10	19 mm /0.75 in. <sup>1)</sup>
R4	1	16 mm /0.63 in. <sup>2)</sup>

<sup>1)</sup> up to gearbox S/N 28986
 <sup>2)</sup> starting from gearbox S/N 28987

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## 2.4) Permissible installation positions

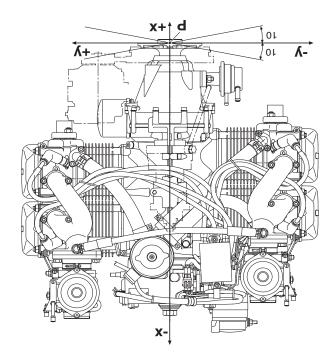
General note	See Fig. 4	•	
	NOTICE	The oil system, fuel system and the cooling system are unsuitable for upside-down/inverted installation of the engine.	
		Dimensions are always from zero reference point and the coordinate system position remains unchanged.	Э
Installation posi- tions	<ul><li>parked position</li><li>Engine suitable</li></ul>	<b>estallation position details refer to the aircraft in</b> <b>(aircraft on ground, ready for take off).</b> e for propeller in tractor or pusher arrangement ly with propeller shaft above cylinders	
Propeller axis	to the y-axis. Permissible dev	ttachment points L1 and R1 must be on a y2 axis parallel riation from parallelism: $\pm 5^{\circ}$ +y	
	Fig. 4	0245-	54



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Vertical axisThe y-axis must be perpendicular to the longitudinal axis of the aircraft.Permissible deviation from perpendicular:  $\pm 10^{\circ}$ 







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INSTALLATION MANUAL

## 3) Preparations for trial run of engine

General note

Non-compliance can result in serious injuries or death! Prior to engine start and operation review all instructions stated in the Operators Manual.

## 3.1) Conduct test run

Instruction See Operators Manual 912 chapter. 3.

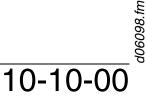
## 3.2) Verification of the throttle lever detent for max. continuous power:

Instruction

Performance check in accordance with Operators Manual. If nominal performance won't be reached or is in excess of, examination of

the installation and engine will be necessary.

*NOTICE* Don't conduct any test flights before fault has been traced and found.



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## Chapter: 24-00-00 ELECTRIC SYSTEM

#### The engine is supplied with the wiring completed and ready to operate. Only the following connections to the aircraft have to be established:

- integrated generator
- external rectifier-regulator
- electronic modules
- electric starter
- start relay
- items conditional for operation like circuit breakers, ON-OFF switches, control lamps, relays, instrumentation and capacitors.

#### **Optional extras**

- external alternator (as option if the output of the integrated generator is inadequate.
- electric rev counter (accessory).
- consumer (battery).

#### Table of contents

Intro

This section contains information about electronic modules, electric starter and wiring diagram of the engine.

Subject	Page
Requirements for the circuit wiring	Page 3
Electromagnetic compatibility (EMC/EMI)	Page 4
Technical data and connection of the electric components	Page 5
Integrated generator	Page 5
Rectifier-regulator	Page 6
Requirements for flawless operation of the rectifier-regu-	Page 7
lator	
Electronic modules	Page 8
Ignition switches (MAG switch)	Page 9
Connection	Page 9
Assembly of the flat pin terminal	Page 11
External alternator (optional extra)	Page 13
Technical data	Page 13
Connection	Page 13
Requirements for correct operation of the integrated rec-	Page 14
tifier-regulator	
Connection of the electric rev counter (tachometer)	Page 16
Technical data	Page 16
Connection	Page 16



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Subject	Page
Battery	Page 16
Capacitor (Option electrical fuel pump)	Page 16
Easy start function on the electronic module (optional)	Page 17
Wiring diagram	Page 18



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## 1) Requirements for the circuit wiring

General note	NOTICE	The connections have to be made by the aircraft man- ufacturer in accordance with applicable regulations and the enclosed wiring diagram. See chap. 24-00-00 section: Switch requirements.
	NOTICE	The power supply to the various consumers (e.g. bat- tery) must be adequately protected by fuses. Using in- correctly rated fuses may result in destruction of the equipment.
		Under no circumstances must consumer cables (e.g. battery) be routed alongside the ignition cable. There is a risk of electromagnetic interference or damage.
	NOTICE	Do not bend, kink, pinch or otherwise improperly stress the wiring harness. Use proper routing, clamping and strain relief on wiring harnesses.



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INSTALLATION MANUAL

## 1.1) Electromagnetic compatibility (EMC/EMI)

, Electromagnet-	Electromagne	etic interference (EMI) and lightning		
ic interference	The engine co	mplies with EMI and lightning requirements as per DO- s 18, 20-22 as detailed in the following paragraphs.		
Emission	Emission			
	Conductive rac	dio interference:		
	Narrowband and broadband emissions meet RTCA DO160C Section 21-2 Cat. B (AZ) requirements except in the frequency range of 150 kHz-2 MHz where emissions are up to 20 dB higher than allowable limits.			
	Radiated radio interference:			
	item 21-6 and	nd broadband emissions meet RTCA DO160C Section 22, 21-7, Cat. B requirements except in the frequency range of z where emissions are up to 35 dB higher than allowable		
	NOTE:	Consult the aircraft manufacturer if further interpretation is needed. The exceeded limits do not affect the operation of the engine.		
Electromagnet-	Electromagnet	ic compatibility (EMC)		
ic compatibility	The engine complies with the electromagnetic interference and lightning strike requirements of DO-160C, section 18, 20-22 and IEC 801-2.			
	The following EMC tests have been carried out:			
	<ul> <li>Radio frequency (RF) sensitivity (conducted)</li> </ul>			
	<ul> <li>Radio frequency (RF) sensitivity (radiated)</li> </ul>			
	- Audio frequency sensitivity			
	- Lightning strike sensitivity			
	<ul> <li>Conducted radio frequency (RF) interference</li> </ul>			
	- Radiated rad	dio frequency (RF) interference		

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24-00-00

#### INSTALLATION MANUAL

## 2) Technical data and connection of the electric components

## 2.1) Internal generator

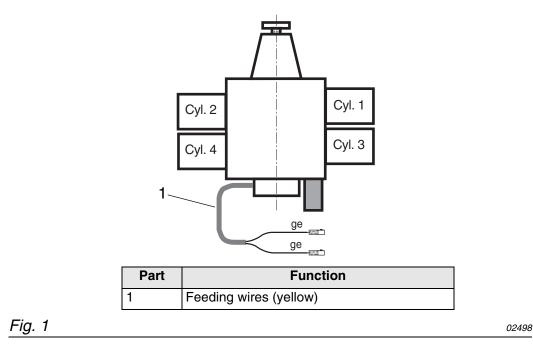
General note NOTE: Approx. 250 W AC output at 5800 rpm. For DC output in connection with rectifier-regulator. See chap. 24-00-00 section: 3).

**Connection** See Fig. 1.

Feeding wires (1) from the generator to rectifier-regulator on left side of ignition housing.

- 2 flexible cables, 1.5 mm<sup>2</sup> yellow (in shielding metal braid)
- length approx. 660 mm (26 in.) starting from ignition housing
- with on each plug socket 6.3 x 0.8 to DIN 46247

Graphic Connection



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#### INSTALLATION MANUAL

#### **Rectifier regulator** 2.2)

2.2) ne	
Туре	Electronic full-wave rectifier regulator.
Output voltage	14.2 V±0.3 (from 1000 ±250 rpm).
Current limit	Current limit: Max. 22 A.
Component tem- perature	Max. permissible component temperature: +80 °C (176 °F) (measured in area (1)). NOTE: The performance specifications are given for optimal cooled components. If necessary, use a separate heat sink for the rectifier regulator.
Weight	See chap. 72-00-00 section: weight.
Graphic	Connection
	Part       Function         1       Area component temperature         2       Description of connections:         G = yellow - from generator         R = red - to battery, positive terminal         B = battery positive terminal         L = warning lamp circuit         C = control or field circuit
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## 2.2.1) Requirements for flawless operation of the rectifier-regulator

General note	,	The voltage difference between battery and terminal <b>C</b>
	NOTICE	of regulator should be less than 0.2 V.
		Use cables in this area as short as possible and with adequate cross section.
	NOTICE	Never sever connection between terminal <b>C</b> and <b>B</b> of regulator (e.g. by removal of a fuse) while the engine is running. Overvoltage and regulator damage can occur.
		During engine stop break circuit between battery and terminal C to avoid discharge of battery! (see Fig. 11). A charge-indicating lamp 3 W/12 V (see Fig. 11 pos. 18) hay be fitted on the instrument panel.
Body of regula- tor	Body of regulator	must be grounded with no restance allowed.
Fuse	The rectifier-regulator has to be protected by a slow blowing 25 A fuse.	
Wire size	Wire size of the main circuit of at least 2.5 $mm^2$ (14 AWG).	
Capacitor	A capacitor (see Fig. 11 pos. 14) of at least 22000 $\mu$ F/25 V is necessary to protect the correct function of regulator and to flatten voltage. The regulator is not designed to store any electrical charge. If for any reason the battery or bus system is disconnected from the regulator while the engine is running (i.e. the master switch is shut off) the capacitor will safely absorb and dissipate the electrical charge produced by the generator. Otherwise the regulator would be damaged.	
Amperage	NOTICE	The graph current over engine speed has been deter- mined and is valid only at the following conditions:
	- Ambient tempe	erature: 20 °C (68 °F)
	- Voltage: per	rmanent 13.5 V
	- Tolerance: ma	x ± 5 %

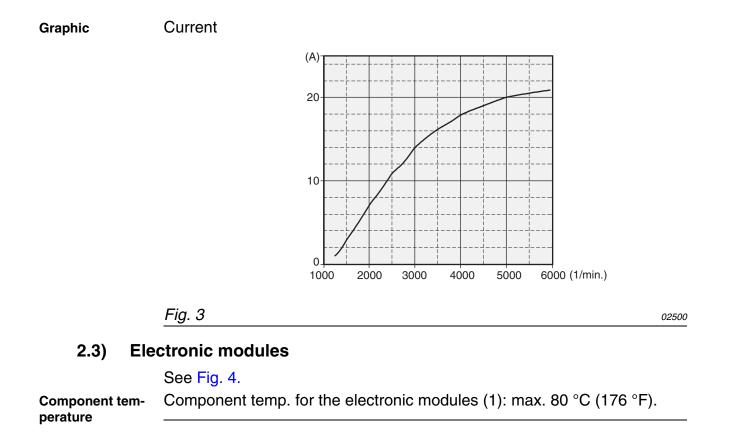
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#### INSTALLATION MANUAL





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## 2.4) Ignition switches (MAG switch)

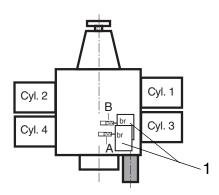
Туре	Two separate, suitable on-off switches (Fig. 11 pos. 15).	
Switching volt- age	Min. 250 V.	
Switching cur-	Min. 0.5 A.	
2.4.1	2.4.1) Connection	

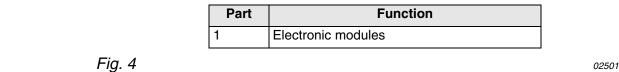
#### Wires

See Fig. 4.

Wires from the ignition switches connect to the electronic module (1).

Graphic Electronic modules





Wire

See Fig. 5.

NOTICE

The electromagnetic compatibility (EMC) and electromagnetic interference (EMI) depends essentially on the wire used.

Min. section area: 2x 0.75 mm<sup>2</sup> (18 AMG) (shielded flexible cable, shielding braid on both ends grounded to prevent EMI (e.g. specification MIL-27500/18).



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#### INSTALLATION MANUAL

	NOTICE	No or insufficient shielded cables can cause engine shut-off due to electromagnetic and radio interference.
		The metal base of each ignition switch must be grounded to aircraft frame to prevent EMI.
Wire A	Wire of top el	ectronic module (marked "A") for ignition circuit A.
Wire B	Wire of botto	m electronic module (marked "B") for ignition circuit B.
Ignition circuit A	NOTE:	Ignition circuit A controls: top spark plugs of cylinder 1 and 2; lower spark plugs of cylinder 3 and 4.
Ignition circuit B	NOTE:	Ignition circuit B controls: top spark plugs of cylinder 3 and 4; lower spark plugs of cylinder 1 and 2.
Graphic	Wire	
		Part Function
		1 Wire for ignition circuit A
		2 Wire for ignition circuit B
	Fig. 5	07602
Flexible wire		kible wire 0.75 mm² (18 AMG), brown. x. 35 mm (1 3/8") beginning at electronic module with one

Length approx. 35 mm (1 3/8") beginning at electronic module with one each plug socket and insulating sleeve 3.96 mm. At the new version the cable grommet and fasten connector are integrated in the 6-pole connector housing. See also SI-912-013, latest issue.

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## 2.4.2) Assembly of the flat pin terminal

General note	See Fig. 6.		
		e each cable grommet (1) and flat pin terminal (2) are pplied loosely packed.	
Special tools	The following special tools and equipment are necessary for fitting the Faston connector.		
	Part number	Description	
	n.a.	MOLEX Crimping pliers 64016-0035	

## Procedure Assembly of the flat pin terminal

n.a.

Step	Procedure
1	Strip cable (3) as required.
2	Install the cable grommet (1) in correct position and direction (A).
3	Use suitable crimping pliers (4) to fit the fasten connector ( <b>B</b> ).
4	The rubber grommet is held by the secondary crimp.
5	Push the faston connector in the corresponding slot (4) of the connector receptacle until it is locked in place ( $C$ ).
6	Check for tight fit.
7	Press the pin holder (white) downwards using the long nose pliers.

MOLEX Disassembly total 63813-1500

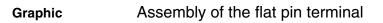
NOTE:	Faston connector and insulation sheath of the old version are available as spare part. See also SI-912-013, latest is-
	sue.
NOTE:	The pin holder must not be pressed with excessive force.

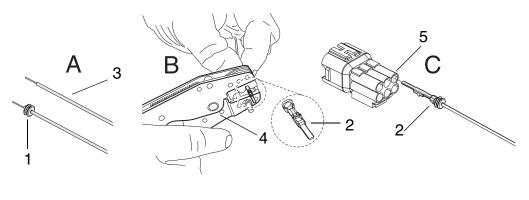




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#### INSTALLATION MANUAL





Part	Function		
1	Cable grommet		
2	Flat pin terminal		
3	Wiring (airframe)		
4	Crimping pliers		
5	Position in the connector housing		

Fig. 6

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INSTALLATION MANUAL

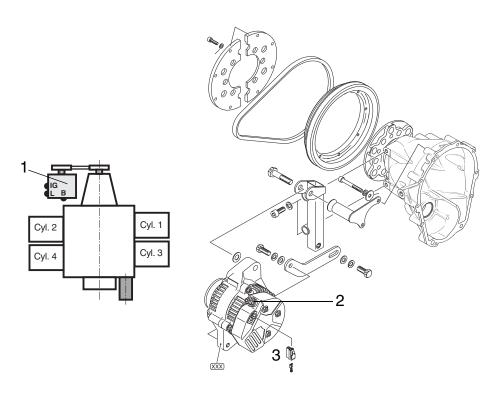
## 2.5) External alternator (optional extra)

2.5) LX			la)	
General note	See Fig. 7.			
2.5.1) Technical data				
General note	NOTE:	The voltage regu	ulator is integrated in the alternator.	
Output	Output: Max. 600 W/DC at 6000 r.p.m.			
Output Voltage	Output Voltage: 14.2 V - 14.8 V.			
Ambient tem-	Ambient tempe	erature:	Min30 °C (-22 °F)	
perature range			Max. +90 °C (194 °F)	
Weight	See chap. 72-00-00 section: Technical data.			
2.5.2)	) Connection			
Power supply wires	Power supply v peller gear.	wires to external a	Iternator (1) located on the outside of pro-	
Positive terminal	Positive termin	al (2):		
		onnection suitable orque 4 Nm (35 in	for cable terminal acording to DIN 46225 .lb).	
Grounding	Via engine bloo	ck.		
Control wiring	Control wiring	(field circuit) (3):		
	- Via supplied connectors.	l standard plug (Si	umitomo 6111-2568) and 6.3 x 0.8 Fasten	



#### INSTALLATION MANUAL

Graphic External alternator



Teil	Funktion	
1	External alternator	
2	Positive terminal	
3	Control wiring	

Fig. 7

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## 2.6) Requirements for correct operation of the integrated rectifier regulator

FuseThe rectifier regulator must be protected by a slow blowing fuse or circuit<br/>breaker. Fuse or circuit breaker rating must be determined by load, wire<br/>size and length.

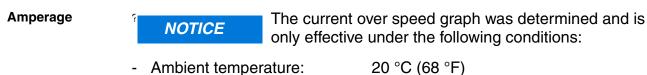
**Cross section** Wire size of the main circuit at least  $4 \text{ mm}^2$  (0.006 in<sup>2</sup>).

**Capacitor** A capacitor of at least 22000 µF/25 V is necessary to flatten voltage.

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- Voltage:

constant 13.5 V

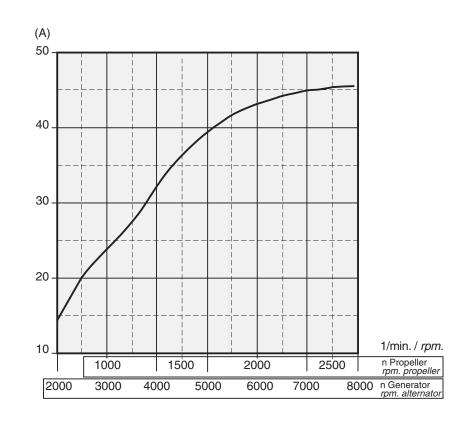
- Tolerance:

NOTE:

max. ± 5%

The speed of the external generator is 1.24 times the crankshaft speed or 3 times the propeller speed.

Graphic





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## 2.7) Connection of the electric rev counter (tachometer)

## 2.7.1) Technical data

,		•••	
Output signal	NOTICE	The graphs depicting output signals have been deter- mined and are effective only at the following condi- tions:	
	- Ambient tem	perature: 20 °C (68 °F)	
	- Tolerance:	Max. ± 5%	
	NOTE:	The pick-up for the rev counter generates one pulse per revolution.	
2.7.2)	Connection		
General note	NOTICE	BRP-Powertrain developed especially for this applica- tion a non-certified electric rev counter. Certification to the latest requirements such as FAR or EASA has to be conducted by the aircraft manufacturer. See also SI-13-1996, latest issue.	
Feeding wiring	Feeding wiring to electric rev counter on left side of ignition housing. - Length approx. 600 mm (24 in.) starting from ignition housing.		
Connections	2 flexible cables 0.5 mm <sup>2</sup> , white/yellow and blue/yellow (in insulation wrap).		
2.8) Bat	tery		
General note	See Fig. 11.		
	NOTICE	To warrant reliable engine start use a battery of at least 16 Ah capacity.	
2.9) Car	acitor (Ontion	n electrical fuel pump)	
<i>,</i> .	•		
General note	See Fig. 11.	To worroot roliable operation of the electrical fuel average	
	NOTICE	To warrant reliable operation of the electrical fuel pump the use of capacitor of at least 1 $\mu$ F/25 V is necessary.	

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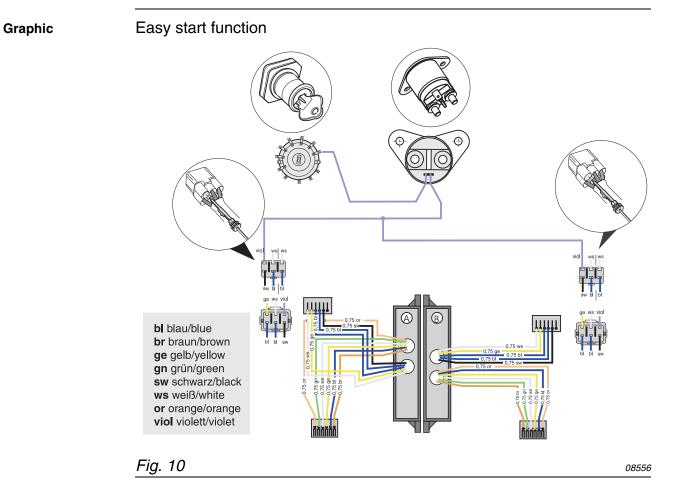
## 2.10) Easy start function on the electronic module (optional)

General note See Fig. 10.

In order to use the easy start function the relevant connections to the starter relays and ignition switch need to be made.

The start function can be used for aircraft, which have an engine start problem in cold conditions.

NOTE: In addition also a modified fly wheel hub is offered, which aids improved starting.



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#### INSTALLATION MANUAL

## 2.11) Wiring diagram

**General note** 

Scope of delivery

NOTICE

See Fig. 11.

Items/components which are not included in the standard engine scope of delivery must be certified the aircraft or fuselage manufacturer in accordance with the latest regulation, such as FAR or EASA.

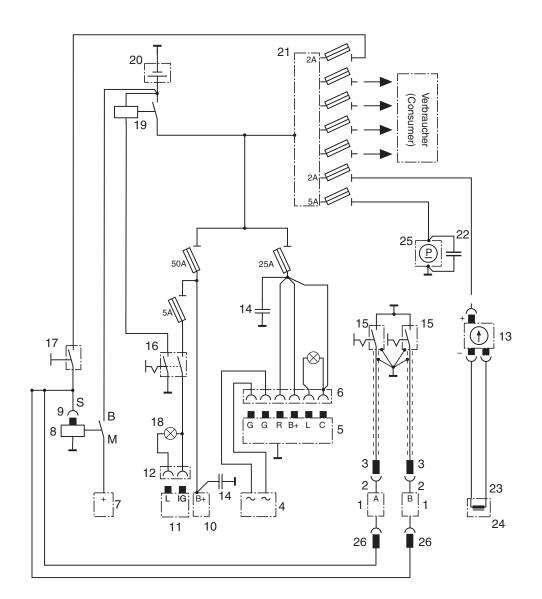
Position	Supply
1-9	Are included in the standard volume of supply of the engine.
22-24	Are included in the standard volume of supply of the engine.
10-14	Are available as accessory.
15-22	Can't be supplied by BRP-Powertrain.
25	Can't be supplied by BRP-Powertrain.



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#### INSTALLATION MANUAL

Graphic Wiring diagram



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## Legend to wiring diagram

Part	Function	Part	Function
1	2 Electronic modules (A and B)	17	Starter switch
2, 3	Plug connection for igni- tion switch	18	Control lamp
4	Integrated generator	19	Battery relay
5, 6	External regulator - recti- fier with plug connec- tions	20	Battery
7	Electric starter	21	Bus Bar
8, 9	Starter relay with plug connection	22	Capacitor 1 µF
10, 11, 12	External alternator with connection	23	Plug connection for trigger coil assy.
13	Electric rev counter	24	Trigger coil assy. (tachometer)
14	2 capacitor 1 μF	25	Electrical fuel pump
15	2 ignition switches	26	Starting equipment at the electronic modules
16	Masterswitch		

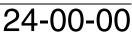
Fig. 11

I

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INSTALLATION MANUAL

# Chapter: 61-00-00 PROPELLER DRIVE

Instruction

Danger of explosion.

Never operate the engine without propeller as this results in serious engine damage from overspeeding. Never fit the propeller directly on the crankshaft.

Table of contents

This section of the Installation Manual contains information on the engine propeller component.

Subject	Page
Propeller drive	Page 3
Technical data	Page 3
Operating limits	Page 4
Vacuum pump	Page 5
Technical data	Page 5
Hydraulic governor for constant speed propeller	Page 7
Technical data for connections	Page 7

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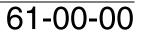


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NOTES





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## 1) Propeller drive

**General note** The propeller in tractor or pusher arrangement must be fitted on the propeller flange in accordance with applicable regulations. As required utilize one of the three possible pitch circle diameters (P.C.D) on the flange.

The propeller design must be certified in accordance with applicable regulations, such as FAR or EASA, by the aircraft manufacturer.

## 1.1) Technical data

Direction of rota- See Fig. 1.

tion

Direction of rotation of the propeller flange:

- left, counter clockwise, looking towards face of flange.

Graphic Direction of rotation

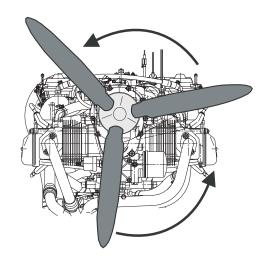


	Fig. 1	08629	
Transmission	Gear transmission:		
	- i= 2.2727 (50 <b>T</b> eeth/22 T)		
	- i= 2.4286	6 (51 <b>T</b> eeth/21 T)	
Vibration analy- sis	NOTE:	Vibration analysis of the whole system (engine, suspen- sion, propeller etc.) should be carried out as part of the certification process.	
		If no limits are available in the technical literature, a max. of 1.0 IPS (inches per second) at 5000 rpm. can be as- sumed.	

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Propeller shaft flange

See Fig. 2.

Attachment of propeller on prop shaft flange:

Pitch circle diameter 75 mm (2.95 in.)	6x through holes 8 mm (0.31 in.)
Pitch circle diameter 80 mm (3.15 in.)	6x through holes 11.5 mm (0.45 in.)
Pitch circle diameter 101.6 mm (4")	6x through holes 13 mm (0.51 in.)
Hub diameter	47 mm (1.85 in.)

#### Graphic

Torque

## Propeller shaft flange

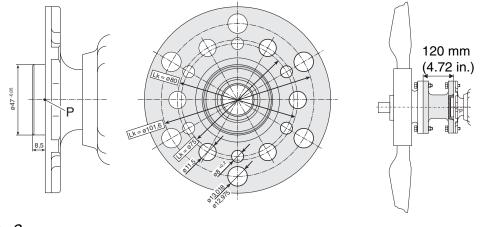


Fig. 2



## 1.2) Operating limits

**NOTICE** Modification of the propeller shaft is not permitted.

Max. torque:

ROTAX 912 A, F, UL for i=2.2727
ROTAX 912 A, F, UL for i=2.4286
ROTAX 912 S, ULS for i=2.4286
238 Nm (176 ft.lb) (at propeller)
255 Nm (188 ft.lb) (at propeller)
315 Nm (232 ft.lb) (at propeller)

Max. moment of inertia	Max. permissible moment of inertia on propeller:
	<ul> <li>6000 kg cm<sup>2</sup> (14.238 lb ft<sup>2</sup>)</li> </ul>
	<ul> <li>Normal between 1500 kg cm<sup>2</sup> and 6000 kg cm<sup>2</sup> (3.559 lb ft<sup>2</sup> and 14.238 lb ft<sup>2</sup>)</li> </ul>
Extension of propeller shaft	- Max. extension of the propeller shaft: 120 mm (4.72 in.)
Out of balance	Dynamic balancing of the proppeller as specified by the propeller manu- facturer must be carried out.

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#### **INSTALLATION MANUAL**

## 2) Vacuum pump

#### 2.1) **Technical data**

**General note** 

See Fig. 3.

NOTICE

Certification to the latest requirements such as FAR or EASA has to be conducted by the aircraft manufacturer.

Drive

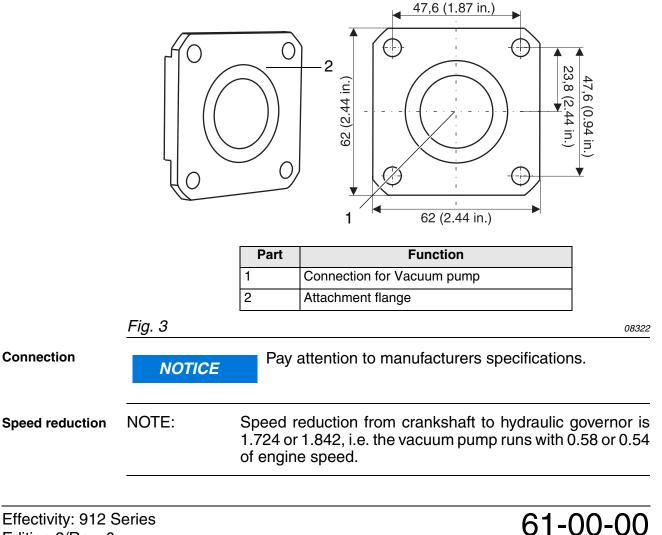
Drive via propeller gear.

Location of the necessary connection (1) on the crankcase.

	Coordinates		
Connection	x-Axis mm	y-Axis mm	z-Axis mm
	-206.3 mm (-8.12 in.)	0	51.5 mm (2.03 in.)

#### Graphic

Attachment flange



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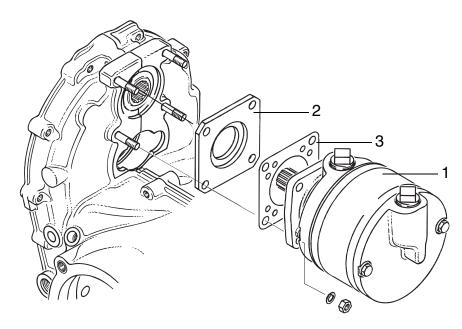
#### INSTALLATION MANUAL

#### Connections

Thread size	M6
Effective thread length	Max. 17 mm (9/16")
Governor drive	Internal spline 20/40 SMS 1834 NA 14x1.27x30x12
Power consumption	Max. 600 W

#### Graphic

## Vacuum pump



Part	Function
1	Vacuum pump
2	Attachment flange
3	Gasket

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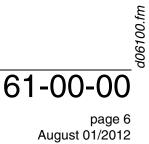


Fig. 4

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## 3) Hydraulic governor for constant speed propeller

## 3.1) Technical data for connections

NOTE:

General note See Fig. 5.

See therefore also SB-912-052 "Installation/Use of governors for ROTAX engine type 912 and 914", latest issue.

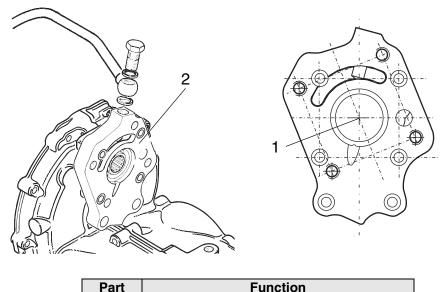
Drive

Drive via propeller gearbox.

- Position of the propeller connection (1) on the governor flange

	Axes		
Point of support	x-Axis mm	y-Axis mm	z-Axis mm
	-206.3 mm (-8.12 in.)	0	51.5 mm (2.03 in.)

Graphic Crankcase flange



Part	Function	
1	Connection for hydraulic governor	
2	Governor flange	



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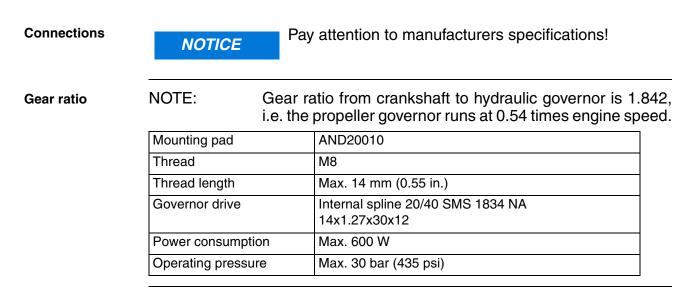
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#### INSTALLATION MANUAL



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INSTALLATION MANUAL

## Chapter: 72-00-00 ENGINE

Introduction

Certification in accordance with the latest regulations, such as FAR or EASA, must be carried out by the aircraft or fuselage manufacturer.

Table of contentsThis section of the Installation Manual contains views of the aircraft<br/>engine, technical data and installation dimensions of the engine.

NOTICE

Subject	Page
Engine components, engine views, cylinder designation	Page 3
Side view	Page 4
Front view	Page 5
Top view	Page 6
Technical data	Page 7
Weight	Page 7
Installation dimensions	Page 8
Centre of gravity of engine and standard accesso-	Page 8
ries	
Moments of inertia	Page 8
Operating limits	Page 9
Deviation from the apparent perpendicular	Page 9

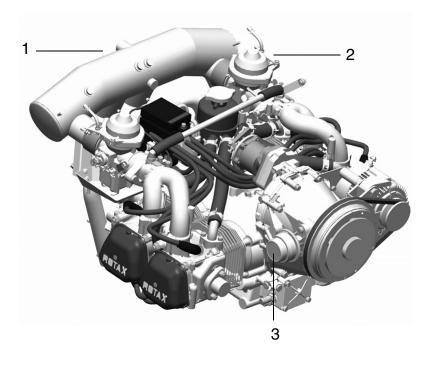
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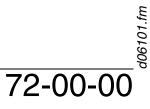
Overview Engine



Part	Function	
1	Airbox	
2	Carburetor	
3	Mechanical fuel pump	

Fig. 1

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1) Engine components, engine views, cylinder designation and denomination of main axes

Regarding change of temperature sensor position, see Fig. 2 and Fig. 3.

NOTE: It is NOT mandatory to retrofit engines with the old cylinder heads. The different versions of the cylinder heads can be mixed installed, but make sure, if and at which position the cylinder head temperature and coolant temperature is measured. This also defines the naming of the indicating instrument with the appropriate temperature limit.

## Suffix -01:

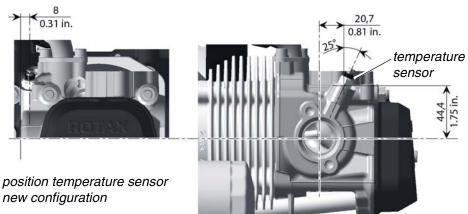
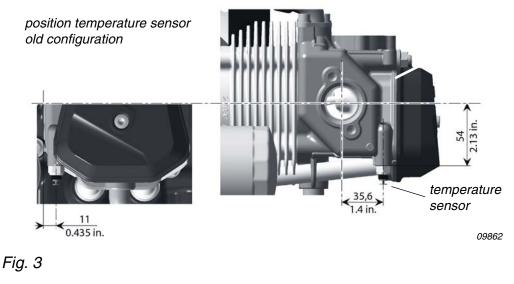


Fig. 2

## without Suffix -01:



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#### INSTALLATION MANUAL

General note See Fig. 4.

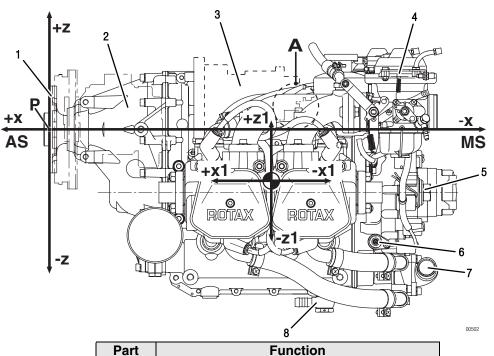
**PTO** power take off side

 $\ensuremath{\text{MS}}$  magneto side

- A points of attachment (for engine transport) centre of gravity
- P zero reference point for all dimensions
- NOTE: Allow ± 1 mm on all stated dimensions as manufacturing tolerance.
- x, y, z axes for system of coordinates
- Cyl. 1 Cylinder 1 Cyl. 3 Cylinder 3
- Cyl. 2 Cylinder 2 Cyl. 4 Cylinder 4

Side view

L



Part	Function
1	Propeller flange
2	Propeller gear
3	Vacuum pump or hydraulic governor for con- stant speed propeller
4	Constant depression carb
5	Ignition cover
6	Connection for mechanical rev counter
7	Coolant pump
8	Connection for oil return line

Fig. 4

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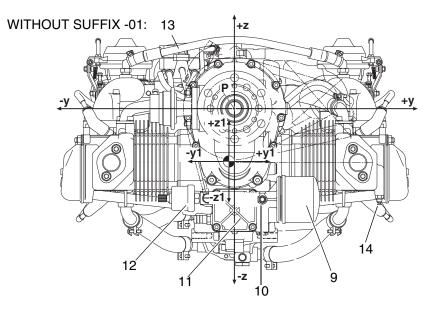
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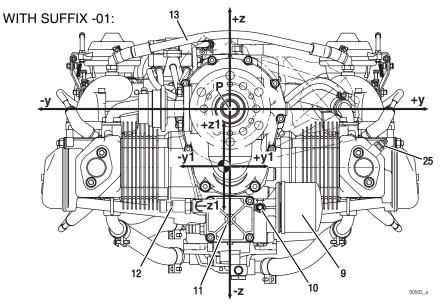
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Front view





Part	Function	
9	Oil filter	
10	Sensor for oil temperature	
11	Oil pump	
12	ensor for oil pressure	
13	Compensation tube	
14	Cylinder head temperature sensor	
25	Coolant temperature sensor	

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Fig. 5

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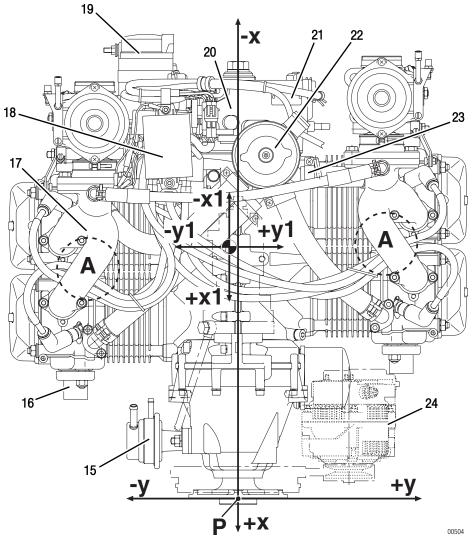
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Top view



Part	Function			
15	Mechanical fuel pump			
16	Exhaust socket			
17	Intake manifold			
18	Electronic module			
19	Electric starter			
20	Ignition housing			
21	Engine number			
22	Expansion tank			
23	Connection for manifold pressure			
24	External alternator			

Fig. 6

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#### INSTALLATION MANUAL

## 2) Technical data

**General note** To maintain clarity, only data relevant for engine installation and operation will be stated in the Manual.

NOTE: Connecting sizes, capacities, gear and reduction ratios, electric power, permissible temperatures, etc. can be found in the respective section of engine installation or other relevant engine type documentation.

## 2.1) Weight

**General note** The engine weight is defined by the following conditions:

- **Engine dry** from serial production with internal alternator, with overload clutch (see chapter Description of design).

#### Version

#### ROTAX 912 A, 912 F, 912 UL:

Version	Weight
Version 2 and 4	57.1 kg (125 lb)
Version 3	59.8 kg (132 lb)

#### ROTAX 912 S, 912 ULS:

Version	Weight
Version 2 and 4	58.3 kg (128 lb)
Version 3	61.0 kg (134 lb)

#### Accessories Overview:

Accessories	Weight
External alternator assy.	3.0 kg (6.6 lb)
Overload clutch	1.7 kg (3.7 lb)
Vacuum pump assy.	0.8 kg (1.76 lb)
Hydraulic governor assy. incl. drive (depending on type)	approx. 2.2 (4.8 lb) to 2.7 kg (6 lb)
HD-starter	additional +0.43 kg (1 lb)
Rectifier regulator	0.3 kg (0.66 lb)
Starter relais	0.145 kg (0.32 lb)
Radiator	1.0 kg (2.2 lb)
Air guide hood	0.36 kg (0.79 lb)
Airbox	1.3 kg (2.8 lb)
2 air filter	0.3 kg (0.66 lb)
Oil radiator	0.55 kg (1.21 lb)

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#### INSTALLATION MANUAL

Accessories	Weight
Exhaust system	approx. 4.0 kg (8.8 lb)
Engine mount	2.0 kg (4.4 lb)

## 2.2) Installation dimensions

Standard engine version

#### See Fig. 5. NOTE:

All dimensions from zero reference points (P).

	Standard engine version		
	Pos. (+)	Neg. (-)	Total
max. dimension along x-axis (mm)	8.5 (0.33 in.)	-581 (-22.87 in.)	589.5 (23.21 in.)
max. dimension along y-axis (mm)	288 (11.34 in.)	-288 (-11.34 in.)	576 (22.68 in.)
max. dimension along z-axis (mm)	118 (4.65 in.)	-276 (-10.87 in.)	394 (15.51 in.)

## 2.3) Centre of gravity of engine and standard accessories

Centre of gravity

See Fig. 5. NOTE:

All dimensions from zero reference points (P).

	Standard engine version 3	External alternator	Hydraulic governor	Vacuum pump
centre of gravity on x-axis (mm)	-316 (-12.44 in.)	-100 (-3.94 in.)	-276 (-10.87 in.)	-255 (-10.04 in.)
centre of gravity on y-axis (mm)	-5 (-0.20 in.)	139 (5.47 in.)	0	0
centre of gravity on z-axis (mm)	-83 (-3.27 in.)	6 (0.24 in.)	56 (2.20 in.)	56 (2.20 in.)

## 2.4) Moments of inertia

Moments of inertia See Fig. 5.

Engine Engine version 2/4 version 3 11100 moment of inertia around 11600 axis x1-x1 (kg  $cm^2$ )  $(26.341 \text{ lb ft}^2)$ (27.527 lb ft<sup>2</sup>) moment of inertia around 10900 11390 (27.029 lb ft<sup>2</sup>) axis y1-y1 (kg cm<sup>2</sup>)  $(25.866 \text{ lb } \text{ft}^2)$ moment of inertia around 17400 18200 axis z1-z1 (kg cm<sup>2</sup>) (41.291 lb ft<sup>2</sup>) (43.190 lb ft<sup>2</sup>)

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#### INSTALLATION MANUAL

## 3) Operating limits

Manuals

1

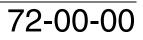
Documentation overview:

Operating limits	Manual		
Engine speed	See Operators Manual 912 Series, chap. 2.1		
Acceleration	See Operators Manual 912 Series, chap. 2.1		
Oil pressure	See Operators Manual 912 Series, chap. 2.1		
Oil temperature	See Operators Manual 912 Series, chap. 2.1		
Cylinder head temperature	See Operators Manual 912 Series, chap. 2.1		
Coolant temperature	See Operators Manual 912 Series, chap. 2.1		
Exhaust gas temperature	See chap. 78-00-00 section: Operating limits.		
Ambient temperature for start up	See Operators Manual 912 Series, chap. 2.1		
Ambient temperature for electronic module	See chap. 24-00-00 section: Electronic module.		
Fuel pressure	See Operators Manual 912 Series, chap. 2.1		
Governor	See Operators Manual 912 Series, chap. 2.1		
External alternator	See Operators Manual 912 Series, chap. 2.1		
Deviation from the apparent per- pendicular	See Operators Manual 912 Series, chap. 2.1		

## 3.1) Deviation from the apparent perpendicular

General note	See Fig. 7.				
	The engine design is for a conventional, non-aerobatic, tractor or pusher configuration with the oil return port in the optimum position. Assuming these points are taken into consideration, the engine will be properly lubricated in all flight profiles.				
Bank angle		ng bank angle $\beta$ (depending on acceleration/deceleration) may ed the max. bank angle.			
	NOTE:	Pitch or role angle $\alpha$ is not equal with $\beta$ , except stabilized condition (without acceleration).			

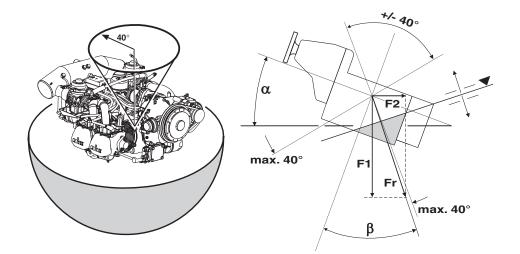
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#### INSTALLATION MANUAL

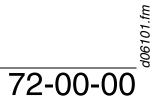




α	Bank or rotation	F1	Gravity
β	Bank angle	F2	Acceleration
		Fr	Result of F1 and F2

Fig. 7

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INSTALLATION MANUAL

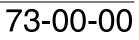
## Chapter: 73-00-00 FUEL SYSTEM

 Instruction
 NOTICE
 The design of the fuel system is the responsibility of the aircraft manufacturer.

 The fuel system must be designed to ensure that the engine is supplied with sufficient fuel at the correct pressure in every operational situation. Operating limits must be adhered to!

 Table of contents
 This section of the Installation Manual contains information on the aircraft engine fuel system.

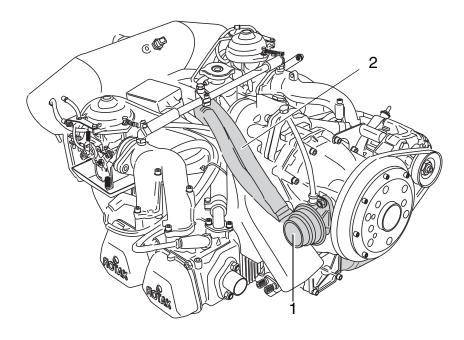
Subject	Page
Fuel system	Page 3
Description of system	Page 3
Operating limits	Page 5
Fuel pressure	Page 5
Electrical fuel pump	Page 6
Requirements of the fuel system	Page 6
Connecting dimensions, location of joints and directives for in- stallation	Page 7
Fuel manifold	Page 7
Fuel pump	Page 9
Check valve	Page 10
Carburetor	Page 11
Requirements on the carburetor	Page 11
Drainage piping on airbox and drip trays	Page 13
Drainage piping on carburetor	Page 14
Connections for Bowden cable actuation and permissible load	Page 15
Technical data	Page 15
Requirements on cable actuation	Page 17
Requirements on the throttle lever	Page 18
Air intake system	Page 21
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Air intake socket for fresh air or pre-heated air	Page 22
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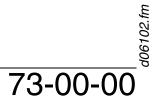




Part	Function
1	Fuel pump
2	Fuel hose assy.

Fig. 1

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#### INSTALLATION MANUAL

## 1) Fuel system

## 1.1) Description of system

, General note	See Fig. 2.			
	NOTE:	The fuel system from tank to the inlet of engine-driven fuel pump has to be installed by the aircraft manufacturer.		
Fuel	The fuel flows from the tank (1) via a coarse filter and fire cock (3) con- tinue to water trap/fine (4) to the mechanical fuel pump (5), from the pumps fuel passes on via the fuel manifold (6) to the two carburetors.			
Fuel lines	Depending on the configuration of the engine the fuel lines from fuel pump to the carburetors are already installed by the manufacturer (optional on some engine).			
	Only the follo	wing connections per Fig. 2 have to be established:		
	- Feeding lir	- Feeding lines to suction side of the mechanical fuel pump (5).		
<ul> <li>Lines from pressure side of the manifold (6).</li> </ul>		pressure side of the mechanical fuel pump to inlet of fuel 6).		
	- Returnline from fuel pressure control to fuel tank.			
Return line	Via the return line (5) surplus fuel flows back to the fuel tank and suc side of fuel system.			
	NOTE:	The return line prevents malfunctions caused by the for- mation of vapor lock.		
Components	The fuel syste	em includes the following items:		
- Tank - Coarse filter				
		er		
	- Fine filter/	Fine filter/water trap		
	- Fuel shut off valve			
	- Electrical fuel pump			
	- Manometer			
	- Return line	e from engine to tank (with integrated adapter sleeve)		
	as well as the required fuel lines and connections.			
	·			

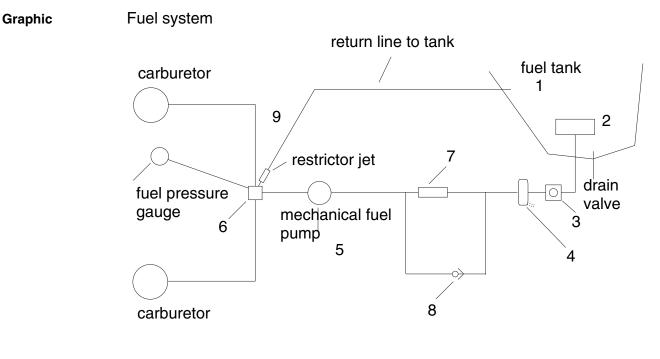
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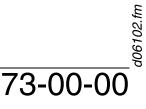
#### INSTALLATION MANUAL



Part	Function	
1	Fuel tank	
2	Coarse filter	
3	Fire cock	
4	Fine filter/water trap	
5	Mechanical fuel pump*	
6	Fuel pressure control*	
7	Electrical fuel pump	
8	1x check valve	
9	Return line from engine to tank (with integrated adapter sleeve)	
	* Standard version	

Fig. 2

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#### INSTALLATION MANUAL

## 1.2) Operating limits

**General note** 

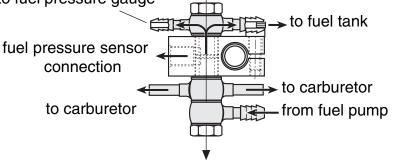
NOTICE

The design and layout of the entire fuel system must ensure engine operation within the specified operating limits.

See 912 Series Operators Manual, section 2.1) Operating Limits.

## 1.2.1) Fuel pressure

1.2.1)	i dei piessuie		
General note	See Fig. 3.		
		Fuel pressure i	e can result in serious injuries or death! In excess of stated limit can lead to an float valve with subsequent engine stop.
I	NOTE:	gauge connection	uel pressure are taken at the pressure on the fuel distributor piece (standard and 912 S, optional for other series).
<b>Operating limits</b>	Fuel pressure:		
	Max.		0.4 bar (5.8 psi) (0.5 bar (7.26 psi))*
	Min.		0.15 bar (2.2 psi)
	* applicable onl	y for fuel pump from	n S/N 11.0036.
Graphic	Fuel pressure		
	to fuel pr	ressure gauge	$z_4$



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Fig. 3

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#### INSTALLATION MANUAL

## 1.2.2) Electrical fuel pump

The engine manufacturer requests the use of an electrical auxiliary fuel **General note** pump. The electrical auxiliary fuel pump is not just required in case of a malfunction or defect of the mechanical fuel pump, but also provides required fuel supply e.g. in case of vapour formation at high altitudes and temperatures. NOTE: If an electrical auxiliary fuel pump is installed, the whole fuel **Operating limits** system has to be designed to warrant engine operation within the specified pressure limits. The fuel pressure of an additional auxiliary fuel pump NOTICE should not exceed 0.3 bar (4.4 psi). 1.3) Requirements of the fuel system Electric or mechanical fuel pump: **Delivery rate**  Min. 35 l/h (8.2 US gal/h). Fuel lines See Fig. 2. Fuel lines have to be established to the latest require-NOTICE ments such as FAR or EASA by the aircraft manufacturer. For prevention of vapour locks, all the fuel lines on the NOTICE suction side of the fuel pump have to be insulated against heat in the engine compartment and routed at distance from hot engine components, without kinks and protected appropriately. At very critical conditions e.g. problems with vapour formation the fuel lines could be routed in a hose with cold air flow. Secure fuel hoses with suitable screw clamps or by crimp connection. **Fuel return line** The installation of a fuel return line is mandatory. NOTICE If the fuel distributor piece with regulator from ROTAX is not available, the fuel pressure must be regulated by a restriction in the fuel return line, which ensures that the fuel pressure is under all operating conditions within the operating limits specified by ROTAX.

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#### INSTALLATION MANUAL

Fuel filter	See Fig. 2.		
	Fuel filter		
	Coarse filterOn fuel tank as per valid certification.		
	n T	n the feed line from tank to the fuel pumps an additional fine filter with <b>neshsize</b> 0.1 mm (.004 in.) has to be provided. The filter has to be controllable for service. A combination of filter/water- rap (gascolator) is recommended.	
Water trap	A suitable water trap must be installed at the lowest point of the fuel feed line.		
Fuel temperature	To avoid vapour locks keep the temperature of the fuel lines, float cham- ber and related deviced below 45 °C (113 °F).		
	If you should encounter problems in this respect during the test period, than the affected components such as the supply line to the fuel pumps have to be cooled.		
1.4) Con latio	•	ensions, location of joints and directives for instal-	
1.4.1)	Fuel manifol	ld	
Return line	See Fig. 4.		
	Return line (1) to tank:		
	Outside dia.	7 mm (.28 in.)	
	Slip-on length	Max. 17 mm (.67 in.)	
Pressure gauge	Pressure gau	uge connection (2):	
	Outside dia.	6 mm (.24 in.)	
	Slip-on length	Max. 17 mm (.67 in.)	

Fuel pressure switch Fuel pressure switch connection (3):

•	
Thread	M10
Thread length	Max. 9 mm (.35 in.)
Tightening torque	15 Nm (135 in.lb) und LOCTITE 221

#### Banjo bolt

NOTICE

At loosening or tightening of the banjo bolt (4) (tightening torque 10 Nm = 90 in.lb) support the fuel manifold appropriately.



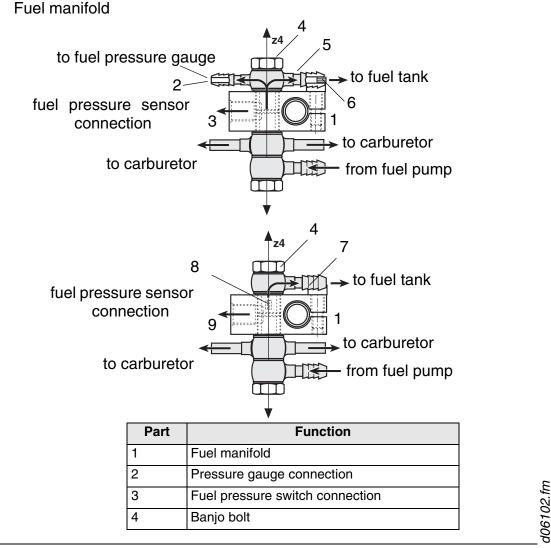
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#### INSTALLATION MANUAL

Connection nip-<br/>pleNOTE:The connection nipple (5) is furnished with an orifice (6)<br/>essential for operation of the fuel system.<br/>If the pressure gauge connection (2) is not used and a hose<br/>nipple (7) installed, the banjo bolt assy. (4) marked with a<br/>color dot or marked "FUEL" is furnished with an orifice (8).<br/>This is essential for operation of the fuel system as it pre-<br/>vent a loss in fuel pressure.CoordinatesPosition of z4 axis of the fuel manifold:<br/>Dimensions always from point of reference (P).

	Coordinates [mm]		
	x-axis	y-axis	z-axis
Fuel distributor	-385.0 mm	-50.0 mm	approx 110 mm
piece	(-15.16 in.)	(-1.97 in.)	(4.33 in.)

Graphic



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#### INSTALLATION MANUAL

Part	Function	
5	Connection nipple	
6	Orifice (0.35 mm = 0.014 in.)	
7 Hose nipple		
8	Orifice (0.35 mm = 0.014 in.)	

Fig. 4

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## 1.4.2) Fuel pump

General note

See also page 10A.



Ensure at installation of the supply line to fuel pump that no additional moments or load will rest on the pump!



Utilize max. slip on length. Secure hoses with suitable screw clamps or crimp.

Slip-on joint Hose connection on fuel pump (1) inlet by slip-on joint. Fuel intake connection (2):

Outside dia.	8 mm (.32 in.)
Slip-on length	Max. 22 mm (.87 in.)

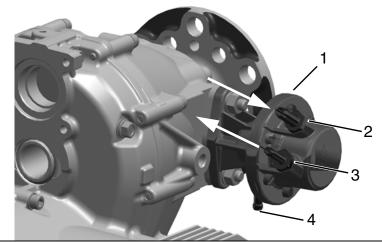
Fuel outlet connection (3):

Outside dia.	6 mm (.24 in.)
Slip-on length	Max. 22 mm (.87 in.)

Drainage (4):

Outside dia.	6 mm (.24 in.)
Slip-on length	Max. 22 mm (.87 in.)

Fig. 5.1



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**Sleeved lines** Hose connection on fuel pump (1) supplied with fire sleeved lines. Fuel intake connection (2):

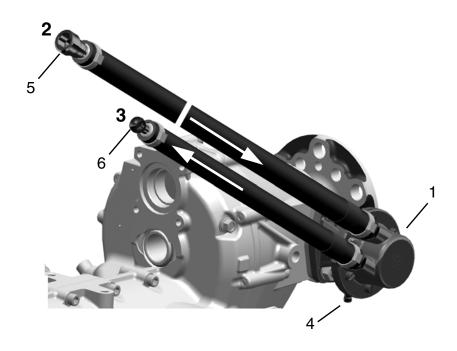
Fitting (5)	9/16-18 UNF (AN-6)
Tightening torque	15 Nm (135 in.lb)

Fuel outlet connection (3):

Hose nipple (6)	3/4 DIN 7642
Tightening torque	15 Nm (135 in.lb)

## Drainage (4):

Outside dia.	6 mm (.24 in.)
Slip-on length	Max. 22 mm (.87 in.)



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гıу.	<i>J.</i> Z

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## 1.4.3) Check valve

#### Specification

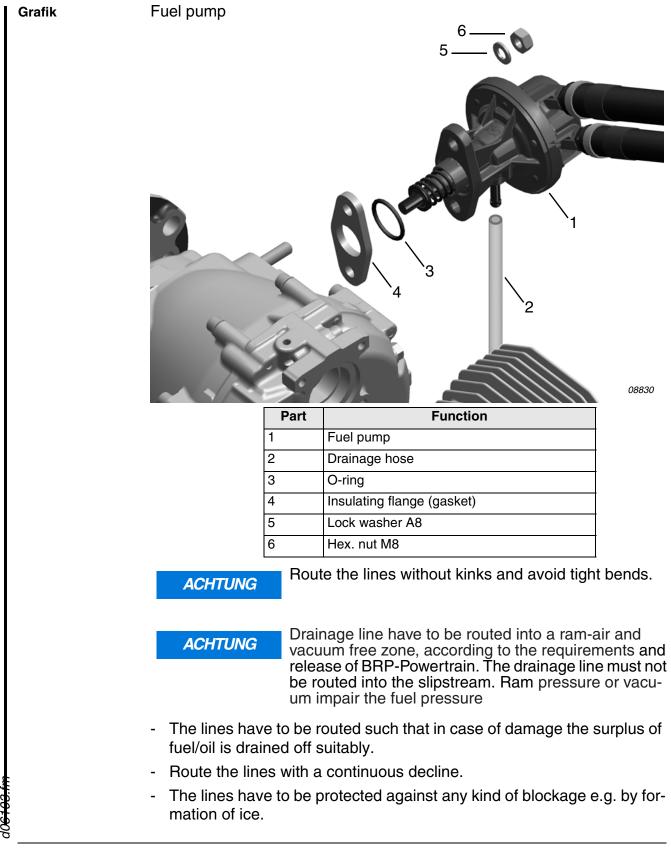
Opening pressure	0.1 bar - 0.15 bar (1.5 psi 2.2 psi.)
Permitted pressure in reverse-biasing	2 bar (29 psi.)
Burst pressure	5 bar (72.5 psi.)

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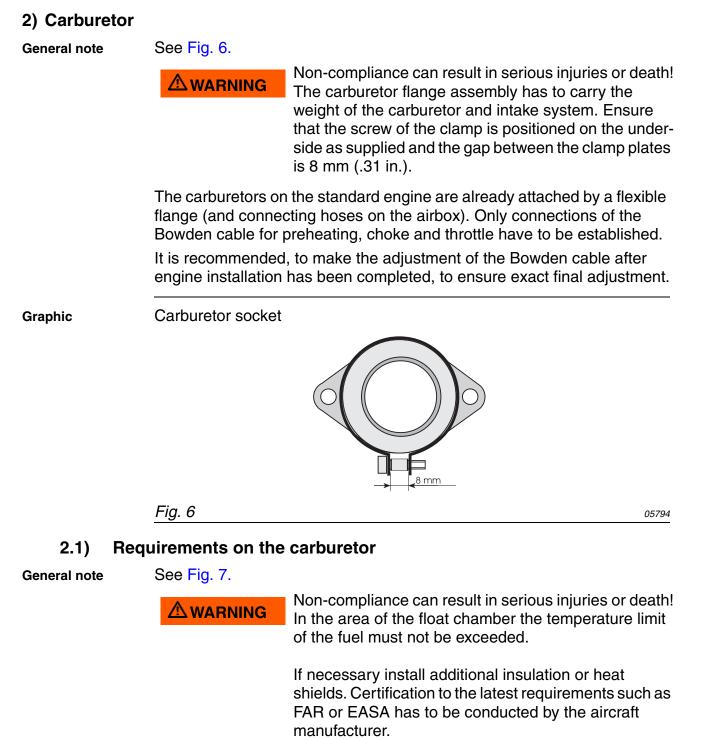
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	NOTICE	route airbo BRF Thes dow	float chamber venting lines (1) lines have to be ed into a ram-air and vacuum free zone or into the ox, according to the requirements and release of P-Powertrain. See chapter "air intake system". se lines must not be routed into the slipstream or n the firewall.
		•	sure in the carburetor chambers may lead to ne malfuction due to incorrect fuel supply.
Drip tray		each dr	itioned above the exhaust sockets. Below the ip tray (2) with a draining connection (3) is fitted shield as well.
Graphic	Drip tray and dra	ining co	onnection
	Drip tray and draining connection		
		Part	Function
		1 2	Float chamber venting lines
		2 3	Drip tray Draining connection
	L	5	
	Fig. 7		08644 0061 08644
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## 2.1.1) Drainage piping on airbox and drip trays

2.1.1	branage piping on anoox and drip days
General note	See Fig. 7           Marning         Non-compliance can result in serious injuries or death!           Connect drainage lines, otherwise emerging fuel from a possible leakage could drip onto the exhaust system.           RISK OF FIRE!
Drainage piping	Requirements on the drainage piping:         NOTICE         With closed or blocked leakage piping, fuel could end up on exhaust system. RISK OF FIRE!
	<ul> <li>The lines have to be routed such that in case of damage the surplus fuel is drained off suitably.</li> <li>Route the lines without kinks and avoid tight bends.</li> <li>Route the lines with a continuous decline.</li> <li>The lines have to be protected against any kind of blockage e.g. by formation of ice.</li> </ul>
Float chamber venting lines	Float chamber venting lines: NOTICE The float chamber venting lines (1) have to be routed into a ram-air and vacuum free zone or into the airbox, according to the requirements and release of BRP-Powertrain. See chapter "air intake system". These lines must not be routed into the slipstream or down the firewall. Pressure differences between intake pressure and pressure in the carburetor chambers may lead to engine malfunction due to incorrect fuel supply.
Connecting nip-	Connecting nipple (3) for leakage line:
ple for leakage line	Outside dia. 6 mm (1/4")
	Olion on length Max 17 mm (11/10%)

Outside dia.	6 mm (1/4"")
Slip on length	Max. 17 mm (11/16")



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## 2.1.2) Drainage piping on carburetor

#### General note

WARNING Non-compliance can result in serious injuries or death! Connect drainage lines, otherwise emerging fuel from a possible leakage could drip onto the exhaust system. RISK OF FIRE!

The primary function of the carburetor float chamber venting lines, is to provide ambient air pressure to the float bowl chambers. However, it is possible for fuel to be expelled from these lines. Normally these lines are connected to fitting on the ROTAX airbox to provide the ideal ambient air pressure and away of draining any expelled fuel overboard.

## **Drainage piping** If an airbox is not installed, the vent lines will need to be routed according to the following instructions:

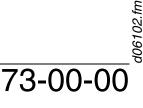
- The lines have to be routed such that in case of fuel being expelled it is drained off suitably.
- Route the lines without kinks and avoid tight bends.
- Route the lines with a continuous decline.

NOTICE

- The lines have to be protected against any kind of blockage e.g. by formation of ice.

> The carburetor float chamber venting lines have to be routed into a ram-air and vacuum free zone (or into the airbox, according to the release of BRP-Powertrain. These lines must not be routed into the slipstream or any other location that is subject to ram-air or vacuum during flight or ground operations. Pressure differences between intake pressure in the

carburetor float chamber may lead to engine malfunction due to incorrect fuel supply.



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INSTALLATION MANUAL

## 2.2) Connections for Bowden cable actuation and permissible load

General note

NOTICE

The specified permissible loads must never be exceeded!

## 2.2.1) Technical data

See Fig. 8.

**Coordinates P1** Centre position of carburetor socket (P1) of the respective carburetor:

	Coordinates P1 [mm]		
Carburetor for	x-axis	y-axis	z-axis
Cylinder 1/3	-521 mm	-180 mm	25 mm
	(-20.52 in.)	(-7.1 in.)	(0.988 in.)
Cylinder 2/4	-553 mm	180 mm	25 mm
	(-21.772 in.)	(7.1 in.)	(0.988 in.)

#### **Reference point** Limit load on point of reference P2:

	Reference point P2
Max. allowable forces (limit load) in (N) in x, y and z-axis	60 N (44 ft.lb)
Max. allowable bending moments (limit load) in (Nm) in x, y and z-axis	4 Nm (3.32 lb ft)

Connection

**P2** 

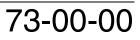
Connection (1) for air filter or intake silencer:

Outside dia.	50 mm (2 in.)
Slip-on length	12 mm (.47 in.)

Connection (2) for throttle actuation:

Connection on throttle lever	Set screw M5x12	
Tightening torque	4 Nm (3.32 lb ft) (suitable for 1.5 mm (.06 in.) steel wire).	
Action travel	65 mm (2.56 in.)	
Actuating force	Min. 1.5 N (.3 lb) Max. 8 N (1.8 lb)	
Limit load	20 N (4.5 lb-force)	
NOTE: Throttle anone by anring		

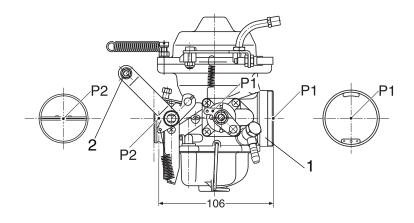
NOTE: Throttle opens by spring.



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#### INSTALLATION MANUAL

## Graphic Coordinates P1 and Reference point P2



	Part	Function	
	1	Connection for air filter or intake silencer	
2 Connection for throttle actuati		Connection for throttle actuation	

#### Fig. 8

Starting carb

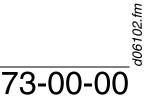
## See Fig. 9.

#### Connection for starting carb (choke) actuation (1):

Connection on choke lever	Clamping nippel 6 (suitable for 1.5 mm (.06 in.) steel wire).
Action travel	23 mm (15/16")
Actuating force	Min. 10 N (2.2 lb) Max. 45 N (10 lb)
Limit load	100 N (22 lb)

## Directive for choke actuation:

The choke shaft (1) is marked (2). This mark has to point towards cable engagement (3).



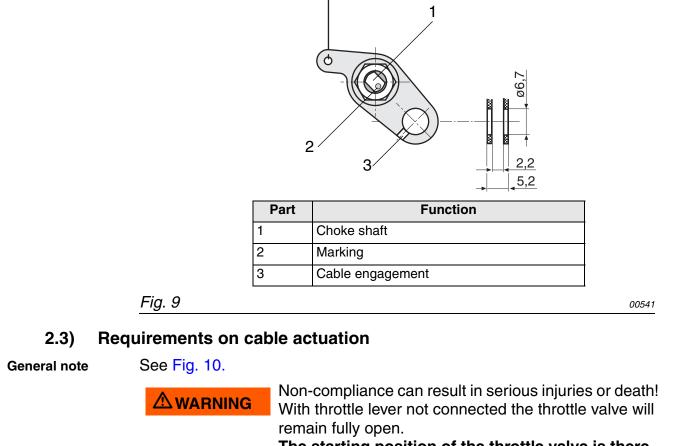
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#### INSTALLATION MANUAL

Choke actuation

Graphic



The starting position of the throttle valve is therefore full throttle!

Therefore never start the engine without connecting the throttle lever first.

**WARNING** Non-compliance can result in serious injuries or death! The cable actuations being used must not be affected at all by vibrations emanating from the engine or the airframe.

## **Bowden cable** The two throttles have to be controlled by two separate Bowden cables working synchronously.

Adjust the cables to a free travel of 1 mm (.04 in.).

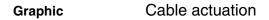


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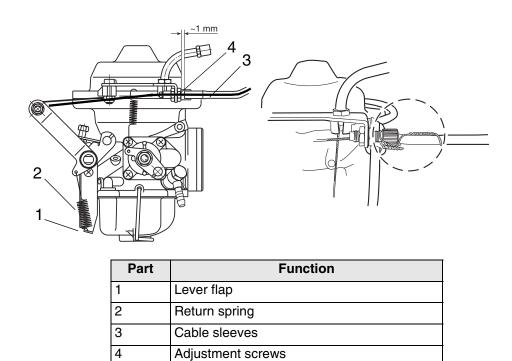


Fig. 10

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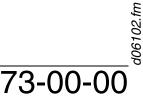
Adjust Bowden cable such that throttle and choke can be fully opened and closed.
Use Bowden cable with minimized friction so that the spring on the throttle can open the throttle completely. Otherwise increase pretension of spring by bending lever flap (1) or fit a stronger return spring, (2) or a cable with pull-push action would have to be used. Secure the bowden cable sleeves (3) in the adjustment screws (4) (e.g. safety wire).

## 2.4) Requirements on the throttle lever

Mechanical stops See Fig. 11.

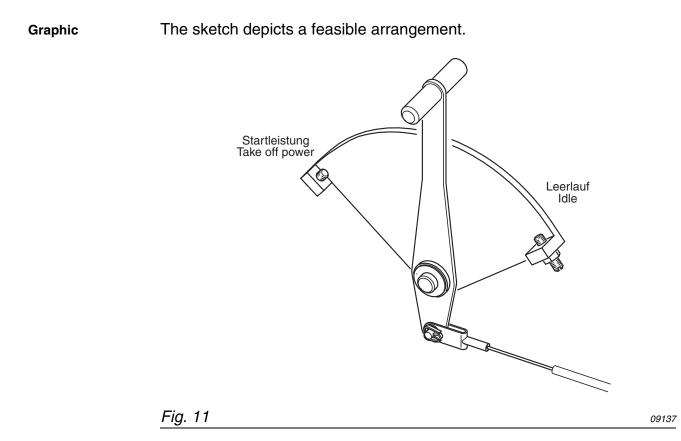
Adjustable positive stops for idle- and full throttle position are of course required.

These stops have to be designed such to render adjustibility and to prevent overload of the idle stop on the carburetor.



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## 3) Air intake system

General note	See Fig. 12.	
	NOTICE	The performance is given at ISA (15 °C) (59 °F) condition only. Engine is equipped with unchanged GENUINE-ROTAX tuned exhaust muffler system and air intake box.
		all illiake box.
	and of the acce	tem is determined essentially by the demands of engine eptable noise emission on the intake side. An airbox can BRP-Powertrain as an option.
		ata as specified and limits of operation can only be war- oyment of the GENUINE-ROTAX airbox.
Installation note	If it will be necessary to use a different airbox or a modified genuine ROTAX airbox for reasons of installation the certification to the latest requirements such as FAR and EASA has to be conducted by the aircraft manufacturer.	
Airbox retrofitted	NOTE:	If an airbox or GENUINE-ROTAX airbox is retrofitted at a ROTAX 912 (A, F, UL) Series, a change in the carb jetting is required. See Illustrated Part Catalog 912/914 chapter 22 and/or SB-912-044 "Use of the ROTAX supplied airbox", latest issue.

## 3.1) Operating limits

Fuel-mixture dis- Fuel-mixture distribution:

Low (cold) air temperature in the airbox is favourable for engine performance and to reduce knocking tendency at combustion.

The certification to the latest requirements such as FAR and EASA has to be conducted by the aircraft manfacturer.

**NOTICE** Any changes on the air intake system (e.g. modification on the airbox etc.) can affect the flow rate in the air intake system and fuel mixture ratio. In the course of certification the fuel mixture process must be proofed by a CO-measurement.



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## CO-Measurement CO-Measurement for configuration with not GENUINE-ROTAX airbox:

CO-Measurement 912 (A, F, UL) Min. 2 % CO. 912 (S, ULS) Min. 3.0 % CO (wide open throttle (WOT); a speed of min. 5200 1/min needs to be achieved).

Measurement in original configuration of aircraft e.g. with installed cowling.

Measured on each single cylinder. Measuring point is the same as the EGT-measurement. See chap. 78-00-00 section: Exhaust system.

## 3.2) Requirements on the air intake system

General note	WARNING	Non-compliance can result in serious injuries or death! Carb icing is a common reason for engine trouble. No implements are included in the supply volume for preheating of the intake air. If an non GENUINE-ROTAX airbox is used provisions for preheating the intake air have to be made to prevent formation of ice in the intake system. Preheating of the intake air will result in performance loss because of the lower air density.
	NOTICE	The certification to the latest requirements such as FAR and EASA has to be conducted by the aircraft manufacturer.
	NOTICE	All components of the air intake have to be secured against loss.

## 3.2.1) Air intake socket for fresh air or pre-heated (intake side)

General note

See Fig. 12.

NOTICE

Utilize the full slip-on length on all connections. Secure hoses by suitable spring type clamps or screw clamps.

#### INSTALLATION MANUAL

Air intake socket Air intake socket (1):

Outside dia. Ø	60 mm (2 3/8")
Slip-on length	Max. 25 mm (1")

## 3.2.2) Requirements on the intake air ducting

**Technical data** High engine performance needs air temperature as low as possible at air intake. Therefore the air filter should be located in a recess of the engine cowling or separated from warm air by baffles such that fresh air can be aspirated.

Max. length of ducting	500 mm (20 in.)
Inside dia.	Min. inside dia. at least outside dia. of the intake socket on airbox.
Min. mean bending radius	100 mm (4")

## 3.2.3) Airfilter

General note BRP-Powertrain offers an air filter as described below.

		Non-compliance can result in serious injuries or death! Use only filter elements which will not tend to restrict the flow when in contact with water.	
	NOTICE	The certification to the latest requirements such as FAR and EASA has to be conducted by the aircraft manufacturer.	
	NOTICE	A minimum flow rate of 220 m <sup>3</sup> /h (260 yd <sup>3</sup> /h) has to be warranted for all conditions. The pressure loss must not exceed 2 hPa.	
Choice of a suitable filter       The following points should assist the aircraft manufacturer at the of a suitable filter:         able filter       four fold cotton fabric         surface covered with metal screen         total filter area at least 1400 cm² (217 in²)         a min. flow rate of 6.23 m³/min (220 yd³/h)		iabric with metal screen It least 1400 cm² (217 in²)	
3.2.4)	3.2.4) Airbox		
General note	- Volume at least	2.5 Liter (.66 US gal)	
	- Outline dimension	on see Fig. 12.	

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The airbox is furnished with 2 drain holes (2) at the lowest position possible.

The holes are necessary to drain fuel from flooding float chambers caused by badly closing float valve.

## Drainage lines:

NOTICE

<b>WARNING</b>	Non-compliance can result in serious injuries or death!	
	Connect draining lines without fail, otherwise emerg- ing fuel could drip onto the exhaust system. RISK OF FIRE!	

Requirements

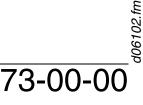
Observe the following requirements!

With closed or blocked drainage bores fuel could flow into combustion chamber, possibly ruining the engine by hydraulic lock or emerging fuel could drip onto the exhaust system. RISK OF FIRE!

Step	Procedure	
1	The lines have to be routed such that in case of damage the surplus fuel is drained away suitably.	
2	Route the lines without kinks and avoid narrow bends.	
3	Route the lines with a continuous decline.	
4	The lines have to be protected against any kind of blockage e.g. by formation of ice.	

NOTICE	The drainage lines (2) have to be routed into a ram-air and vacuum free or into the airbox, according to the		
	requirements and release of BRP-Powertrain. See also chap. Carburetor. These lines must not be route into the slipstream. If the drainage lines of the airbo are connected with the drainge lines of the drip tray or the carburetors by a T-piece, these lines must no be routed down the firewall (drainage lines of the airbox separately are allowed).		
NOTICE	Pressure differences between intake pressure and		

# *CE* Pressure differences between intake pressure and pressure in the carburetor chambers may lead to engine malfunction due to incorrect fuel supply.



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/		
General note	See Fig. 12.	
	NOTICE	Utilize the complete slip-on length. Secure hoses by suitable screw clamps or by crimp connection.
	NOTICE	If the engine has been installed without employment of the optional ROTAX engine frame which includes also support of the airbox, than provide an appropriately support (6) for the airbox.
Connecting nip-	Connecting nipple	(2) of drainage line:
ple	Outside dia.	6 mm (1/4")
	Slip-on length	Max. 17 mm (11/16")
Manifold pres- sure	Provide connection to take readings of manifold pressure (3).	
Temperature sen-	Provide connection	is for temperature sensor (4):
sor	Outside dia.	6 mm (.24 in.)
	Slip-on length	Max. 17 mm (.67 in.)
Connecting nip- ple	Connecting nipple Outside dia. Slip-on length	(5) of float chamber venting lines: 6 mm (1/4") Max. 17 mm (11/16")

## 3.2.5) Technical data





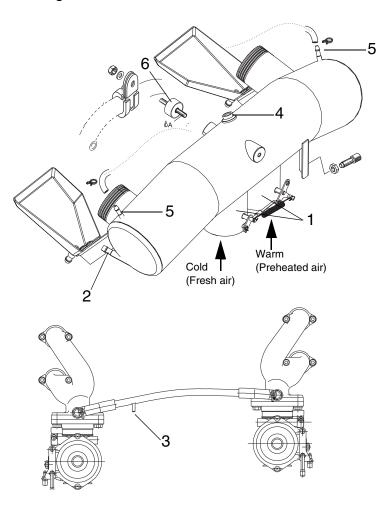
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#### INSTALLATION MANUAL

Graphic

Air intake system

NOTE: Make sure that the air intake tubes of the airbox for fresh air and preheated air are connected correctly, Fig. shows the GENUINE-ROTAX airbox.



Part	Function
1	Air intake socket
2	Connecting nipple of drainage line
3	Connection for manifold pressure
4	Connection for temperature sensor
5	Connection for float chamber venting lines
6	Rubber puffer

Fig. 12



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# 3.3) Data for optional components of air intake system

Air filter

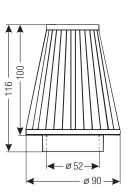
See Fig. 13.

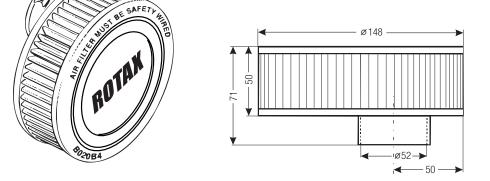
Weight:

- See chap. 72-00-00 section: Technical data.

Graphic Air filter











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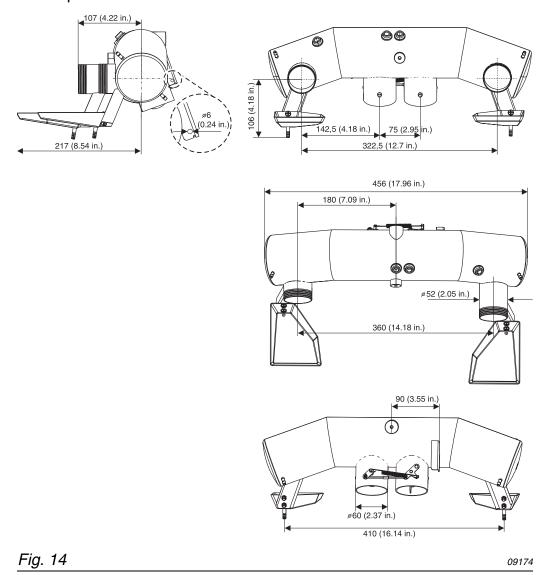
### INSTALLATION MANUAL

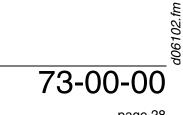
AirboxSee Fig. 14.Airbox (configuration part no. 867756).Weight:

See also chap. 72-00-00 section: Technical data.

Graphic

Airbox part no. 867756.





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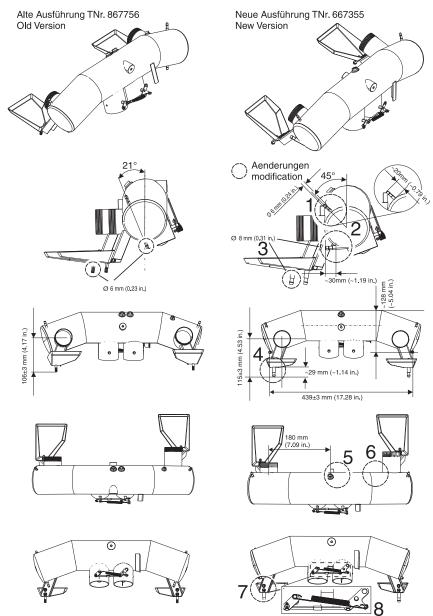
Airbox See Fig. 15.

Airbox (new version part no. 667355 in comparison to the old version). Weight:

See also chap. 72-00-00 section: Technical data.

Graphic

## Airbox part no. 667355



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Fig. 15

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# Chapter: 75-00-00 COOLING SYSTEM

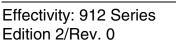
# **General note** The shape, size and position of the radiator(s) depends mainly on the space available in the aircraft.

When correctly installed in the aircraft, the optionally available BRP-Powertrain radiator has enough cooling capacity to keep within the standard specified operating limits. The flow resistance of the radiator coolant is correctly adjusted to the cooling system. The tube size must be sufficient. The size , shape, orientation of all cooling components must not compromise the engine cooling under all operation conditions.

 
 Table of contents
 This section of the Installation Manual contains system description, operating limits and requirements for the aircraft engine cooling system.

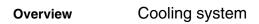
Subject	Page
Cooling system	Page 3
System description	Page 3
Operating limits	Page 5
Coolant types	Page 7
Checking the efficiency of the cooling system	Page 10
Determination of operating limits, Coolant and nec-	Page 15
essary modification on radiator installation	
Requirements on the cooling system	Page 15
Connecting size and position of connection	Page 16
Feasible location of radiator, expansion tank, over-	Page 19
flow bottle	
General notes for the cooling system	Page 23
Coolant capacity	Page 24
Cooling air duct	Page 25
General notes on the cooling air ducts	Page 26
Data for optional components of cooling system	Page 27

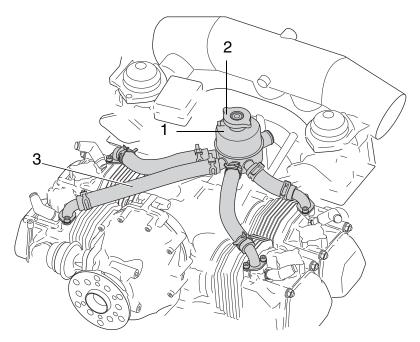
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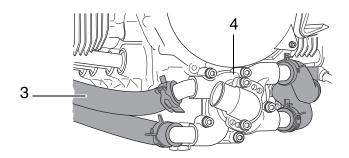




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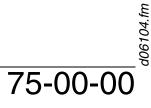






Part	Function	
1	Expansion tank	
2	Radiator cap	
3	Water tube	
4	Water pump	

Fig. 1



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### INSTALLATION MANUAL

# 1) Cooling system

# 1.1) System description

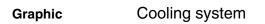
Cooling	See Fig. 2. The engine cooling system is designed for liquid cooling of the cylinder heads and ram air cooling of the cylinders. The cooling system of the cylinder heads is a <b>closed</b> circuit with an		
	expansion tank and overflow bottle.		
Coolant	The coolant flow is forced by a water pump, driven from the camshaft, from the radiator to the individual cylinder heads. The coolant flows from the top of the cylinder heads to the expansion tank (1). Since the stan- dard location of the radiator (3) is below engine level, the expansion tank located on top of the engine allows for coolant expansion.		
Expansion tank	The expansion tank is closed with a pressure cap (2) (with pressure relief valve and return valve). As the coolant heats up and expands, the pressure relief valve opens and the coolant flows via a thin hose at atmospheric pressure to the transparent overflow bottle (4). As it cools down, the coolant is sucked back into the cooling circuit.		
Shape, size and location	The shape, size and position of the radiator(s) depends mainly on the space available in the aircraft.		
Measuring the coolant temp.	Readings are taken on measuring point of the hottest cylinder head, depending on engine installation.		
	NOTE: The temperature sensors are located in cylinder head 2 and 3.		
Radiator	If a GENUINE-ROTAX radiator is being used, then an oil-water heat exchanger must not be present. The radiator is dimensioned to cater for the heat of the coolant and cannot cope with the additional heat gener- ated by the oil system.		

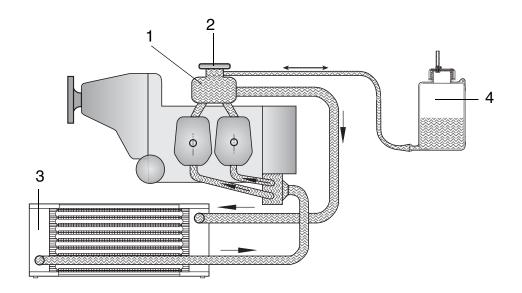




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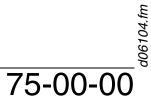




Part	Function
1	Expansion tank
2	Pressure cap
3	Radiator
4	Overflow bottle

Fig. 2

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# 1.2) Operating Limits

1.2) Ope	erating Limits	
General note	<b>A</b> WARNING	Non-compliance can result in serious injuries or death! The cooling system must be designed so that operat- ing temperatures will not exceed the maximum values.
Optional radiator	When correctly installed in the aircraft, the optionally available BRP- Powertrain radiator has enough cooling capacity to keep within the stan- dard specified operating limits. The flow resistance of the radiator coolant is correctly adjusted to the cooling system. The tube size must be suffi- cient.	
Boiling point of the coolant	<ul> <li>Monitoring the cooling system is important for controlling engine cooling and prevent knocking combustion within the operating limits. It is important that the coolant circuit is designed so that the coolant does not reach boiling point under any conditions. If the temperature exceeds the boiling point, the engine can quickly overheat due to loss of coolant.</li> <li>The boiling point of the coolant is mainly influenced by:</li> <li>the type of coolant (not for Suffix -01)</li> <li>mixture ratio (percentage water rate)</li> <li>the system pressure (opening pressure of radiator cap).</li> </ul>	
Coolant tempera- ture, Suffix -01		Coolant temperature:
	Max.	120 °C (248 °F)
	Permanent monitoring of coolant temperature is necessary.	
Coolant tempera- ture, without Suf-	Using conventio	
fix -01		Coolant temperature:
	Max.	120 °C (248 °F)
Cylinder head temperature:		
	912 A/F/UL	Max. 150°C (300 °F)
	912 S/ULS	Max. 135°C (275 °F)
		the necessary instrumentation, see section 2.1) rating limits, coolant and/or necessary modifica- nstallation.
	Using waterless	coolant:

Cylinder head temperature:		
912 A/F/UL	Max. 150 °C (300 °F)	
912 S/ULS	Max. 135 °C (275 °F)	
NOTE: Regarding to the necessary instrumentation, see section 2.1) Determination of operating limits, coolant and/or necessary modifica- tion on the radiator installation.		

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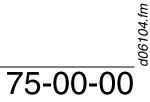


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Coolant tem- perature and	Correlation be ture	etween coolant temperature and cylinder head tempera-
cylinder head temperature	and cylinder he bustion heat to than the cylind between coola	nciple a regular relationship between coolant temperature ead temperature. The coolant transfers some of the com- o the radiator. Thus, the coolant temperature is usually lower ler head temperature. But the temperature difference int and cylinder head is not constant and can vary with dif- nstallation (cowling or free installation, tractor or pusher, tc.).
	NOTE:	The basic requirement for safe operation is that boiling of

OTE: The basic requirement for safe operation is that boiling of conventional coolant must be prevented. The boiling point of conventional coolant is 120 °C (248 °F) with a 50/50 mix-ture proportion and a system pressure of 1.2 bar (18 psi).



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# 1.3) Coolant types

# 1.3.1) Without Suffix -01

**General note** 

In principle, 2 different types of coolant are permitted:

Description	
1	Conventional coolant based on ethylene glycol
2	Waterless coolant based on propylene glycol

When selecting a suitable coolant, the information in Service Instruction SI-912-016, latest issue, must be observed.

**Conventional coolant** Conventional coolant is recommended as it commonly available and has a greater thermal heat transfer capability. Its limitation is its lower boiling point.

Waterless coolant Waterless coolant is recommended if the design of the aircraft can not maintain the coolant temperature limit 120 °C (248 °F).

Mixing ratio

NOTICE

NOTICE

The manufacturers instructions regarding the coolant must be observed.

	Mixing	ratio
Description	Concentrate	Water
Conventional coolant	50 %	50 %
Some conventional coolant is available pre-mixed by the manufacturer. In this case do not mix with water, instead follow the manufacturers instructions.		
Waterless coolant	100 %	0

**Boiling point** 

# **Conventional coolant:**

Conventional coolant with a rate of 50 % water cannot boil at a temperature below 120 °C (248 °F) at a pressure of 1.2 bar (18 psi). The max. coolant temperature limit is therefore 120 °C (248 °F).

Permanent monitoring of coolant temperature and cylinder head temperature is necessary.

# Waterless coolant:

Waterless coolant has a very high boiling point that prevents coolant loss due to "boiling over" (vapor loss), but not to prevent detonation, which can occur with cylinder head temperatures higher than 150 °C (300 °F) (for ROTAX 912 A/F/UL) and 135 °C (275 °F) (for ROTAX 912 S/ULS). It does not require pressure to maintain its boiling point. Due to a lower thermal conductivity the engine temperature will typically run about 5-10 °C (41-50 °F) higher with waterless coolant.

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Permanent monitoring of cylinder head temperature is necessary.

Additional monitoring of the actual coolant temperature is possible but not necessary for waterless coolant.

NOTE: When using EVANS NPGR, NPG+ or added pure ethylene glycol as a coolant, note that these fluids have a flammability rating 1 (classification LOW at a scale from 0 to 4). The mentioned coolants are complying according to their material safety data sheet with a flammability classification, which has only low danger and a low risk of flammability. To date, no cases in engine operation or flight operation, laboratory conditions or from the field were reported, which show unsafe conditions of ROTAX aircraft engines in combination with the relevant coolants.

Marking

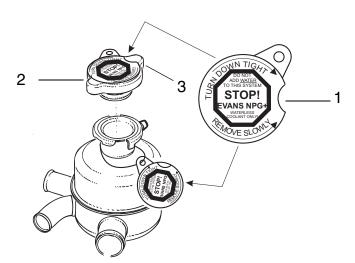
See Fig. 3.

### Marking of the coolant to be used:

NOTIOE	The coolant to be used and its concentration (percent-
NOTICE	age water rate) must be correctly communicated to the
	owner.

Waterless coolant must not mix with water, as otherwise it will lose the advantages of a high boiling point.

Graphic Marking



Part	Function	
1	Warning sticker	
2	Radiator cap	
3	Opening pressure information of radiator cap	

Fig. 3

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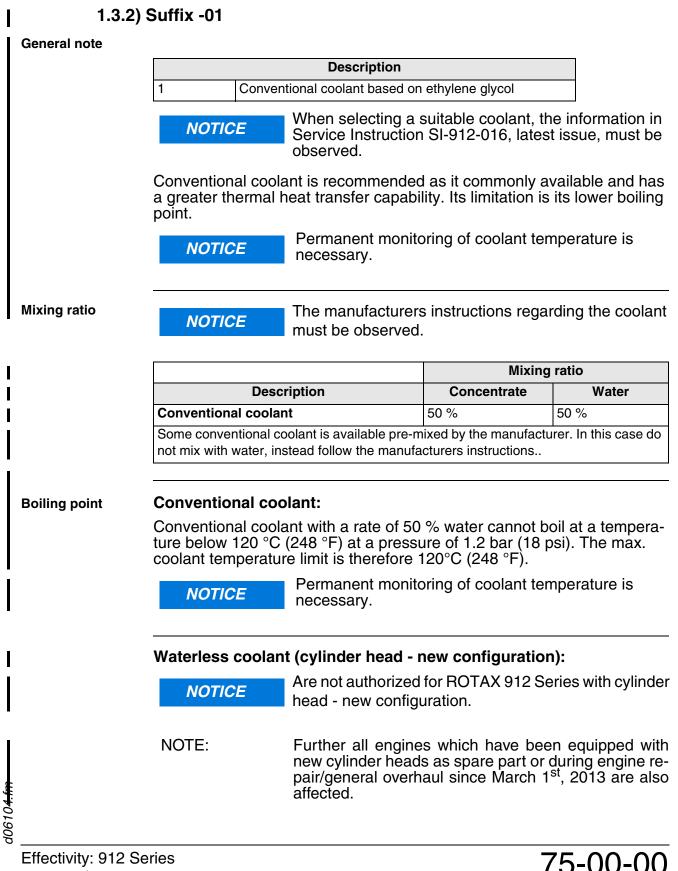
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# 2) Checking the efficiency of the cooling system

# 2.0.1) Suffix -01

General note

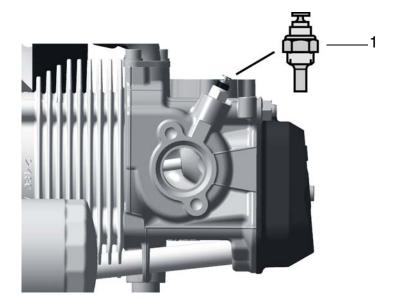
The maximum coolant temperature must be determined in order to check the efficiency of the cooling system.

# See Fig. 4.

There are two temperature sensors (1) on the cylinder 2 and 3 for measuring the coolant temperature. During flight test the place with the highest coolant temperature must be found, this can vary with different engine installation (cowling or free installation, tractor or pusher, fight speed etc.).

Graphic

Temperature sensor





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NOTE: At engines with cylinder heads of the new configuration, the cooling system must be designed so that the operating limits are not exceeded. A determination of the dependancy on coolant temperature and cylinder head temperature is not necessary any more.

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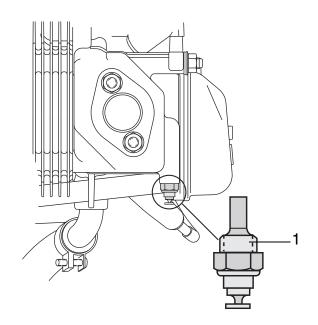
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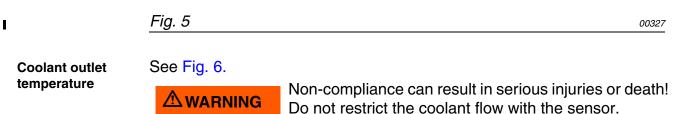
# 2.0.2) Without Suffix -01

**General note** The maximum coolant temperature must be determined in order to check the efficiency of the cooling system.

Cylinder head temperature See Fig. 5. There are two temperature sensors (1) on the cylinder 2 and 3 for measuring the cylinder head temperature. During flight test the place with the highest cylinder head temperature must be found, this can vary with different engine installation (cowling or free installation, tractor or pusher, fight speed etc.).

Graphic Temperature sensors





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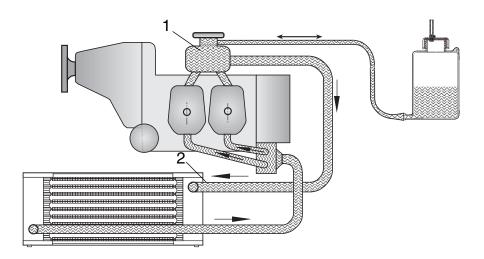
### INSTALLATION MANUAL

# NOTICE

It is possible to record a false measurement when measuring fluid temperatures. If fluid volume is lost and the sensor is not fully submerged in the liquid, the indicating instrument could incorrectly display a lower temperature, by measuring the air temperature instead of the coolant temperature.

The measuring of the coolant outlet temperature is performed using a separate sensor, which has to be installed in the line between expansion tank (1) and radiator inlet (2).

### Graphic Measurement of coolant outlet temperature

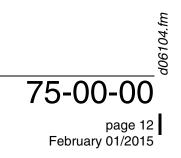


Part	Function	
1	Expansion tank	
2	Radiator inlet	

Fig. 6

Installation

The sensor may be installed in a "TEE" inline with the fluid hose or the expansion tank may be modified to attach the sensor (not supplied by BRP-Powertrain).



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# 2.1) Determination of operating limits, coolant and/or necessary modification on the radiator installation on engines

# 2.1.1) Without Suffix -01

**Maximum values** 

Depending on the achieved maximum values of the cylinder head temperature and the coolant temperature following action are necessary:

Maximum values for		Coolant used for tests		
Coolant temperature	Cylinder head temperature	Conventional coolant	Waterless coolant	
less than 120 °C (248 °F)	less than 135 °C <sup>1</sup> (275 °F) (150 °C) <sup>2</sup> (300 °F)	Additional instruments for displaying coolant temperature is neces- sary. <b>b)</b>	Modifications to the in- struments or limit not necessary. <b>a)</b>	
more than 120 °C (248 °F)	less than 135 °C <sup>1</sup> (275 °F) (150 °C) <sup>2</sup> (300 °F)	Cooling capacity too low. Check of the in- stallation necessary.		
less than 120 °C (248 °F)	more than 135 °C <sup>1</sup> (150 °C) <sup>2</sup> (300 °F)	c)	Cooling capacity too low. Check of the instal- lation necessary.	
more than 120 °C (248 °F)	more than 135 °C <sup>1</sup> (275 °F) (150 °C) <sup>2</sup> (300 °F)		c)	

1. engine type 912 S/ULS

2. engine type 912 A/F/UL

- a) Maximum cylinder head temperature is below operating limits. Operating with waterless coolant, is permissible without modification to the installation.
- b) Maximum cylinder head temperature and coolant exit temperature is below operating limit.

For operating with conventional coolant it is necessary to monitoring constantly cylinder head temperature and coolant exit temperature.

NOTE: For detection of possible indication error an additional monitoring of the cylinder head temperature is necessary which shows an exceeding in case of coolant loss.

Flight test

The aircraft manufacturer has the option of converting the coolant temperature and the cylinder head temperature to an aircraft specific cylinder head temperature. This is possible by calculating the difference between the head material and the coolant temperature.

See therefore the following flight test example (page 14).

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Once the calculation is made and the indicating instrument re-labeled, it is acceptable to use the cylinder head temperature as the primary cockpit display instead of installing a sensor in the coolant flow.

The measurement is based on the maximum coolant temperature and cylinder head temperature according to the current requirement.



In no case a cylinder head temperature higher than the limit of 150 °C (300 °F) (for ROTAX 912 A/F/UL) and 135 °C (275 °F) (for ROTAX 912 S/ULS) can be defined because detonation could not be sufficiently prevented.

Refer to the flight test example that follows.

c) Cooling capacity of the installation too low.

Flight test example Calculated values (maximum values found for coolant temperature and cylinder head temperature. Refer to the current specification of the FAA and/or EASA).

Coolant temperature ..... 102 °C (216 °F)

Cylinder head temperature ...... 110 °C (230 °F)

The cylinder head temperature is 8  $^\circ C$  (46  $^\circ F) higher than the coolant temperature.$ 

<u>Thus:</u>

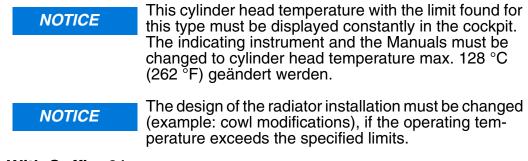
Coolant temperature ..... 120 °C (248 °F)

Difference cylinder head and coolant temperature <u>..... +8 °C (46 °F)</u>

Total ..... = 128 °C (262 °F)

The highest cylinder head temperature permitted is 128 °C (262 °F), so that the max. coolant temperature is kept.

With this special application, safe operation of the engine that prevents boiling of the coolant is possible up to a cylinder head temperature of 128  $^{\circ}$ C (262  $^{\circ}$ F).



# 2.1.2) With Suffix -01

Not relevant.

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### INSTALLATION MANUAL

# 3) Cooling system requirements

Safety	WARNI	NG Non-compliance can result in serious injuries or death! The cooling system must be designed so that the op- erating limits are not exceeded. To minimize flow resistance, use radiators that have both a parallel flow and have a low flow resistance. A prime example would be the GENUINE-ROTAX radia- tors. Be sure to use short hoses and pipelines.			
	NOTICE	All components of the cooling system must be suitably secured.			
Coolant hoses	See Fig. 7.				
	NOTICE	Hoses exposed to direct heat radiation from the ex- haust system, must be suitably protected with heat-re- sistant protection tubes, for example.			
	NOTE:	Aluminium tubes with an inner diameter of 25 mm (0.98 in.) can be used instead of longer hoses. These must have a bulge (1) in order to prevent coolant hoses working loose. Note as well that this will double the number of hose clips required!			
	•	ure resistance, min. 125 °C (257 °F)			
		<ul> <li>Pressure durability: min. 5 bar (72 psi)</li> <li>Inner diameter: 25 mm (1")</li> </ul>			
	-	adius: min. 175 mm (6.89 in.) (except moulded hoses) 100 % resistant to glycol, antifreeze and ozone.			
Graphic	Drawing alur	ninium tube			
4. <del>4</del> 47	Fig. 7	09158			
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INSTALLATION MANUAL

Hose connecting expansion tank

# Hose from expansion tank to overflow bottle:

**WARNING** Non-compliance can result in serious injuries or death! A soft walled hose is not suitable as it can collapse and cause cooling system failure..

- The hose from the expansion tank to the overflow bottle must be rated for vacuum/suction for min. 125 °C (257 °F), e.g. it must be strong enough to withstand high temperatures and vacuum/suction during the cooling down period.

The aircraft manufacturer must give the possibility to the pilots to check the coolant level in the expansion tank. Also it is necessary to inform the pilots about the daily inspection of the coolant level in the aircraft manufacturers operators (pilots) manual or an adequate link to the ROTAX 912 Series Operators Manual.

It is recommended that adequate measures are taken for carrying out these inspections, e.g. a flap or panel on the cowling or a warning instrument in the cockpit for low coolant level.

# 3.1) Connecting size and position of connections

General note

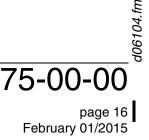
NOTICE

See Fig. 8 and Fig. 9.

The hoses must be fixed with appropriate clips to prevent loss, e.g. with spring type hose clips, such as those used for the coolant hoses between the water pump and cylinder. Clips of this type have performed well in the field.

Expansion tank (1) with radiator cap (2)		
to radiator (3): Slip-on length	Outside dia. 25 mm (1") Max. 22 mm (7/8")	
to overflow bottle (4): Slip-on length	Outside dia. 8 mm (3/8") Max. 15 mm (9/16")	
water inlet elbow (5) Slip-on length	Outside dia. 27 mm (1 1/16") Max. 19 mm (3/4")	

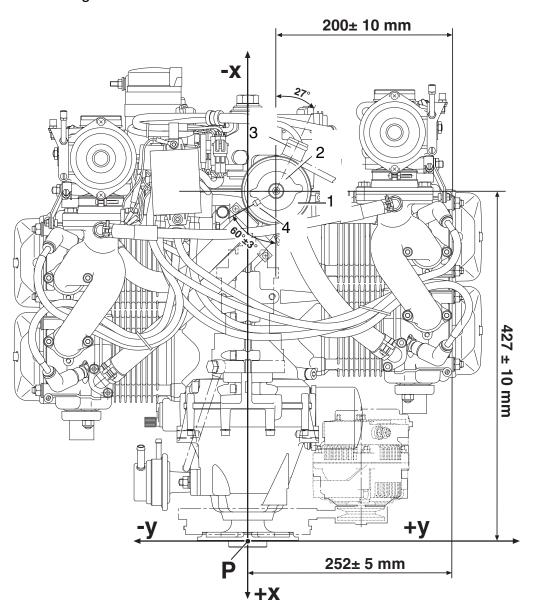
NOTE: See therefore also SI-912-020 "Running modifications", latest issue.



### INSTALLATION MANUAL



Connecting dimension



Part	Function		
1	Expansion tank		
2	Radiator cap		
3	Connection to the radiator		
4	Connection to the overflow bottle		

Fig. 8

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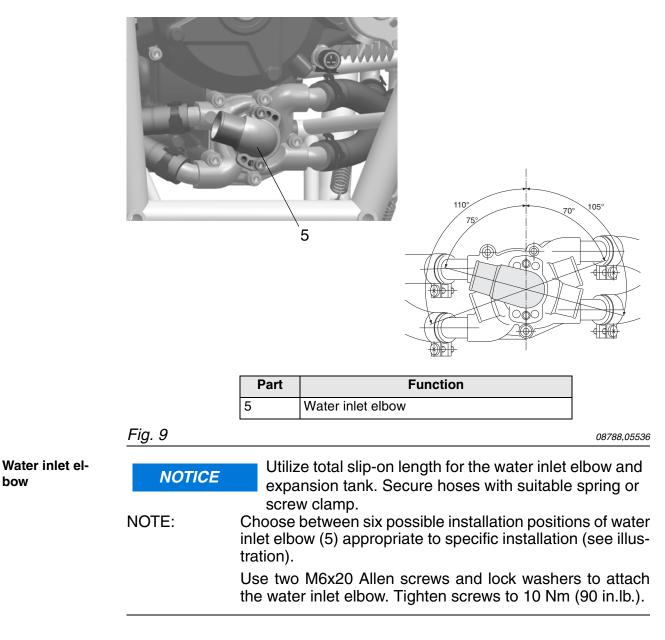
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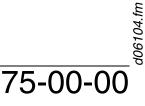
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### INSTALLATION MANUAL

# Connecting dimension





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### INSTALLATION MANUAL

# 3.2) Requirements, permissible location and installation position of the radiator/expansion tank/overflow bottle

Radiator See Fig. 10.

Non-compliance can result in serious injuries or death! The radiator must be designed and installed such that the permissible operating temperatures are maintained and the max. values are not exceeded. This must also apply to "**Hot day conditions**".

NOTICE

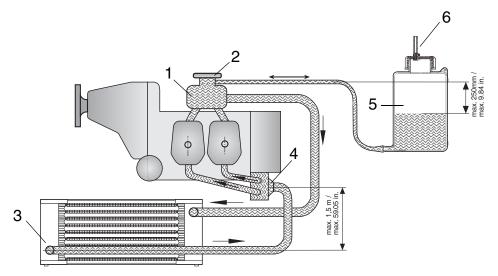
If required, the radiator outlet (3) may be located max. 1.5 m (4.92 ft.) underneath the inlet elbow (4) of the water pump and no higher than the expansion tank (1). (see Fig. 10).

**Expansion tank** To ensure proper operation of the cooling system, the expansion tank (1) with pressure cap (2) in the main operating systems must be installed on the highest point of the cooling circuit.

NOTE: The expansion tank (1) is fitted on top of the engine.

Graphic

Permissible position



Part	Function		
1	Expansion tank		
2	Radiator cap		

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### INSTALLATION MANUAL

		Part	Function	
		3	Radiator outlet	
		4	Water inlet elbow	
		5	Overflow bottle	
		6	Purging	
I	Fig. 10			08319
3.2.1)	Overflow bott	le		
General note	See Fig. 11.			
	•		an overflow bottle in which surplus coolane coolant circuit during the cooling down	
	NOTICE	suct	ensure proper operation of the cooling sy- ion height between overflow bottle and e must not exceed 250 mm (10 in.).	
	NOTE:		per operation ensure that the hose to th as short as possible.	e overflow
Overflow bottle	- Transparent	material		
requirements	- Temperature resistant from -40 °C to +130 °C (-40 °F to 266 °F)			
	- 100 % resista	ant to gly	col and suitable for all other antifreeze a	agents
	- Volume appr	ox. 0.5 l	(.13 USgal)	
			er 2.5 mm (0.1 in.)	
	NOTE:		o SB-912-039 "Modification of the overfle	ow bottle",
	NOTE:		rflow bottle should be furnished with a lak tion and content.	pel indicat-
Capacity		The will k	-compliance can result in serious injuries overflow bottle must never be empty, oth be sucked into the cooling circuit; this ca ative effect on the safe operation of the e	erwise air n have a
Installation	NOTICE	not b	overflow bottle and its supply and discha be installed close to the exhaust system, a coolant can be flammable under certain c	as emerg-

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# 3.3) ROTAX overflow bottle (optional)

**General note** If the optional ROTAX overflow bottle is used, the purging system must be arranged as shown below.

NOTE: To vent coolant steam from the overflow bottle in case of overheating, the plastic cap can be retrofitted with a hose nipple and hose.

The purging line (5) must be routed so that coolant cannot come in contact with the hot exhaust system.

The vent line must be routed in a continuous decline or furnished with a drain bore at its lowest point to drain any condensation.

The line must be protected from any kind of ice formation from condensation, e.g. insulation protection or routing in a hose with hot air flow and furnishing the line with a bypass opening before the cowling outlet.

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# Work instruction See Fig. 11.

Procedure for attaching the hose nipple:

Step	Procedure
1	Unscrew the plug screw (2) from the overflow bottle.
2	Bore the existing purging hole from dia. 2.5 mm (0.10 in.) to dia. 6 mm (0.236 in.).
3	Apply LOCTITE 603 to the threads of the hose nipple (3).
4	Insert hose nipple (3) with the thread first into the vent hole.
5	Fix M6 hex. nut (1) onto the hose nipple (3). Tightening torque 5 Nm (3.69 lbft).
6	Screw the plug screw onto the overflow bottle.

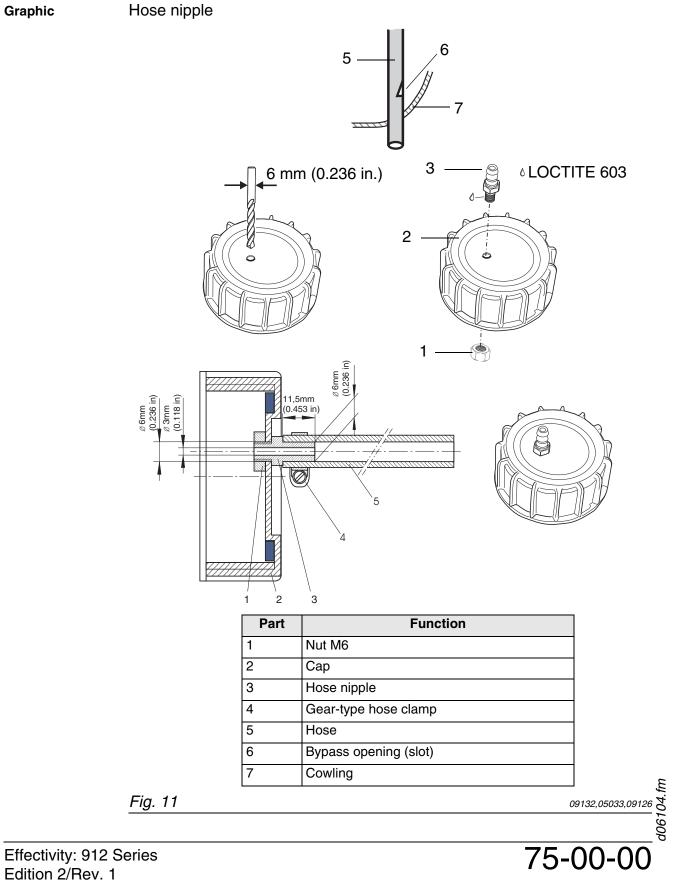
Steps for attaching the hose:

Step	Procedure
1	Secure the hose with a gear-type hose clip (4) or spring type hose clip.
2	Secure and route the hose (5) without kinks.

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# 4) General notes on the cooling system

General note Non-compliance can result in serious injuries or death! Certification according to the latest regulations, such as FAR or EASA, must be conducted by the aircraft or fuselage manufacturer. Essential parts of the cooling system, such as radiator, etc., are available for this engine from BRP-Powertrain. Radiator See Fig. 12. The size and type of radiator should be adequate to NOTICE transfer thermal energy of approx. 25 kW (24 BTU/s) (for ROTAX 912 A/F/UL) or approx. 28 kW (26.5 BTU/ s) (for ROTAX 912 S/ULS) at take-off power. In an installation as depicted with the radiator (1) in a higher position than the standard supplied expansion tank, a water accumulator (2) has to be fitted instead of the expansion tank. Additionally a suitable expansion tank (3) has to be installed at the highest point of the cooling circuit. NOTE: Experience has shown that with good airflow, a radiator with an area of 500 cm<sup>2</sup> (77.5 in<sup>2</sup>) is required for troublefree operation. Radiator Graphic 3 2 Part Function 1 Radiator 2 Water accumulator 3 Expansion tank 08320



Fig. 12

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Flow rate	The flow rate in the coolant circuit is approx. 60 l/min (15.85 USgal/min.) at 5800 rpm. At full throttle, an approximate value of around 0.75 m <sup>3</sup> /s (28.59 cu.ft/sec) can be assumed for the required cooling air flow.		
Flow resistance	The flow resistance of the coolant in the optional ROTAX radiator is cor- rectly adjusted for the cooling system. If using other radiators, check the flow rate and cooling capacity.		
Installation of the radiator	No provision has been made for attachment of the radiator(s) on the engine (rubber mounts are recommended).		
	<b>NOTICE</b> The radiator must be installed without distortion or stress and free of vibrations. If a GENUINE-ROTAX radiator is not being installed, ensure sufficient cooling capacity.		

# 4.1) Coolant capacity

l

Description	Capacity		
4 cylinder heads	560 cm $^3$ /0.020 cu.ft (without Suffix -01)		
	400 cm <sup>3</sup> / 0.016 cu.ft (Suffix -01)		
Coolant pump	100 cm <sup>3</sup> / 0.004 cu.ft		
Expansion tank	250 cm <sup>3</sup> / 0.009 cu.ft		
Overflow bottle	ca. 0,5 I / 0.13 USgal		
2 m coolant hose (inner dia.Ø 18 mm)	500 cm <sup>3</sup> / 0.018 cu.ft		
Total coolant quantity for engine	ca. 1,5 I / 0.4 USgal		

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#### 4.2) Cooling air ducts (optional)

Cooling air ducts are not required if the oil and coolant temperatures are General note within the prescribed operating limits. Otherwise following measurement must be performed for the first installation of an aircraft type (not in serialproduction).

See Fig. 13. Hot day condition

> In contrast to the cylinder heads, the cylinders are ram air cooled. Plan the cooling air ducts according to installation requirement.

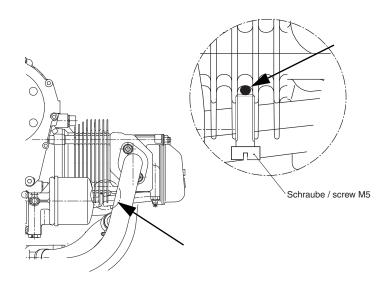
Non-compliance can result in serious injuries or death! WARNING The cooling air ducts must be designed and built such that the operating temperatures are within the specified limits and maximum values are not exceeded. This must also apply to "Hot day condition".

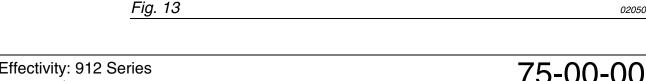
Max. permitted cylinder wall temperature on hottest cylinder...200 °C (392 °F)

- NOTE: If this temperature is exceeded, appropriate measures (e.g. cooling air ducts, modifications to cowling, etc.) must be taken to bring it within limits again. NOTE:
- As long as the oil and coolant temperatures are within the operating limits, no cooling air ducts are necessary.

Graphic

Cooling air duct





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INSTALLATION MANUAL

# 4.3) General notes on the cooling air ducts

Front installation **WARNING** Non-compliance can result in serious injuries or death! Certification according to the latest regulations, such as FAR or EASA, must be conducted by the aircraft or fuselage manufacturer.

For front installation in a closed fuselage, ducting of cooling air to the cylinders is recommended. This removes the need for costly horizontal partitioning (baffles).

NOTE: It also means that the engine remains completely on the warm side of the engine compartment and is very easy to access. In special cases a separate cold air supply to the air filters must be provided.

BRP-Powertrain has developed a non-certified cooling air duct especially for this application.

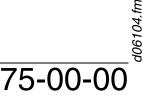
Selecting cool-<br/>ing air ductsThe following recommendations should assist the aircraft or fuselage man-<br/>ufacturer in selecting suitable cooling air ducts.

Cooling capacity	The cooling air ducts must be designed such that they transfer thermal energy of approx. 6 kW (5.7 BTU/s) at take-off performance.		
Cross section of air duct	Cross section of air duct under the airflow baffle min. $100 \text{ cm}^2$ (15.50 in <sup>2</sup> ).		
Material	Glass fibre reinforced plastic or heat and fire resistant ma- terial.		
	Formlocking on engine block and mounting above the cyl- inder and the crankcase.		
Attachment options	NOTE:	If formlocking attachment is not suffi- cient, additional attachment is possi- ble using two M8 threaded lugs on the top of the engine block.	

NOTICE

The stated maximum permissible loads (per screw) are valid only if using the minimum specified thread length, and must never be exceeded.

Thread height 18 mm (0.71 in.)).



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Permissible loads (per screw)

	x-axis	y-axis	z-axis		
Attachment points	-300 mm (-11.81 in.)	-30 mm (-1.18 in.)	-14 mm (-0.55 in.)		
	-300 mm (-11.81 in.)	-30 mm (-1.18 in.)	-14 mm (-0.55 in.)		
		Attachment poir	nts		
Max. permissible force (safe load) in (N) on x, y and z axis		2000 N (449.62 lb-fo	orce)		
Max. permissible bend load) in (Nm) in x, y a	50 Nm (36.89 lbft)				
Min. length of thread (mm)		15 mm (0.59 in.)			

# 4.4) Data for optional components of cooling system

Overflow bottle

See from Fig. 14 to Fig. 16

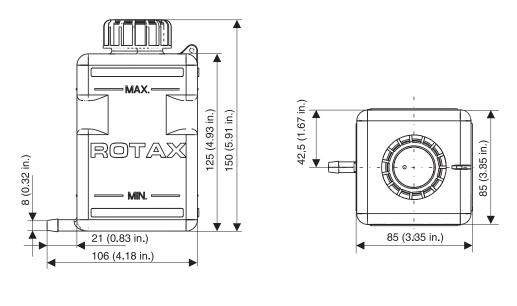


Fig. 14



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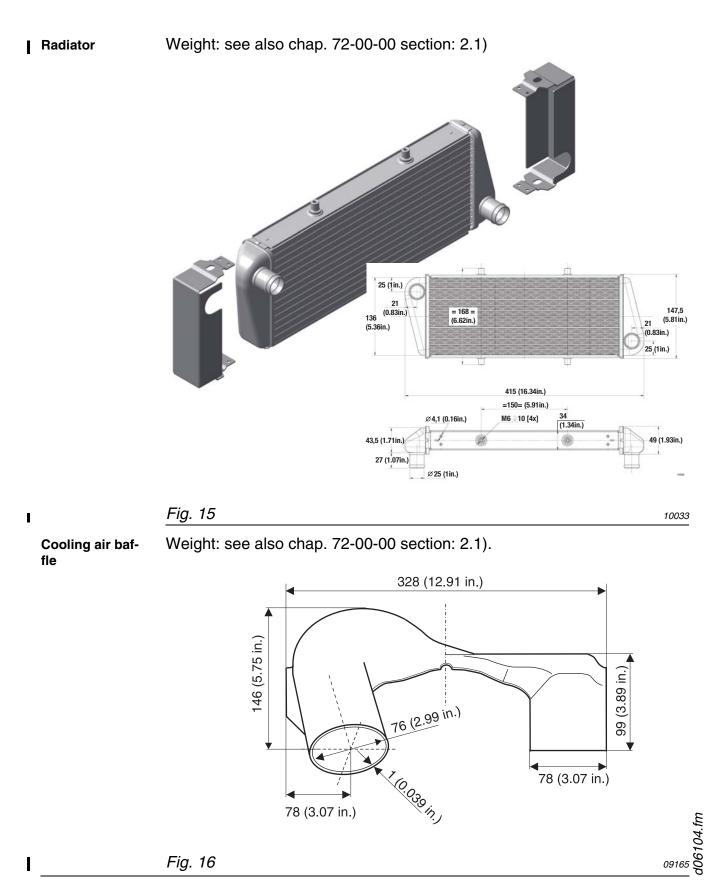
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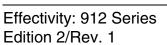
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INSTALLATION MANUAL

# Chapter: 76-00-00 ENGINE MANAGEMENT

Introduction

Obey the manufacturers instructions!

NOTICE

Table of contents

This section of the Installation Manual describes the engine management of the aircraft engines.

Subject	Page
Connections for instrumentation	Page 3
Sensor for cylinder head temperature	Page 3
Sensor for coolant temperature (Suffix -01)	Page 3
Sensor for oil temperature	Page 6
Oil pressure sensor	Page 8
Mechanical rev counter (tach drive)	Page 10
Monitoring of the intake manifold pressure	Page 11
Air temperature in the airbox (optional)	Page 12

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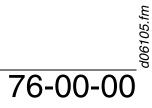
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INSTALLATION MANUAL

# 1) Connections for instrumentation

General note

NOTICE

These connections to be established in accordance to certification and/or national specifications. The certification for connections and connection lines have to be conducted by the aircraft manufacturer to the latest requirements like FAR and EASA.

For notes regarding the electric rev counter consult the chap. Electric system.

# 1.1) Sensor for cylinder head temperature and coolant temperature

General note

See Fig. 1. Depending on the cylinder head design (old or new version), there are different methods of measurement with either cylinder head temperature sensor (without Suffix -01) or coolant temperature sensor (Suffix -01).

# 1.1.1)Cylinder head temperature sensor (without Suffix -01)

**Technical data** The temperature sensor (1) is directly fitted into cylinder head i.e. a direct temperature reading of the cylinder head material is taken.

Location	In the cylinder head of the cylinder 2 and 3
Connection	Spade terminal 6.3x0.8 DIN 46247
Grounding	Via engine block

Position

### Position temperature sensor:

	Axes		
Cylinder head	x-axis	y-axis	z-axis
2	-200.0 mm (-7.88 in)	241.0 mm (9.49 in)	-157.0 mm (-6.18 in)
3	-387.0 mm (-15.24 in)	-241.0 mm (-9.49 in)	-157.0 mm (-6.18 in)

Graph resistance

Graph of sensor resistance over temperature:

# See Fig. 1.

NOTICE

The graph resistance over temperature has been determined, and is effective at the following conditions only: Ambient temperature: 20 °C (68 °F)

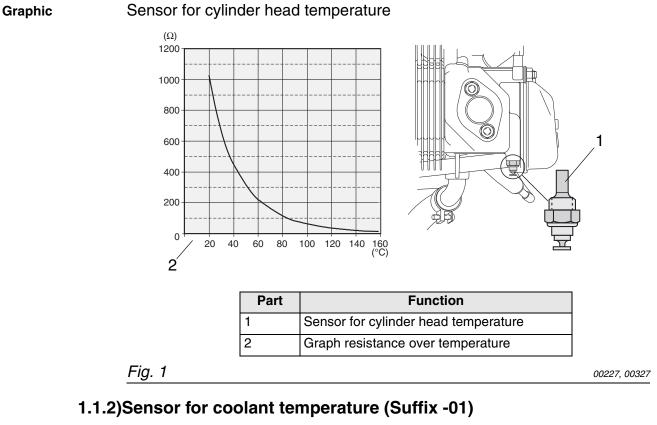
Tolerance: Max ±10 %



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### INSTALLATION MANUAL



#### General

### See Fig. 2.

The temperature sensor is directly fitted into cylinder head i.e. a direct temperature reading of the coolant is taken.

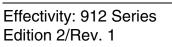
**Technical data** 

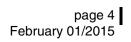
Location	In the cylinder head of the cylinder 2 and 3	
Connection	Spade terminal 6.3x0.8 DIN 46247	
Grounding	Via engine block	

Position

Position temperature sensor:

	Axes		
Cylinder head	x-axis	y-axis	z-axis
2	26.0 mm (1.02 in)	225.9 mm (8.90 in)	44.4 mm (1.74 in)
3	-173.0 mm (-6.81 in)	-225.9 mm (-8.90 in)	44.4 mm (1.74 in)

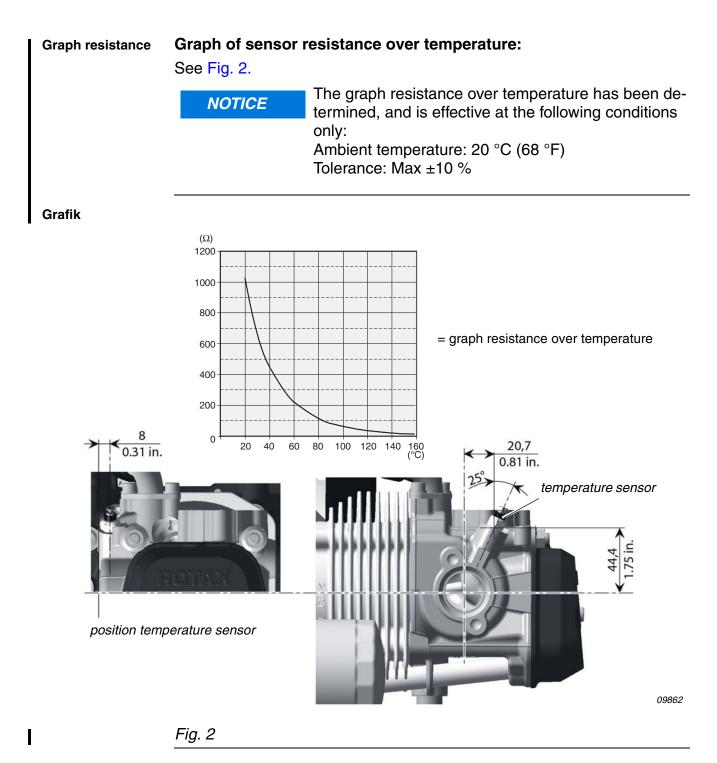




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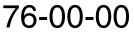
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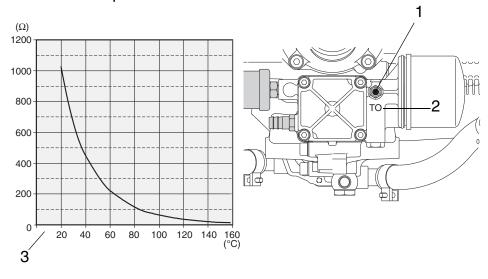
# 1.2) Sensor for oil temperature

General note	See Fig. 3.					
	NOTICE			fication to the latest requirements such as FAR of A has to be conducted by the aircraft manufactur-		
	BRP-Powertra Refer to Illustra			•	indicating instrumer	nt.
Marking	Marking (2): Marked with "TO" (Temperature Oel) on oil pump flange.					
	NOTICE			mix-up with indica le also with "TO".	tion wiring, mark thi	S
Position	on Position of the temperature sensor (1) on the oil pump flange:					
			Axes			
	Point of support	x-ax	is	y-axis	z-axis	
		-115.0 mm	n (-4.53 in)	46.0 mm (1.81 in)	-150.0 mm (-5.92 in)	
Technical data	Anschlüsse für Öltemperaturgeber:					
	Location		Oil pump	-		
	Connection of sensor wiring		Spade terminal 6.3x0.8 DIN 46247			
	Grounding		Via engine block		l	
Graph resis- tance	Graph of sensor resistance over temperature:         See Fig. 3.         NOTICE       The graph resistance over temperature has been termined, and is effective at the following conditionally:         Ambient temperature: 20 °C (68 °F)         Tolerance: Max ±10 %					
			e following conditions			

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Sensor for oil temperature



Part	Function	
1	Sensor for oil temperature	
2	TO marking	
3	Graph resistance over temperature	



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# 1.3) Oil pressure sensor

General note

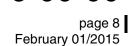
See Fig. 4.

NOTICE

Certification to the latest requirements such as FAR of EASA has to be conducted by the aircraft manufacturer.

As the instruments need a separate power supply and a different design for the electrical oil pressure sensor, the resistance type instrument (type VDO), which was supplied by BRP-Powertrain up to now, is not suitable anymore. Suitable instruments are offered by various instrument manufacturers (e.g. ROAD or Aviasport).

Technical data	Oil pressure sensor:				
	Location	Oil pump housing			
	Wire gauge	Standard wire 0.5 mm <sup>2</sup> (AWG 20)			
	Cable length	3 m (118 in)			
	Operating temperature range	Min40 °C (-40 °F) Max. +125 °C (+257 °F)			
	Grounding	Via engine block/airframe ground			
	Tightening torque	15 Nm (133 in.lb) and LOCTITE 243			
Output signal	In contrary to the oil pressure sensor offered up to now, which was provid- ing the signal on the basis of a sensor resistance variation, the new oil pressure sensor (1) operates on basis of a current variation. This has to be taken into account for the selection of the appropriate cockpit instrument.				
Wiring connec-	Wiring connection for instrument:				
tion	NOTE: The sensor cable can be modified in its length according to the installation situation, e.g. shortened or extended. For extension an appropriate, commercially available cable can be used. A resistance cable or similar is not necessary.				
	The sensor cable is approx. 3 m (118 in) long and has 3 leads. The <b>Black</b> lead is not to be connected and has no function.				
	<ul> <li>The <b>Red</b> lead from the sensor has to be connected to the positive bus via a fuse or circuit breaker.</li> </ul>				
	<ul> <li>The White lead (output signal) has to be connected directly to the instrument.</li> </ul>				
	See also the relevant instructions of the instrument supplier/aircraft manu- facturer for correct connection and wiring.				
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#### INSTALLATION MANUAL

Graph current over pressure

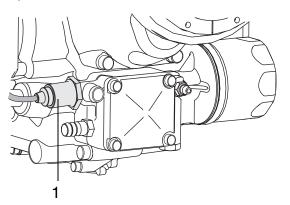
See Fig. 4.

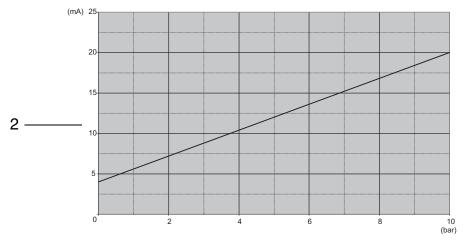
NOTICE

The graph current over pressure (2) has been determined, and is effectiva at the following conditions only: Ambient temperature: 20 °C (68 °F) Tolerance: Max  $\pm$ 3 %

Graphic

### Oil pressure sensor





Part	Function
1	Oil pressure sensor
2	Graph current over pressure sensor

Fig. 4

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# 1.4) Mechanical rev counter (tach driver) (optional)

General note See Fig. 5.

**Technical data** 

### Mechanical rev counter:

Location	Ignition housing (1)
Direction of rotation of the rev counter shaft (2)	Right (Clockwise)
Reduction ratio	i= 4 i.e. 1/4 of engine speed
Installation dimensions	See figures above

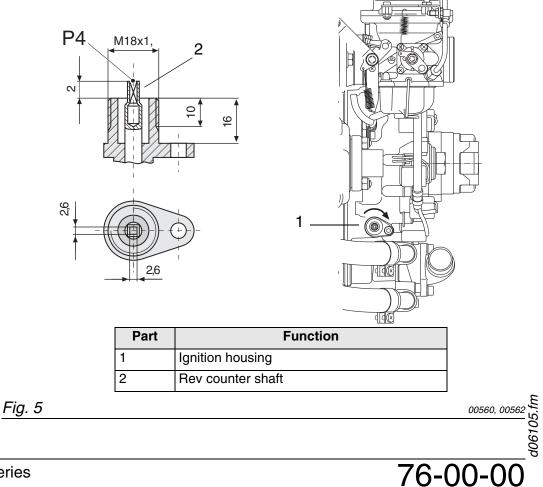
Position

### Position mechanical rev counter:

	Axes		
point of engage- ment P4	x-axis	y-axis	z-axis
	-465,0 mm (-18.31 in)	87,0 mm (3.43 in)	-160,0 mm (-6.3 in)

#### Graphic

Mechanical rev counter



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# 2) Monitoring of the intake manifold pressure

Connection nip-	Connection nip	by suitable screw clamps or crimp connection.	
ple	Outside dia.	6 mm (1/4")	
	Slip-on length	Max. 17 mm (11/16")	
	NOTICE	Protective covering to be utilized for transport engine installation only. If connection for press reading is not employed it has to suitably plugge style compensating tubes have plugged this c tion by a screw M3.5x6 (2).	sure ed. New
	NOTICE	Flawless operation of the indicating instrument the installations of a water trap between engine strument for fuel condensate.	
Graphic		e intake manifold pressure	
	[	Part Function	
		1 Connection nipple	
	L	2 Screw M3.5x6	
I	Fig. 6		02051
d06105.fm			

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# 2.1) Air temperature in the airbox (optional)

### General note See Fig. 7.

To take air temperature readings in the airbox a connection is provided. This connection is closed on the standard engine by a plug screw.

**Plug screw** 

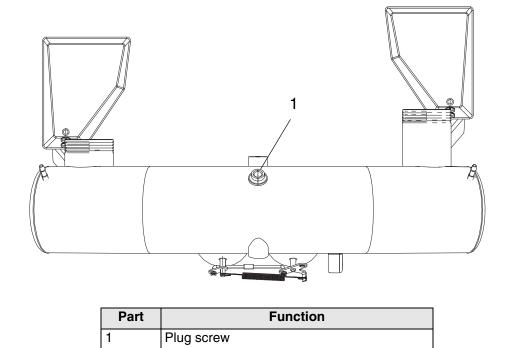
### **Connection:**

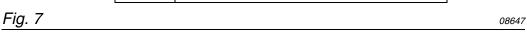
Thread	M6
Thread length	approx. 9 mm (3/8")

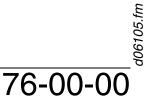
Graphic

I

Airbox







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INSTALLATION MANUAL

# Chapter: 78-00-00 EXHAUST SYSTEM

General note See Fig. 1.

NOTICE

WARNING Non-compliance can result in serious injuries or death! Connect drainage lines, otherwise emerging fuel from a possible leakage could drip onto the exhaust system. RISK OF FIRE!

> The exhaust system must be designed by the aircraft or fuselage manufacturer such that the permissible loads and bending moments on the points of attachment are not exceeded. The exhaust system may reguire additional support.

Table of contentsThis section of the Installation Manual contains information on the<br/>exhaust system of the aircraft engines.

Subject	Page
General notes on the exhaust system	Page 3
Exhaust system requirements Technical data	Page 5 Page 5
Attaching of the exhaust system	Page 7
Operating limits Data for optional components of exhaust system	Page 9 Page 10

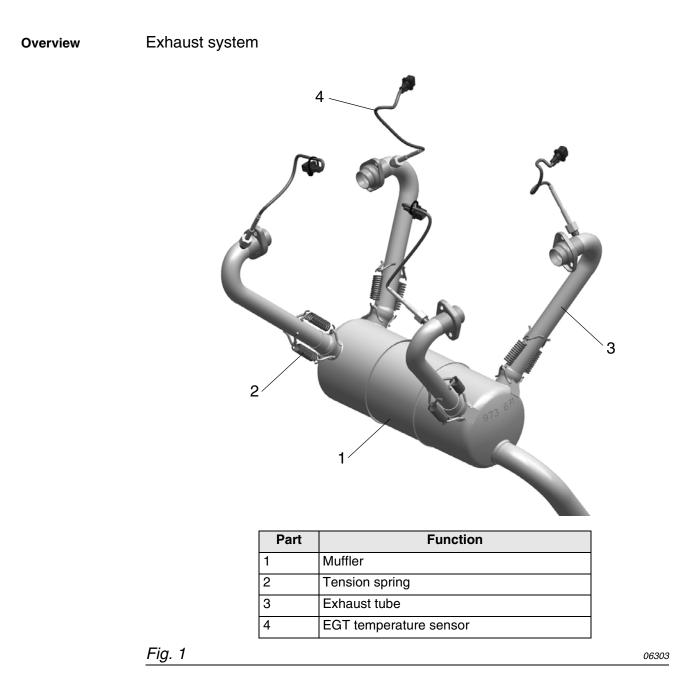
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#### INSTALLATION MANUAL





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# 1) General notes on the exhaust system

NOTICE

**Certification** An exhaust system especially designed for universal application has been developed by BRP-Powertrain. Certification according to the latest regulations, such as FAR or EASA, must be conducted by the aircraft or fuselage manufacturer.

**NOTICE** Vibrations due to improper installation and maintenance is the most common reason for damage of the exhaust system.

# 1.1) The following recommendations should help the aircraft or fuselage manufacturer to select a suitable exhaust system.

The ideal is a common transversal damping element serving all 4 cylin-Damping element ders, positioned under the engine. NOTE: Equal length of pipes from the cylinder to damping element is recommended for better tuning. **Distribution of** Distribution of the exhaust system into 2 separate systems is not recomthe exhaust sysmended. Individual mufflers on either side cause power loss and tem increased engine noise. The 4 ball joints must be used to avoid damage due to vibration. **Ball joints** Be aware that locked up stresses cause cracks! NOTICE

All ball joints have to be greased regularly with heat resistant lubricant (e.g. LOCTITE ANTISEIZE) to avoid gripping and seizing of the joints.

Vibration

Appropriate to the installation a vibration damping support for the exhaust system has to be provided on the airframe manufacturers side.

Springs to be secured with safety wire to prevent FOD! See Fig. 2.

The sketch illustrates a possibility how to interconnect the exhaust springs to prevent the vibration of these springs and thus premature wear.

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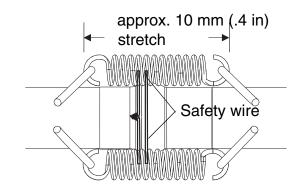


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### INSTALLATION MANUAL

Graphic Exhaust spring.



It is also recommended to fill the springs with high heat silicone for additional damping of vibrations.

Fig. 2

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### INSTALLATION MANUAL

# 2) Exhaust system requirements

General note

Install heat shields in required areas (fuel, oil, coolant hoses or tubes) and/or on the electronic components. Because of the high temperatures, provide suitable protection against accidental contact.



NOTICE

Secure exhaust system by suitable means according to installation requirements (Lockwire, heat-resistant silicone to dampen the exhaust spring etc.).

# 2.1) Technical data

See Fig. 3.

- Average radius of exhaust manifold: at least 40 mm (1.57 in.)
- Inner diameter of manifold pipe: at least 28 mm (1.10 in.)
- Volume of damping element: approx. 5 I (1.32 USgal)
- Back pressure at maximum power: max. 0.2 bar (2.9 psi) measured in each case approx. 100 mm (3.94 in.) beyond the end of the exhaust flange)

# 2.2) If a GENUINE-ROTAX exhaust is not used

**General note** 

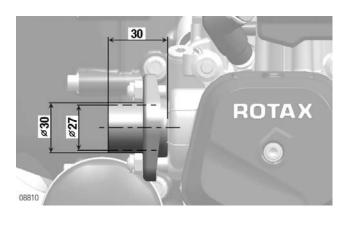
The four prefitted exhaust sockets with exhaust flange and lock nuts must be used.

Exhaust sockets material: X6CrNiTi 1810 (DIN 1.4541)

Tightening torque of M8 lock nuts: 15 Nm (133 in.lb).

NOTE: The exhaust flange does not touch the cylinder head.

Graphic



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Fig. 3

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INSTALLATION MANUAL

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### INSTALLATION MANUAL

# 3) Attaching of the exhaust system

General note See the following graphic.

NOTE:

The shape and configuration of the exhaust system is essentially determined by the free space available in the aircraft.

Two M8x23 studs are provided on each cylinder for attaching the exhaust system.

Location of the studs

All dimensions from zero reference point (P).

	Coordinates		
Location	x axis mm/in	y axis mm/in	z axis mm/in
Cylinder 1	-160 mm (-6.3 in)	-196 mm (-7.72 in)	-82 mm (-3.23 in)
	-160 mm (-6.3 in)	-212 mm (-8.35 in)	-113 mm (-4.45 in)
Cylinder 2	-192 mm (-7.56 in)	196 mm (7.72 in)	-82 mm (-3.23 in)
	-192 mm (-7.56 in)	212 mm (8.35 in)	-113 mm (-4.45 in)
Cylinder 3	-408 mm (-16.06 in)	-196 mm (-7.72 in)	-82 mm (-3.23 in)
	-408 mm (-16.06 in)	-212 mm (-8.35 in)	-113 mm (-4.45 in)
Cylinder 4	-438 mm (-17.24 in)	196 mm (7.72 in)	-82 mm (-3.23 in)
	-438 mm (-17.24 in)	212 mm (8.35 in)	-113 mm (-4.45 in)

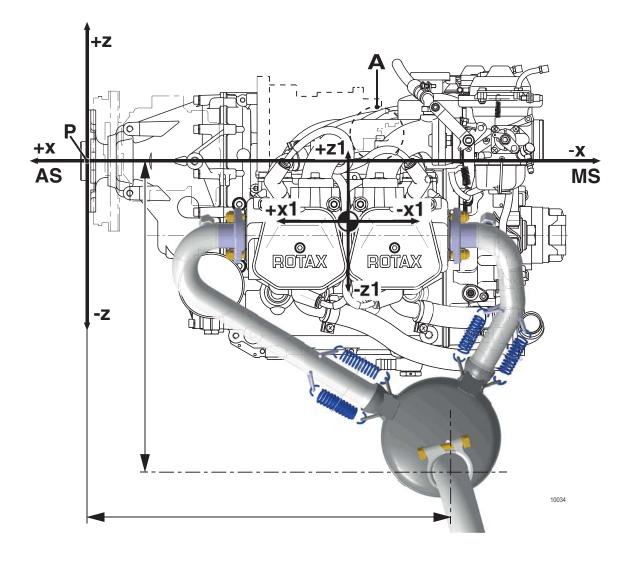
	Attachment points
Max. permissible forces (safe load) in (N/lb- force) on x, y and z axis	1000 N/224.81 lbf
Max. permissible bending moment (safe load) in (Nm) on x, y and z axis	40 Nm/30 ft.lb

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#### INSTALLATION MANUAL

**Graphic** Exhaust system assy.



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### INSTALLATION MANUAL

# 4) Operating limits

Safety notes See Fig. 4.

Non-compliance can result in serious injuries or death! The exhaust system must be designed and built such that the permissible operating temperatures are maintained and the max. exhaust gas temperatures are not exceeded.

**NOTICE** The performance specifications relate to ISA (15 °C) (59 °F)) conditions and are only achieved if the engine is equipped with an unmodified GENUINE-ROTAX exhaust system and airbox.

Readings of EGTThe exhaust gas temperatures (EGT) must be measured at the initial<br/>engine installation in an aircraft and verified in the course of test flights.Readings of EGT taken approx. 100 mm (3.93 in) from exhaust flange<br/>connections.

Graphic

Readings of EGT

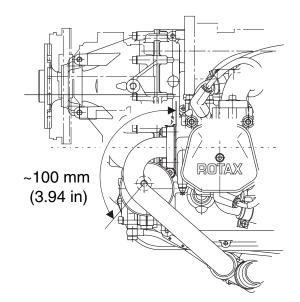


Fig. 4

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 Values
 Exhaust gas temperature (EGT):

 (both ignition circuits active)

 Nominal exhaust gas temperature:
 800 °C (1470 °F)

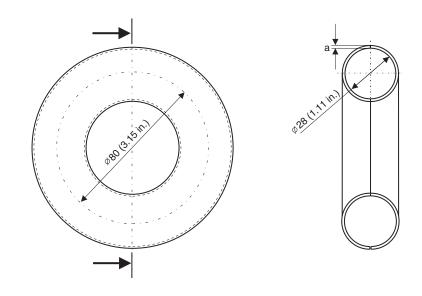
 max. 850 °C (1560 °F)

 At take-off:
 max. 880 °C (1616 °F)

# 4.1) Data for optional components of exhaust system

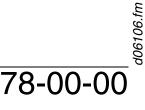
Weight Graphic See also chap. 72-00-00.

Exhaust elbow



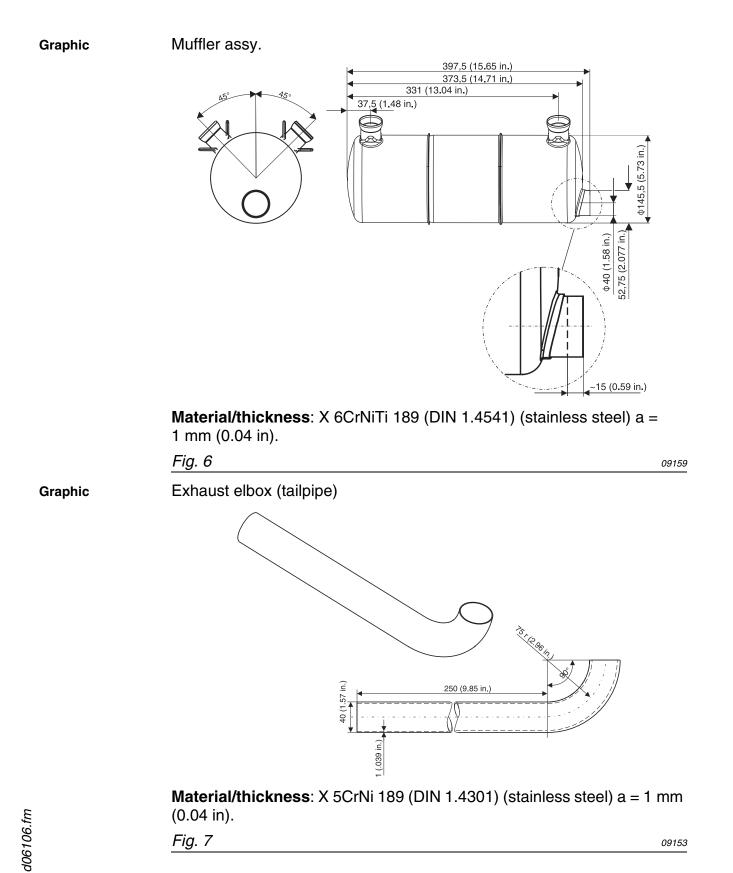
**Material/thickness**: X 15 CrNiSi20-12 (DIN 1.4828) (stainless steel) a = 1.5 mm (0.06 in).

Fig. 5	09164



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#### INSTALLATION MANUAL



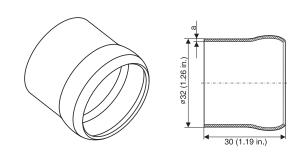
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### INSTALLATION MANUAL

Graphic

Ball joint, male

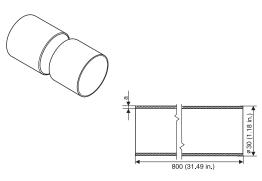


**Material/-thickness**: X 15CrNiSi 20, 12 (DIN 1.4828) (stainless steel) a = 1 mm (0.04 in).

Fig. 8	09166

Graphic

Exhaust tube



**Material/-stärke**: X 15CrNiSi 20, 12 (DIN 1.4828) (stainless steel) a = 1 mm (0.04 in).



INSTALLATION MANUAL

# Kapitel: 79-00-00 LUBRICATION SYSTEM

General noteSee Fig. 1.The ROTAX 912 Series is fitted with a dry sump forced lubrication system<br/>with a main oil pump with integrated pressure regulator and oil pressure<br/>sensor.

Table of contentsThis section of the Installation Manual describes the system, operating<br/>limits and requirements for the lubrication system.

Subject	Page
Lubrication system (oil system)	Page 3
System description	Page 3
Operating limits	Page 4
Checking the oil circuit	Page 5
Measuring of the vacuum	Page 7
Oil and purging line requirements	Page 9
Connecting sizes and position of connections	Page 11
Oil circuit	Page 11
Oil tank	Page 15
Permissible position and location of the oil tank	Page 18
General notes on the oil cooler	Page 21
Permissible position and location of the oil coo- ler	Page 21
Capacity	Page 22
Purging the lubrication system	Page 23
Checking the hydraulic valve tappet for correct purging	Page 26
Replacement of components	Page 27
Data for optional components of lubrication system	Page 29
Oil cooler	Page 29
Variants of connectors	Page 29

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### INSTALLATION MANUAL

# 1) Lubrication system (oil system)

# 1.1) System description

Drive

See Fig. 1.

NOTE: The oil pump is driven by the camshaft.

The main oil pump sucks the engine oil from oil tank (1) via the oil cooler (4) and forces it through the oil filter to the individual points of lubrication (also lubricates the propeller governor).

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

Purging NOTE: The oil circuit is vented via nipple in the oil tank.

Connections

WARNING

Non-compliance can result in serious injuries or death!

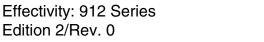
The oil cooler and its connections must be certified according to the latest regulations, such as FAR and EASA, by the aircraft or fuselage manufacturer.

Only the following connections need to be established to complete the lubrication system (oil system):

	Oil circuit, engine (main oil pump)
	Oil tank (outlet) to oil cooler
Connections from	Oil cooler to oil pump (inlet)
Connections nom	Oil return to oil tank (inlet)
	Oil tank to purging line

NOTE: An oil tank is included with the standard engine version. No provision has been made for attachment of an oil cooler on the engine.

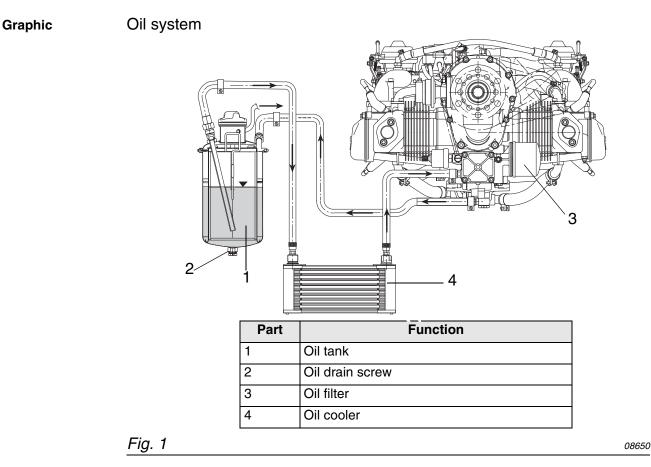
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#### INSTALLATION MANUAL



# 1.2) Operating limits

**General note** 

Non-compliance can result in serious injuries or death! The lubrication system must be designed such that the permissible operating temperatures and maximum values are not exceeded.

Operation limits	Manual
Oil pressure	See OM 912 Series, section. 2.1
Oil temperature	See OM 912 Series, section. 2.1

Non-compliance can result in serious injuries or death! At operation below nominal temperature, formation of condensate in the oil system might negatively affect oil quality.

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### INSTALLATION MANUAL

Low temperatures NOTE: When operating at low temperatures, installation of an oil thermostat, parallel to the oil cooler is highly recommended.

A warning Non-compliance can result in serious injuries or death!

If an oil thermostat is being used and the ambient temperature is low, there is a possibility that the oil may congeal briefly when in a steep descent flight. Pay extra attention to the oil pressure and oil temperature during these abnormal conditions. If necessary, revert to a cruising or climb situation.

Advantages: safe oil pressure after cold start, prevention of fuel and water accumulation in the oil.

See SL-912-011 "Use of an oil thermostat", latest issue.

# **1.3)** Checking the oil circuit

General note	NOTE:	NOTE: The required pressure gauges and connection parts are not included in the BRP-Powertrain delivery.		
To check the oil circuit for corre be taken with the engine runnin Measurement of See Fig. 2.		il circuit for correct function, the following readings have to he engine running:		
crankcase pres- sure	Measurement of the mean crankcase pressure at full throttle, this ensures correct oil return from crankcase (blow-by gas).			
	NOTICE	Do not remove the magnetic plug for prolonged peri- ods nor during flight operations.		

A pressure sensor (1) (pressure gauge with liquid damping) can be fitted instead of the magnetic plug (2) or the crankshaft locking screw (3). The magnetic plug (2) or the crankshaft locking screw (3) is removed and the pressure sensor (1) is fitted.

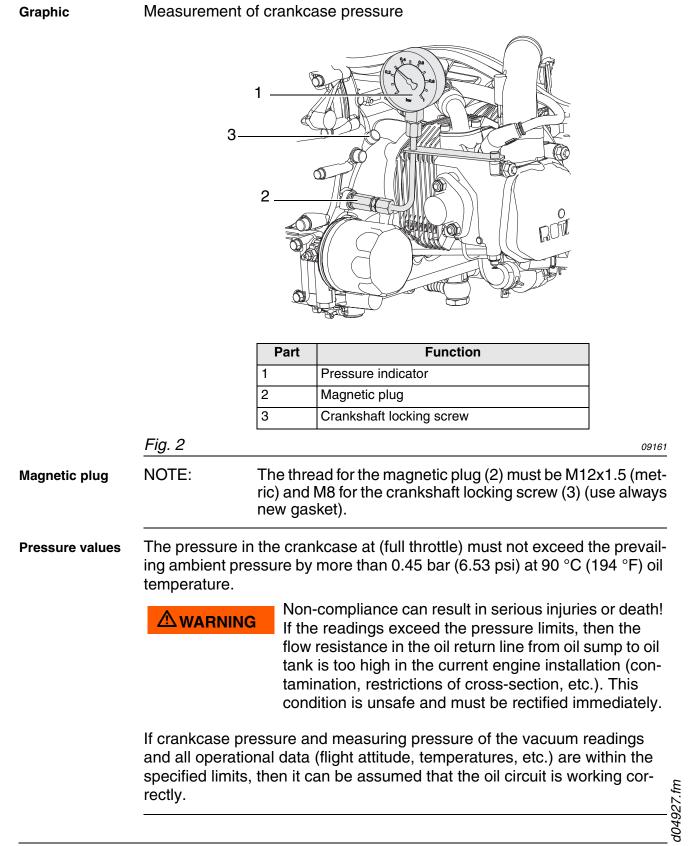


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### INSTALLATION MANUAL

# 1.4) Measuring of the vacuum

Measuring of the See

vacuum

See Fig. 3.

Measure the vacuum in the suction oil line (1) - from the oil tank via the oil cooler to the engine oil pump - at a distance of max. 100 mm (4 in.) from the oil pump suction connector (2).

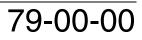
At full throttle, the indicated vacuum (3) upstream of the oil pump must not be less than 0.3 bar (4.35 psi), otherwise the oil hose (1) could collapse and block the oil supply to the engine.

# 

Non-compliance can result in serious injuries or death!

The vacuum (3) (pressure gauge with liquid damping) must be verified over the complete engine operation range. If the oil is cold, the flow resistance increases, which means that not enough oil will flow on the suction side.

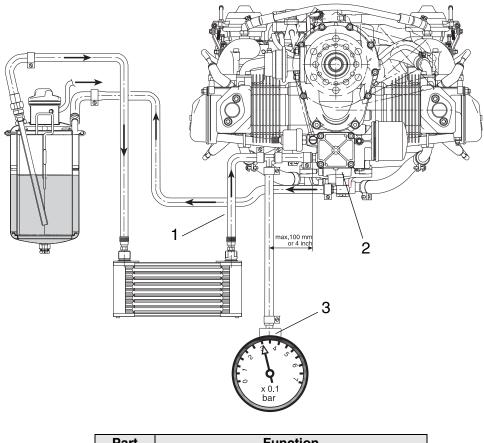
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### INSTALLATION MANUAL

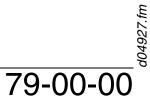
# Graphic Measuring of the vacuum



Part	Function	
1	Suction oil line	
2	Oil pump	
3	Pressure gauge	

Fig. 3

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### INSTALLATION MANUAL

1.5)	Oil and purging lin	and purging line requirements			
Oil lines	Oil circuit, en	Oil circuit, engine (main oil pump)			
	- Temperature	e durability:	min. 140 °C (284 °F)		
	- Pressure du	rability:	min. 10 bar (73 psi.)		
	<ul> <li>Bending rad</li> </ul>	- Bending radius: min. 70 mm* (2.76 in.)			
	* unless	* unless otherwise stated by the hose manufacturer			
	- Minimum inr	num inner dia. of oil lines in relation to total length			
	up to 1	up to 1 m (39.37 in.) inner diameter minimum 11 mm (0.43 in.)			
	up to 2	up to 2 m (78.74 in.) inner diameter minimum 12 mm (0.47 in.)			
	up to 3	up to 3 m (118.11 in.) inner diameter minimum 13 mm (0.51 in.)			
	- Length of in	- Length of individual oil line: max. 3 m (9.84 ft.)			
Purging line	Purging line o	Purging line of oil tank			
	See Fig. 4.				
	- Route the lir	ne without kinks an	d avoid sharp bends.		
		duct of the combustion of fuel. Most of sipate from the combustion chamber with s.			
A small amount will reach the crankcase and mu posed of through the purging line.					
	<ul> <li>The purging line must be routed in a continuous decline or furnish with a drain bore at its lowest point to drain any condensate.</li> </ul>				
<ul> <li>The purging line must be protected from any kind of ice fo condensation, e.g. insulation protection or routing in a hos flow and furnishing the vent line with a bypass opening (1 cowling outlet (2).</li> </ul>		rotection or routing in a hose with hot air			



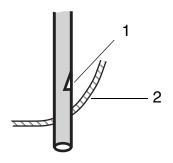
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#### INSTALLATION MANUAL

Graphic Purging line



Part	Function	
1	Bypass opening	
2	Outlet through the cowling	

Fig. 4

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INSTALLATION MANUAL

# 2) Connecting sizes and position of connections

NOTICE	Utilize the full slip-on length for all connections. Se- cure hoses with suitable screw clamps or crimp con-
NOTE:	nections The oil line connections are optionally available as UNF threads (AN-8).

# 2.1) Oil circuit (engine)

**General note** 

**General note** 

See Fig. 5.

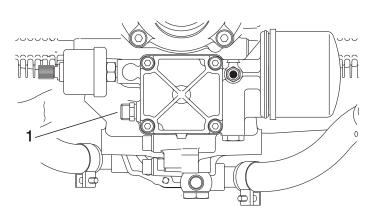
Depending on engine configuration, the oil feed line connectors may vary:

- 912 A/F/S: Thread M18 optional UNF-thread (AN-8)
- 912 UL/ULS: Inlet nipple optional M18 or UNF-thread (AN-8)

**Oil pump (inlet)** Connection variant 1:

	Oil pump (inl	et)	
Thread		M18x1,5x11	
Tightening torque of inlet line		25 Nm (18.5 ft.lb)	
NOTE:	Suitable for us	e of a swivel joint.	

Graphic Oil pump-inlet



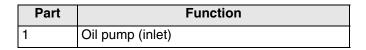


Fig. 5

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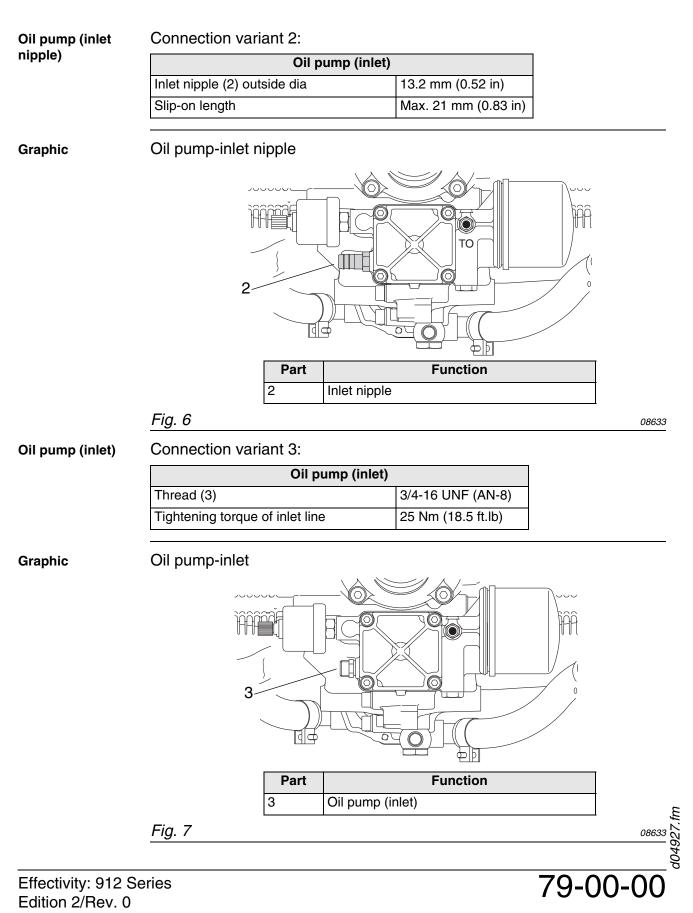
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#### INSTALLATION MANUAL



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#### INSTALLATION MANUAL

Oil return See Fig. 8

NOTICE

The engine design is for a conventional, non-aerobatic, tractor or pusher configuration with the oil return port in the optimum position. Assuming these points are taken into consideration, the engine will be properly lubricated in all flight profiles. Aircraft that are not conventional (e.g. airships, gyrocopters, dive brake equipped aircraft, etc.) that require engine load at steep inclination angles may have special lubrication requirements.

Select the appropriate connection for the oil return line according to the propeller configuration and oil system layout.

- Position 1 for tractor or position
- Position 2 for pusher configuration

Connector option

Connector option (1), (2) and (5). See Fig. 8. **Option 1**: Connection with slip-on connection.

Connection with slip-on connection (1)		
Hose nipple (3)	10 DIN 7642	
Outside dia.	13.5 mm (.53 in)	
Slip-on length	Max. 24 mm (max94 in)	
Tightening torque of banjo bolt (4) M16x1.5x28.	30 Nm (22 ft.lb)	

#### Option 2 and 3

**Option 2 and 3**: Connection with adaptor (2) or (5).

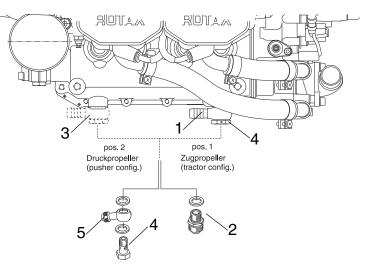
mto # (0)				
Connection with adaptor (2)				
3/4-16 UNF (AN-8)				
25 Nm (18.5 ft.lb)				
25 Nm (18.5 ft.lb)				
Connection with screw connection (5)				
3/4-16 UNF (AN-8)				
25 Nm (18.5 ft.lb)				
30 Nm (22 ft.lb)				



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### INSTALLATION MANUAL

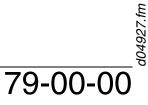
# Graphic Connection



Part	Function	
1	Slip-on connection	
2	Adaptor 3/4-16 UNF (AN-8)	
3	Hose nipple 10 DIN 7642	
4	Banjo bolt M16x1.5x28	
5	Screw connection	

Fig. 8

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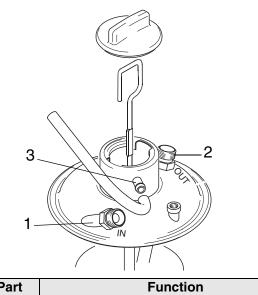
### INSTALLATION MANUAL

# 2.2) Oil tank

Connection	See Fig. 9 and	Fig. 10.
	NOTICE	Only use the oil tank provided in the scope of delivery, as its design has changed compared with older tanks.
	NOTE:	Optional extra: Nipple either straight or with 90° elbow. Metric M18x1.5 or UNF 3/4-16 thread
	NOTICE	Check what type of thread or connection there is on the supplied oil tank.

# Connections for oil circuit (engine)

Graphic



Function		
Oil feed line		
Oil outlet		
Purging nipple		

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#### INSTALLATION MANUAL

#### UNF-thread

- Oil feed line and outlet have UNF thread (AN-8) (optional):

Screw connection (optional)		
Thread	3/4-16 UNF (AN-8)	
Tightening torque of oil inlet and outlet	25 Nm (18.5 ft.lb)	

 NOTICE
 The oil tank cover is also marked with the designations

 IN- oil return line from crankcase
 OUT- outlet to oil cooler/oil pump.

#### **Purging nipple**

### Purging nipple:

Purging nipple		
Outer dia.	8 mm (.31 in)	
Slip-on length	Max. 15 mm (.59 in)	

# Bent socket 90° optional

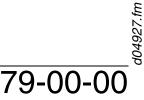
#### part no. 956580

Bent socket 90° / M18x1.5		
Outer dia.	12 mm (0.47 in.)	
Slip-on length	max. 24 mm (0.94 in.)	
Tightening torque	25 Nm (18.44 ft.lb.)	

#### Nipple optional

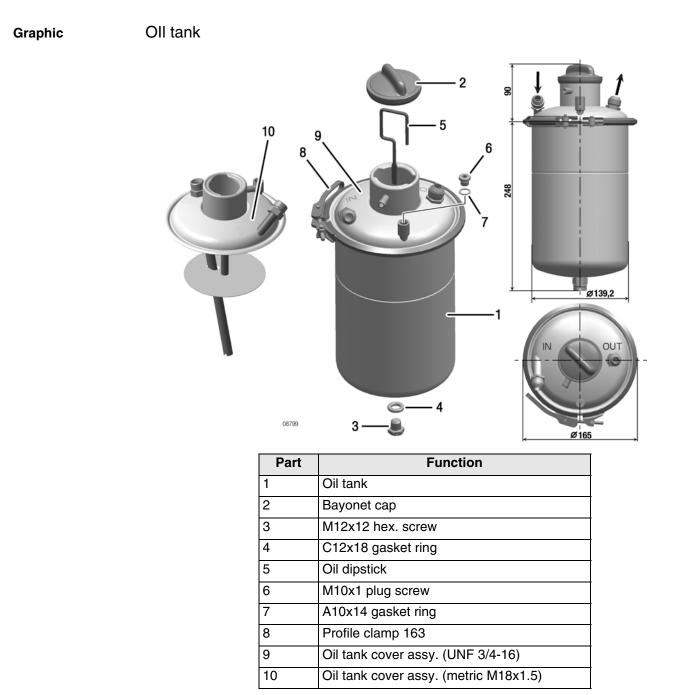
#### part no. 956610

Nipple with cap nut / straight		
Outer dia.	12 mm (0.47 in.)	
Slip-on length	max. 24 mm (0.94 in.)	
Tightening torque	25 Nm (18.44 ft.lb.)	



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# Fig. 10

NOTICE

If the lines are connected incorrectly, the engine will not be lubricated and the engine will be damaged very quickly!



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# 2.3) Permissible position and location of the oil tank

Position and location

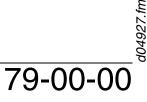
- See Fig. 11.
  - The longitudinal axis z3 must be parallel to z-axis of the system of coordinates.

Permissible deviation from parallel:  $\pm 10^\circ$ 

NOTE: This applies to both planes..

**WARNING** Non-compliance can result in serious injuries or death! If the oil tank is located higher, oil might trickle through bearing clearances into the crankcase during longer periods of engine stop. If fitted too low it might damage the oil circuit.

- The oil tank (1) must be positioned on its z-axis such that the normal oil level (2) is always between 0 and -400 mm (-15.75 in) on the y-axis.
- NOTE: If the profile clamp of the oil tank is 360 mm (14.17 in.) below the propeller shaft, then the oil in the oil tank is at the same level as the oil pump. This is the ideal position for the oil tank.
- Install the oil tank free of vibrations and not directly to the engine.
- Bayonet cap (3) and oil drain screw (4) must be easily accessible.

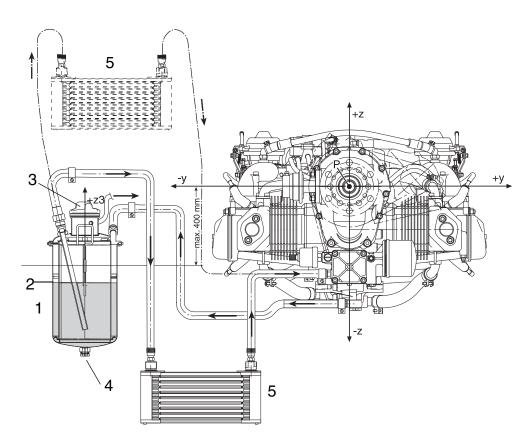


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#### INSTALLATION MANUAL

Graphic

Position and location of the oil tank and oil cooler



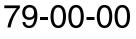
Part	Function	
1	Oil tank	
2	Oil level	
3	Bayonet cap	
4	Oil drain screw	
5	Oil cooler	

Fig. 11

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# 3) General notes on oil cooler

**General note** An oil cooler is available for this engine from BRP-Powertrain (see Illustrated Parts Catalog).

> Non-compliance can result in serious injuries or death! Certification according to the latest regulations, such as FAR or EASA, must be conducted by the aircraft or fuselage manufacturer. The oil cooler must be designed to dissipate approx. NOTICE 10 kW (7.58 BTU/s) of thermal energy at take-off performance. The oil cooler must not restrict oil flow. Test system as NOTICE per chap. 79-00-00 section 1.3. Experience has shown that an oil cooler of at least NOTE: 160 cm<sup>2</sup> (25 in<sup>2</sup>) is required, provided that air flow is adequate.

# 3.1) Permissible position and location of the oil cooler

Installation

See Fig. 11.

- ▲ WARNING
  Non-compliance can result in serious injuries or death!
  The oil cooler must be designed and installed such that the permissible operating temperatures are maintained and that these do no exceed or fall below the maximum values.
  This must also apply to "hot day conditions".
  If need be, take appropriate measures such as changing the size of the oil cooler, partially covering the
- The oil cooler should always be installed below the engine oil pump.

cooler, etc.

**NOTICE** The oil cooler must be installed with the radiator caps pointing upwards i.e. in positive direction on the z-axis.

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#### INSTALLATION MANUAL

- If this position is not practical, also install the oil cooler with the radiator caps pointing upwards, i.e. in positive direction on the z-axis.

NOTICE

This will prevent unintentional draining of the oil cooler during longer periods of engine stop.

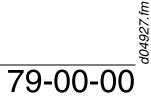
# 3.2) Capacity

Oil tank

- Capacity without oil cooler and connecting lines min. 3 I (0.8 USgal) depending on the respective installation.

Volume of oil tank		
Up to the MINmark	2.5 I (0.66 US gal)	
Up to the MAXmark	3.0 I (0.8 US gal)	

- Perform oil level check and add oil if necessary.



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# 3.3) Purging the lubrication system

Safety	See Fig. 12.	
	<b>A WARNING</b> Risk of burns and scalds. Hot engine parts. Always allow engine to cool down to ambient temperature before starting work	
Introduction	Ensure that oil lines are connected correctly and secured and that the oil cooler (if fitted) is in the suction line (1) between the oil tank and the oil pump. Verify that the oil tank is filled up to the maximum level (to the top of the flat portion of the dipstick). Additional oil (up to 0.5 litre (0.13 USgal)) may be added to the tank for the purpose of this procedure.	
Instruction	The following work procedures must be carried out:	
	<b>NOTICE</b> Incorrectly connected oil lines to the oil tank or to the engine will result in severe engine damage.	

Step	Procedure	
1	Disconnect oil return line (2) from the oil tank.	
2	Place the free end (3) of the return line into a suitable container (4) below the engine.	
3	Plug open connection (5) on oil tank with suitable air tight cap.	
4	Remove the spark plug connectors.	
5	For easier rotation of engine remove one spark plug from each cylinder.	
	<b>NOTICE</b> Prevent any foreign objects entering through spark plug hole.	
6	Using a compressed air line, pressurise the oil tank through its purging connection (6) (on the neck of the tank). Adjust the compressor outlet regulator so that the air line pressure is between 0.4 bar (5.8 psi) and 1 bar (14.5 psi). Do not exceed 1 bar (14.5 psi).	

Non-compliance can result in serious injuries or death!

Do not remove the oil tank cover before ensuring that air pressure has been completely released from the tank.





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NOTE: The bayonet cap is not pressure-tight, some air can escape.

The pressure in the oil tank has to be maintained during the following steps.

**NOTICE** The oil tank may empty and as a result introduce air into the oil system. Pay attention to the oil level and fill tank as required.

# NOTICE

Do not use the starter for this purpose. Fit propeller and use it to turn the engine.

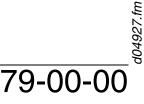
7	Turn the engine by hand in direction of normal rotation until the first pres- sure indication appears on the oil pressure gauge. Normally this will take approx. 20 turns. Depending on installation it may take up to 60 turns.	
8	Stop the pressurisation.	
9	Open the cap (5) for the oil return line on the oil tank and reconnect the en- gine oil return line (2) to the tank.	
	<b>NOTICE</b> Ensure that the suction oil line (1) and oil return lines (2) are connected to the proper fittings on the oil tank. If the oil lines from the engine to the oil tank are incorrectly connected, severe engine damage may result.	
10	Refit the spark plug. Restore aircraft to original operating condition.	
11	Residual oil may have accumulated in the crankcase. Return it to the oil tank by following the oil level check procedure in the relevant Operators Manual.	
12	Fill the oil in the tank up to the full mark on the dipstick.	

NOTICE

Carefully check all lubrication system connections, lines and clamps for leaks and tightness.

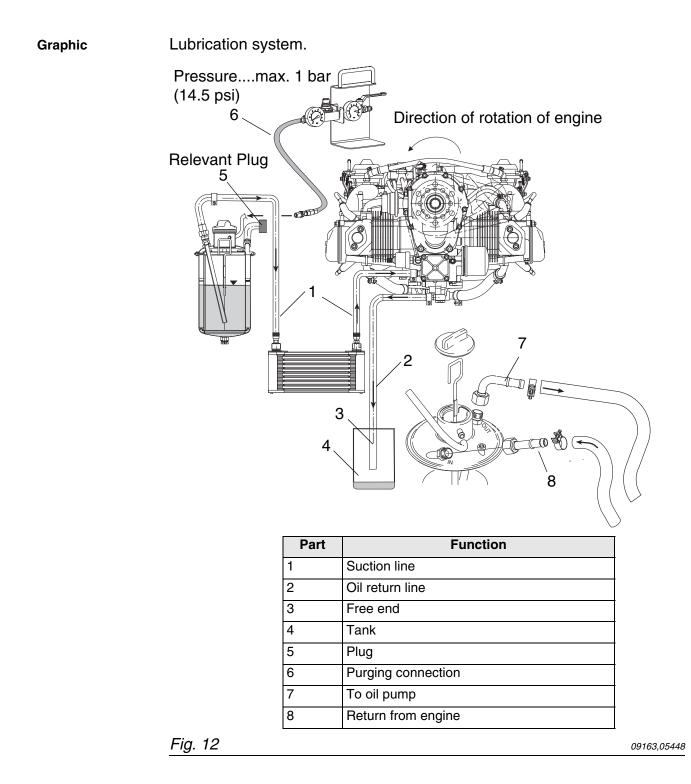
# ENVIRONMENT NOTE

Protect their environment. Observe to bury no oil! Dispose of oil in an environmentally friendly manner.



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# 3.4) Checking the hydraulic valve tappet for correct purging

General note

See Fig. 13.

Risk of burns and scalds. Hot engine parts. Always allow engine to cool down to ambient temperature before starting work.

The following check procedure describes the correct method for purging the hydraulic valve tappet.

Instruction

The following work procedures must be carried out:

Step	Procedure	
1	Remove valve cover on cylinder 1.	
2	Turn crankshaft in direction of normal rotation so that cylinder 1 is set to <b>top dead centre</b> ignition (both valves are closed).	
3	Push down the rocker arm on the push-rod side with a force (F) of around 70 N (15.74 lbf) for about 3 seconds. You can using a belt tester, for example, to check approximately how much force is being exerted. Repeat on other rocker arms.	
4	Check the size of the gap between the rocker arm and the valve contact surfaces. Max. permitted gap 0.5 mm (0.02 in.).	
	<b>NOTICE</b> If it is possible to push the hydraulic valve tappet further than this limit, an additional engine run for about 5 min. at 3500 rpm, after refitting the valve covers, is required. In order to vent the hydraulic valve tappet, this process can be repeated another 2 times.	
5	Repeat on all other cylinders.	



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<u>max. 0,5 mm</u> / 0.0197 in.

Hydraulic valve tappet

Graphic

Fig. 13	08800

General note	If an hydraulic valve tappet still malfunctions after several engine runs, it must be replaced and the valve spring support must be inspected for wear.	
Work procedures	All work has to be performed in accordance with the relevant Mainte- nance Manual.	



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# 4) Data for optional components of lubrication system

# 4.1) Oil cooler

General note	See Fig. 14.	
Weight	See also chap. 72-00-00 section: weight.	

# 4.1.1) Variants of connectors

General note

NOTICE

Counter hold screw sockets when securing the oil lines.

#### **UNF screw socket**

UNF screw socket	
Thread	3/4-16 UNF (AN-8)
Tightening torque	22 Nm (16.23 ft.lb) and LOCTITE 648
Tightening torque of oil feed line and outlet	25 Nm (18.5 ft.lb)

# Nipple 13.2/9.2

Nipple	
Outer dia.	13.2 mm (0.52 in)
Slip-on length	max. 21 mm (0.83 in)
Tightening torque	22 Nm (16.23 ft.lb) and LOCTITE 243

# Metric screw socket



Counter hold screw sockets when securing the oil lines.

Metric screw socket		
Thread	M18x1,5	
Tightening torque	22 Nm (16.23 ft.lb) and LOCTITE 648	
Tightening torque of oil feed line and outlet, bent socket or hose nipple	25 Nm (18.5 ft.lb)	

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# Angular tube

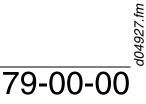
Angular tube (90°)	
Outer dia.	13.2 mm (0.52 in)
Slip-on length	max. 21 mm (0.83 in)
Tightening torque	22 Nm (16.23 ft.lb) and LOCTITE 648

## Bent socket

Bent socket 90°	
Outer dia.	12 mm (0.47 in)
Slip-on length	max. 24 mm (max. 0.94 in)
Tightening torque	25 Nm (18.5 ft.lb)

# Hose nipple with cap nut (straight nipple)

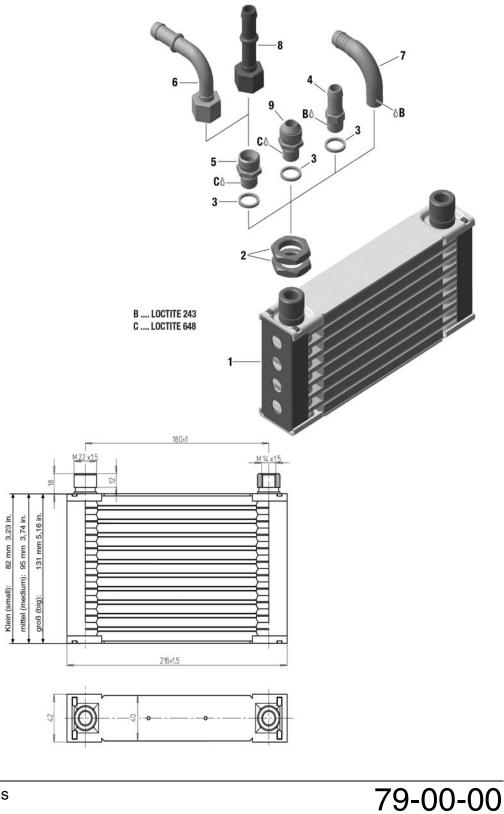
Hose nipple with union nut	
Outer dia.	12 mm (0.47 in)
Slip-on length	max. 24 mm (max. 0.94 in)
Tightening torque	25 Nm (18.5 ft.lb)



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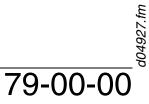
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Part	Function	
1	Oil cooler	
2	M22x1.5 hex. nut	
3	Gasket ring 14.2/18/2	
4	Nipple 13.2/9.5	
5	M18x1.5/M14x1.5 screw socket	
6	Bent socket assy.	
7	M14x1.5 angular tube	
8	Hose nipple with cap nut	
9	3/4-16 UNF/M14x1.5 screw socket	

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# Chapter: 80-00-00 ELECTRIC STARTER

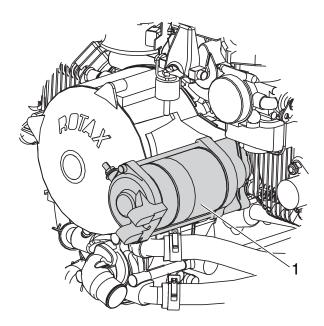
General note	<b>A</b> WARNING	risk of short circuit and el All installation work on the	ctric starter assy., there is a ectrical fault. e electric starter assy. must switched off and the battery nnected.
Table of contents	This section of the Installation Manual contains the electric starter of the aircraft engine.		
		Subject	Page
	Electric starter		Page 3
	Power supply v electric starter	vires from starter relay to the	Page 3
	Starter relay as	ssy. technical data	Page 4

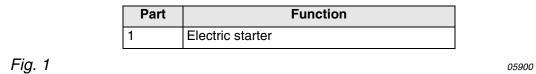


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Overview Electric starter







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# 1) Electric starter

**General note** 

NOTICE

Suitable for short starting periods only.

NOTICE

Max. 80 °C (176 °F) ambient temperature by the electric starter housing. Activate starter for max. 10 sec. (without interruption), followed by a cooling period of 2 minutes!

# 1.1) Power supply wires from starter relay to the electric starter

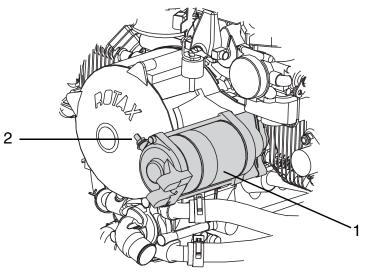
 $\label{eq:cross section} \mbox{ At least 16 mm}^2 \ (2.48 \ in^2).$ 

Output 0.7 kW (0.9 kW optional)

Connection See Fig. 2.

Plus terminal (2): M6 screw connection (tightening torque 4 Nm (36 in.lb)) suitable for cable terminals according to DIN 46225 (MIL-T-7928; PIDG or equivalent).

Graphic Connection



Part	Function	
1	Electric starter	
2	Plus terminal	

# Fig. 2

*Ltf* Grounding

Grounding cable via engine block.

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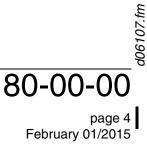
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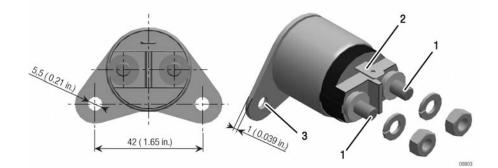
# 1.2) Starter relay assy. technical data

General note	See Fig. 3.
	<b>NOTICE</b> Activation of starter relay limited to short duration. The duty cycle over an interval of 4 minutes is 25%.
Nominal voltage	- 12 V/DC
Control voltage	- Min. 6 V - Max. 18 V
Switching cur-	- Max. 75 A 8 (permanent)
rent	- Max. 300 A/1 sec. (short duration)
Ambient tem-	Ambient temperature range:
perature range	- Min40 °C (-40 °F)
	- Max. +100 °C (212 °F)
Weight	See chap. 72-00-00 section: Technical data.
Connections	Main current connections (1):
	M6 screw connection (tightening torque 4 Nm (36 in.lb.)) suitable for cable terminals according to DIN 46225 (MIL-T-7928; PIDG or equivalent).
	Control wiring (2):
	6.3x0.8 plug connector suitable for Faston connector (female) according to DIN 46247 (MIL-T-7928; (PIDG) or equivalent).



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Part	Function
1	Main current connections
2	Control wiring
3	Ground



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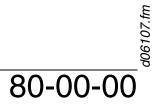




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Motornummer / Engine serial no.

Flugzeugtype / Type of aircraft

Flugzeugkennzeichen / Aircraft registration no.

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