ROTAX®
AIRCRAFT ENGINES

INSTALLATION MANUAL

FOR ROTAX® ENGINE TYPE 912 i SERIES

ref. no.: IM-912 i | part no.: 898647

picture: ROTAX® 912 iS with options

⚠ WARNING

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

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

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:

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Chapter: LEP

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Chapter: TOA

TABLE OF AMENDMENTS

Approval*

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

no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclusion	signature
0	INTRO	all	01 01 2012				
0	LEP	all	01 01 2012				
0	TOA	all	01 01 2012				
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1	78-00-00	5,7	07 01 2012	DOA*			
1	79-00-00	5	07 01 2012	DOA*			

NOTES

Chapter: TOA

SUMMARY OF AMENDMENTS

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

Current No.	chapter	page	date of change	Comment
1	00-00-00	5	2012 07 01	Chap. 2.1 Standard version: Fuel pump assy.
1	24-00-00	4,9, 23	2012 07 01	Chap. 1.1 Electromagnetic compatibility: Change of text
1	73-00-00	1,3,5,6	2012 07 01	Chap. 1.5+1.7.2 Coarse+fine filter: mesh size
1	76-00-00	9, 12	2012 07 01	Chap. 3 Internal generator: Change of text Chap. 5.3 Wiring diagram: New graphics
1	78-00-00	5,7	2012 07 01	Chap. 2 Exhaust system requirements: Text Chap. 3 Positioning the sensor: Text Chap. 3.1 Pin assignment for maintenance tool: Text Chap. 4.1 Pin assignment for display: New graphics
1	79-00-00	5	2012 07 01	Chap. 1.3 Measurement of crankcase pressure: Text

NOTES

Chapter: 00-00-00

GENERAL NOTE

Introduction

This section describes the installation of engine type ROTAX 912 i Series.

NOTE: ROTAX 912 i Series includes 912 iSc and 912 iS.

Table of contents

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

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General note	Page 3
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Safety notice Safety information Instruction Technical documentation	Page 11 Page 12 Page 14 Page 15

NOTES

1) General note

Purpose

The purpose of this Installation Manual is to acquaint maintenance service 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 aircraft 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 Operators 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 top of the crankcase, behind of the propeller gearbox.

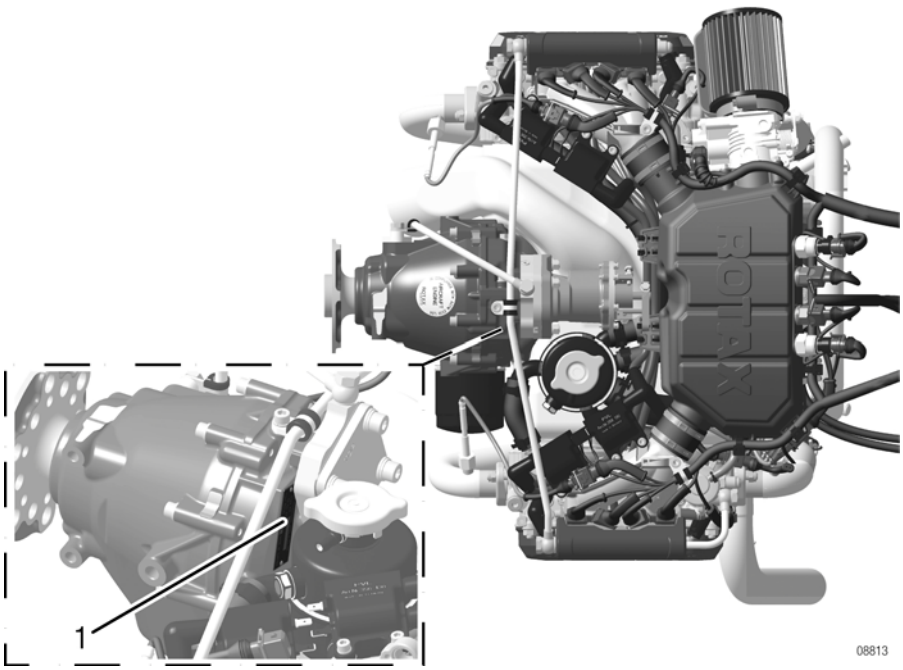

Fig. 1

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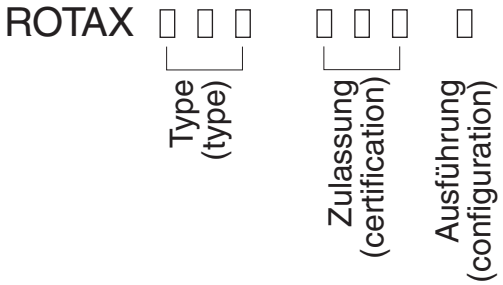
2) Type description

e.g. 912 iSc 3

The type description is made up the following:



Designation

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

Options

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

	external alternator	vacuum pump	governor	exhaust system
for configuration 2	YES	YES	NO	YES
for configuration 3	YES	NO	YES	YES

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2.1) Standard version

Serial production

- 4-stroke, 4 cylinder horizontally opposed, spark ignition engine, single central camshaft push rods - OHV
- Liquid cooled cylinder heads
- Ram air cooled cylinders
- Dry sump forced lubrication
- Fully redundant electronic engine management (EMS) includes fuel injection, ignition characteristics, etc.
- Propeller drive via integrated gearbox with mechanical shock absorber and overload clutch
- Oil tank
- Electric starter (12 V 0.8 kW)
- Fuel pump assy.

Optional

- Electric starter (12 V 0.9 kW)
- Preparation for hydraulic governor for constant speed propeller: (configuration 3 only)
- Exhaust system
- Cooling air baffle
- Engine suspension frame

Auxiliary equipment tested

NOTE: The following equipment is not included as part of the standard 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 i 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.

- external alternator
- oil cooler with connections
- coolant radiator
- coolant overflow bottle

Auxiliary equipment not tested

The following auxiliary equipment has <u>not</u> been tested on ROTAX engine type 912 i for safety and durability to the standards of aviation.

⚠WARNING

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.

- intake filter
- shock mount

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3) Abbreviations and terms used in this Manual

Abbreviations

Abbreviation	Description
*	Reference to another section
⊕	center of gravity
💧	The drop symbol indicates use of sealing agents, adhesives or lubricants (only in the Illustrated Parts Catalog).
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
912 iS	see OM (Type designation)
912 iSc	see OM (Type designation)
A	Ampere
a.c.	alternating current
Ah	Ampere hour
A/C	Aircraft
AD	Airworthiness Directive
A/F	Across-flat dimension
ASB	Alert Service Bulletin
ACG	Austro Control GmbH
AKI	Anti Knock Index
API	American Petrol Institute
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
AWG	American Wire Gauge
BUDS	BRP Utility and Diagnostic Software
CAN	Controller Area Network
CAN/CGSB	Canadian General Standards Board
CPS 1+2	Crankshaft Position Sensor 1+2
CSA	Constant Speed Actuator
CTS	Cooling Temperature Sensor
CW	Clockwise
CCW	Counter-clockwise
DCDI	Dual Capacitor Discharge Ignition
d.c.	direct current
DOA	Design Organisation Approval
DOT	Department of Transport
EASA	European Aviation Safety Agency
ECU	Engine Control Unit
EGT	Exhaust Gas Temperature

Abbreviation	Description
EMS	Engine Management System
EN	European Norm
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
hr.	hours
IFR	Instrument Flight Rules
IM	Installation Manual
INJ 1-8	Injector 1-8
INTRO	Introduction
IPC	Illustrated Parts Catalog
iRMT	independent ROTAX Maintenance Technician
ISA	International Standard Atmosphere
kg	kilograms
LEP	List of Effective Pages
MAPS 1+2	Manifold Air Pressure Sensor 1+2
MATS 1+2	Manifold Air Temperature Sensor 1+2
MM	Maintenance Manual
MON	Motor Octane Number
MAG	Magneto Side
N	new part (only Illustrated Parts Catalog)
n.a.	not available
nB	as necessary (only Illustrated Parts Catalog)
NDT	non-destructive testing
Nm	Newtonmeter
OHM	Overhaul Manual
OM	Operators Manual
part no.	Part number
PTO side	power take off side
Rev.	Revision
RON	Research Octane Number
ROTAX	is a trade mark of BRP-Powertrain GmbH & Co KG
rpm	Revolutions per minute
SB	Service Bulletin
SI	Service Instruction
SL	Service Letter
SMD	Surface Mounted Devices
S/N	Serial Number
s.v.	still valid (only Illustrated Parts Catalog)

Abbreviation	Description
TBO	Time Between Overhaul
TOA	Table of amendments
TOC	Table of Contents
TSN	Time Since New
TSNP	Time Since New Part
TSO	Time Since Overhaul
V	Volt
VFR	Visual Flight Rules
XXX	shows the serial component number

3.1) Conversion table

Units of length:

1 mm = 0.03937 in
1 in = 25.4 mm
1 ft = 12 in
= 0.3048 m

Units of area:

1 cm^2 = 0.155 sq. in (in^2)
1 sq. in (in^2) = 6.4516 cm^2

Units of volume:

1 cm^3 = 0.06102 cu in (in^3)
1 cu in (in^3) = 16.3871 cm^3 (in^3)
1 dm^3 = 1 l
1 dm^3 = 0.21997 gal (UK)
1 gal (UK) = 4.5461 dm^3
1 dm^3 = 0.26417 gal (US)
1 gal (US) = 3.7854 dm^3

Units of mass:

1 kg = 2.2046 lb
1 lb. = 0.45359 kg

Density:

1 g/cm^3 = 0.016018 lb/ft^3
1 lb/ft^3 = 62.43 g/cm^3

Units of force:

1 N = 0.224809 lbf
1 lbf = 4.4482 N

Units of pressure:

1 Pa = 1N/m^2
1 bar = 100000 Pa/1000 hPa/ 100 kPa
1 bar = 14.5037 lbf/in^2 (psi)
1 in Hg = 33.8638 hPa

Units of power:

1 kW = 1.341 hp
1 hp = 0.7457 kW
1 kW = 1.3596 PS
1 PS = 0.7355 kW

Units of temperature:

K = °C - 273.15
°C = (°F - 32) / 1.8
°F = (°C x 1.8) + 32

Units of velocity:

1 m/s = 3.6 km/h
1 ft/min = 0.3048 m/min
= 0.00508 m/sec
1 m/s = 196.85 ft/min
1 kt = 1.852 km/h
1 km/h = 0.53996 kn

spec. fuel consumption:

1 g/kWh = 0.001644 lb/hph
1 lb./hph = 608.277 g/kWh

Units of torque:

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^2

AWG	4	6	8	10	12	14	16	18	20
mm^2	21	13	8.4	5.3	3.3	2.1	1.3	0.8	0.52

4) Safety notice

General note

Although the reading of such information does not eliminate the hazard, it promotes the understanding and application of the information contained in for correct use of the engine. Always use common workshop safety practice.

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

Revision

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

Measure

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

Symbols used

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

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

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

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

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

ENVIRONMENT NOTE

Environment note gives you tips and behaviors to environmental protection.

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

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4.1) Safety information

Use for intended purpose

⚠WARNING 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.

⚠WARNING 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 aerobatics (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..

⚠WARNING Non-compliance can result in serious injuries or death!
Unless correctly equipped to provide enough electrical power for night IFR (according latest requirement as ASTM), the ROTAX 912 iS is restricted to DAY VFR only.

- 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.

- For continuing airworthiness see Maintenance Manual Line.
- Unauthorized modifications of engine or aircraft will automatically exclude any liability of the manufacturer for sequential damage.

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 the engine manufacturer from any liability.
- Improper engine installation and use of unsuitable piping for fuel, cooling and lubrication system releases the engine manufacturer from any liability.

4.2) Instruction

General note

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

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

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

Safety notice

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

Accessories

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

Spare parts

NOTICE

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

NOTICE

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

State of delivery

⚠WARNING

Engine and gearbox are delivered in "dry" conditions (without oil). Before putting the engine into operation it must be filled with oil. Use only oil as specified (consult Operators Manual and SI-912 i-001 "Selection of suitable operating fluids" current issue).

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4.3) Technical documentation

General note

These documents form the instructions ensuring continued airworthiness of ROTAX aircraft engines.

The information contained is based on data and experience that are considered applicable for 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

Status

The status of the Manuals can be determined with the aid of the table of amendments. The first column indicates the revision state.

This figure should be compared with the revision provided on ROTAX-Aircraft Engines Website: www.FLYROTAX.com.

Amendments and current versions can be downloaded free of charge.

Replacement pages

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

Reference

NOTICE

This Manual for engine installation is only part of the Technical Documentation and will be supplemented by the respective Operators Manual, Maintenance Manual and Illustrated Parts Catalog.
Pay attention to references to other documentation, found in various parts of this Manual.

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

Illustrations

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

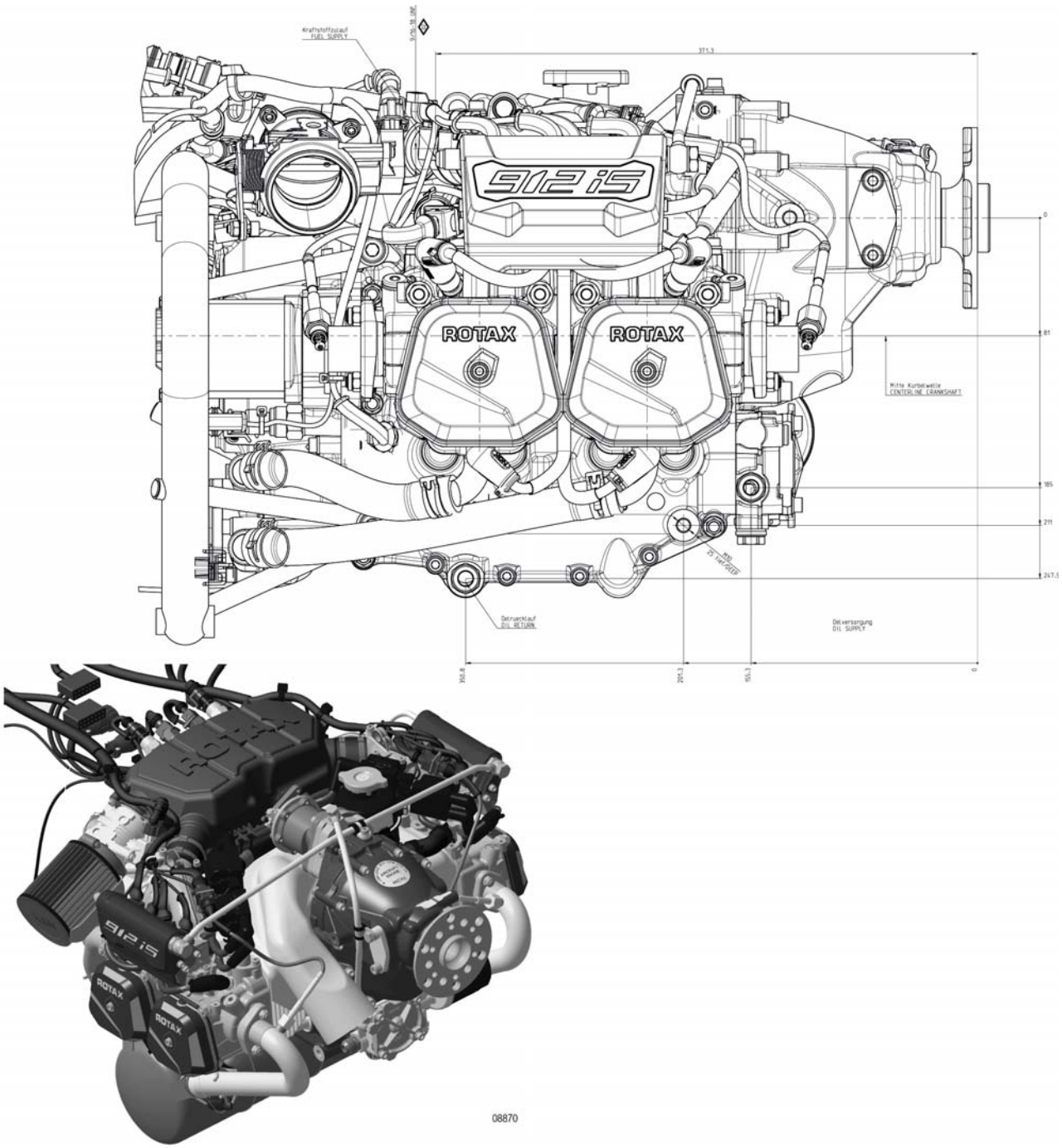
NOTE: The Illustrations in this Manual are stored in a graphic data base system and are provided with a consecutive irrelevant number.

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

Installation drawings

Installation drawings and a DMU-model for (virtual) installation analysis are available from the ROTAX Authorized Distributors or their Service Centers.

Graphic Installation drawing



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NOTES

Chapter: 10-10-00

STORAGE AND INSTALLATION

Introduction

NOTICE 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 4
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 11

NOTES

1) Preparations for engine installation

1.1) State of delivery

Attachment

NOTICE

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!

NOTICE

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 is attached to the pivot point (A) of the governor using a special tool and lifted up to the intake manifolds using two straps or hooks. See Fig. 1

NOTICE

Do not use the fuel line assy. to lift the engine!

Graphic

Governor pivot point (A)

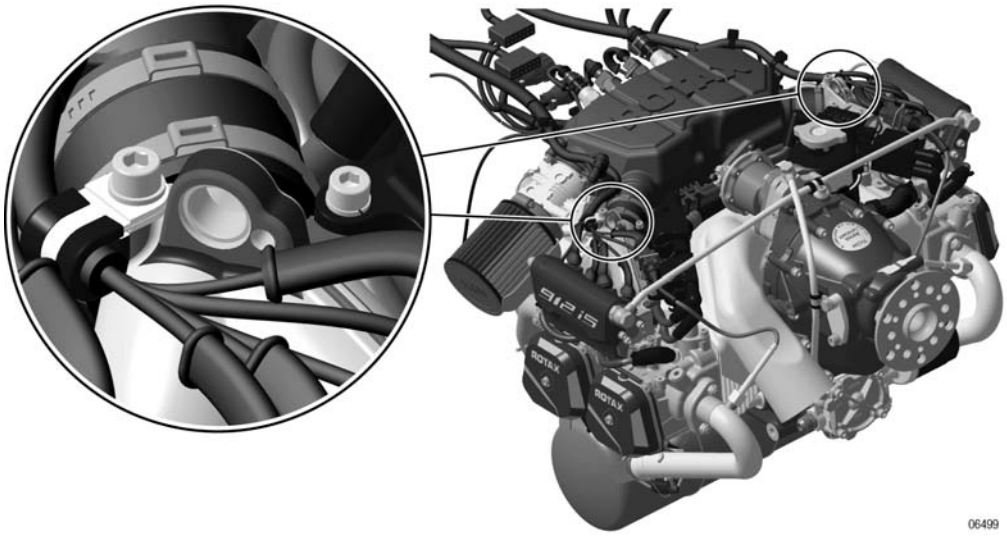


Fig. 1

1.3) Preservation and storage of the engine

General note

The engine is preserved at BRP-Powertrain thus guaranteeing proper protection against corrosion damage for at least 24 months after the date of delivery from BRP-Powertrain.

Warranty

This warranty is subject to the following conditions:

- The engine must be stored in the GENUINE-ROTAX packing as supplied by BRP-Powertrain.
- The covers on various openings must not be removed.
- The engine must be stored in a suitable place (at min. -40 °C/-40 °F and max. +80 °C/176 °F).
- 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“.

1.4) Protective coverings

General note

NOTICE

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 coverings

List of protective coverings. See Fig. 2.

Pos.	Installation location
1	Exhaust sockets
2	Fuel rail (outlet) / fuel pressure regulator
3	Fuel rail (inlet)
4	Oil inlet/outlet
5	Supply and discharge of coolant
6	Throttle valve support assy.
7	Propeller shaft

Graphic

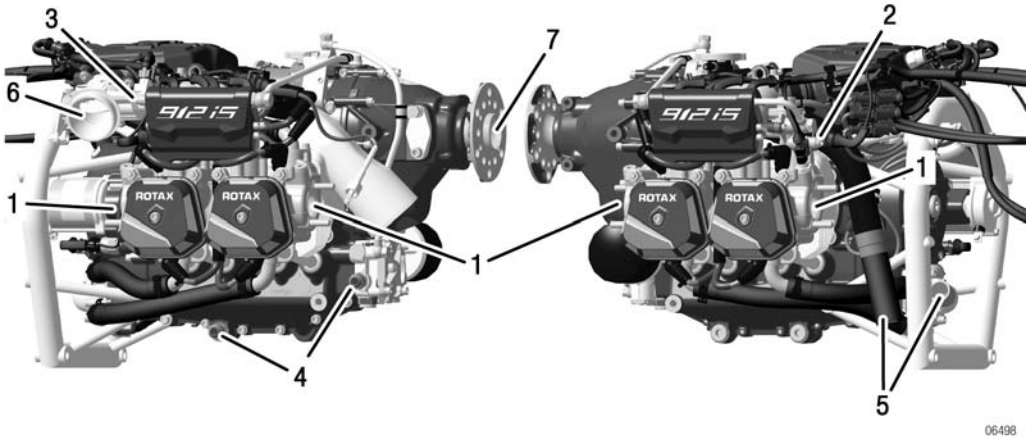


Fig. 2

2) Engine suspension and installation position

General note

NOTICE

During engine installation take into account the total engine weight and ensure careful handling.

Engine suspension

The engine suspension is essentially determined by the aircraft design. Eight attachment points are provided (4 on the engine if the ring mount is used, if not: 2 on the engine and 2 on the engine suspension frame).

Engine suspension frame

NOTICE

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 delivery 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 manufacturer.

Noise emission 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

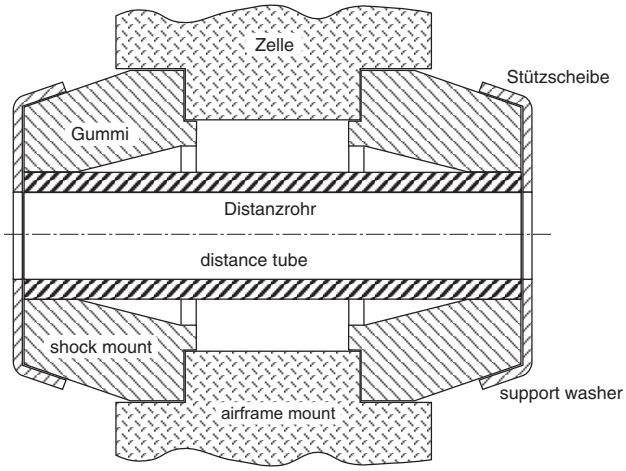
If the GENUINE-ROTAX engine suspension frame is not being used, a vibration test must be carried out. See SL-912-010.

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. 3.

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. 3 *07600*

Vibration neutralisation

The vibration and acoustic insulation factor is dependent on the cell manufacturer. Perform the determination as described in SL-912-010.

Damping elements

NOTICE All elements for neutralising vibrations must be captive.

Vertical axis

The y-axis must be perpendicular to the longitudinal axis of the aircraft.

Deviation

Permissible deviation from perpendicular: ±10°.
See Fig. 4.

Graphic Deviation

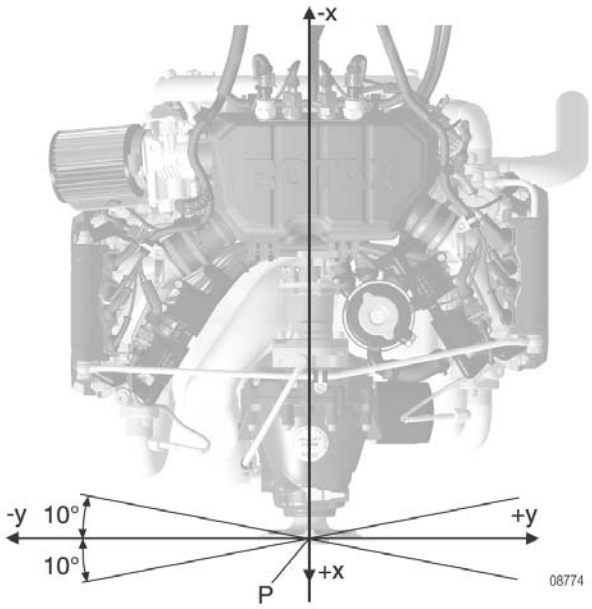


Fig. 4

2.2) Attachment points

General note See Fig. 5.

NOTICE 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.

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

2.3) Definition of attachment points

General note

See Fig. 5.

⚠WARNING

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.

Graphic

Attachment points

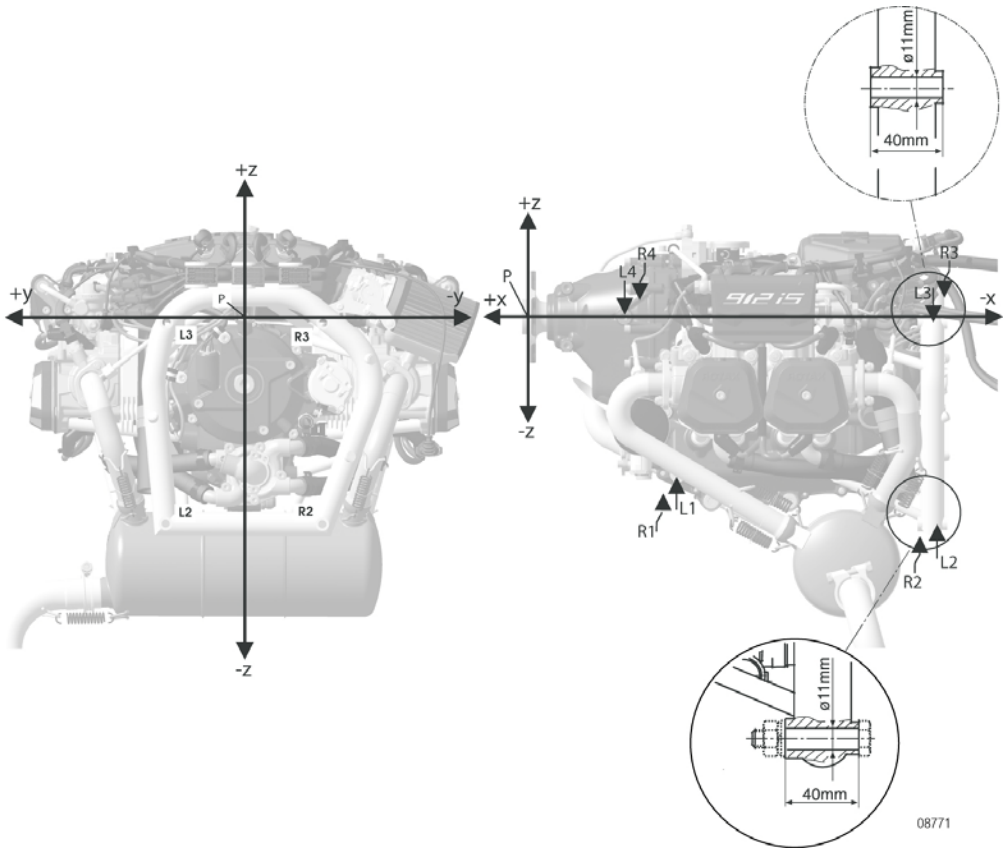


Fig. 5

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Attachment points	x-axis mm/in	y-axis mm/in	z-axis mm/in
L1	-200.8/-7.90	-71.0/-2.80	-211.0/-8.31
R1	-200.8/-7.90	-71.0/-2.80	-211.0/-8.31
L2	-564.0/-22.20	105.0/4.13	-277.0/-10.91
R2	-564.0/-22.20	-105.0/-4.13	-277.0/-10.91
L3	-564.0/-22.20	105.0/4.13	-7.0/-0.28
R3	-564.0/-22.20	-105.0/-4.13	-7.0/-0.28
L4	-128.3/-5.05	87.0/3.43	0
L4	-128.3/-5.05	-87.0/-3.43	0

Attachment points	Max. permissible force (secure load) in (N) in. x, y, and z axis	Max. permissible bending moment (secure load) in (Nm) in. x, y, and z axis
L1	5000/196.85	77/3.03
R1		
L4	1900/74.80	39/1.54
R4		

Attachment points	Max. permissible force (secure load) in (N) in. x axis	Max. permissible bending moment (secure load) in (N) in. y axis	Max. permissible bending moment (secure load) in (N) in. z axis	Max. permissible bending moment (secure load) in (Nm) in. x, y and z axis
L2	5000/196.85	2000/78.74	3000/118.11	100/3.94
R2				
L3				
R3				

Attachment points	Thread	Max. usable Thread length
L1	M10	25 mm/0.98 in.
R1		
L4	M10	16 mm/0.63 in.
R4		

2.4) Permissible installation positions

General note

NOTICE The oil system, fuel system and the cooling system are unsuitable for upside-down/inverted installation of the engine.

NOTE: Dimensions are always from zero reference point and the coordinate system position remains unchanged.

Installation positions

The following installation position details refer to the aircraft in parked position (aircraft on ground, ready for take off).

- Engine suitable for propeller in tractor or pusher arrangement
- Installation only with propeller shaft above cylinders

Propeller axis

The centres of attachment points L1 and R1 must be on a y2 axis parallel to the y-axis.

Permissible deviation from parallel: ±5°

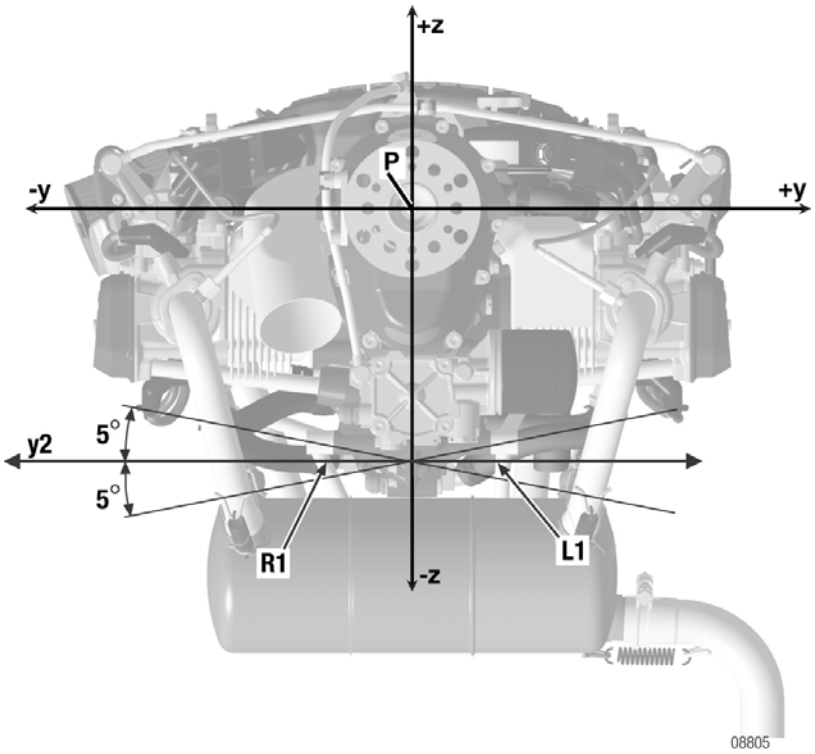


Fig. 6

Vertical axis

The y-axis must be perpendicular to the longitudinal axis of the aircraft.

Permissible deviation from perpendicular: ±10°

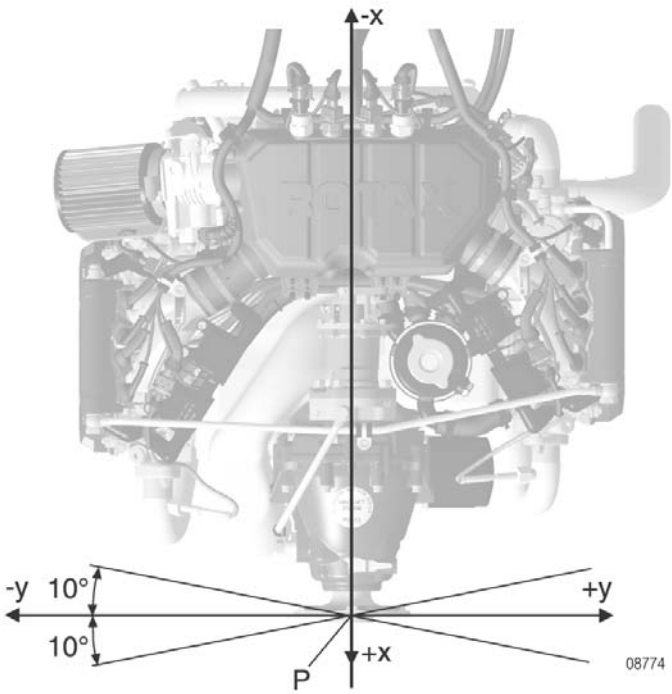


Fig. 7

Chapter: 24-00-00

ELECTRICAL SYSTEM

Introduction

This section describes the general requirements for the circuit wiring, electromagnetic compatibility, grounding cables, battery and optional components. More details can be found in the Overhaul Manual.

Table of contents

This section of the installation manual lists the requirements placed on the wiring, grounding cables, the internal alternator, rectifier regulator, external alternator, the wiring harness and wiring diagrams of the aircraft engine.

Subject	Page
Requirements for the circuit wiring Approval of electric and electronic components Battery Technical data	Page 3 Page 4 Page 5 Page 5
Grounding cables (EMS ground point/engine/ground point) Controller boards on the FUSE BOX FUSE BOX connections	Page 6 Page 7 Page 8
Technical data and connection of the electric components Internal alternator Rectifier regulator	Page 9 Page 9 Page 11
External alternator (optional extra) Technical data Connections Requirements for correct operation of the integrated rectifier regulator External alternator engine bus system	Page 13 Page 13 Page 13 Page 14 Page 16
Wiring harness Fitting the Faston connector to the Harness Interface Connector Switch requirements Wiring diagram	Page 17 Page 18 Page 21 Page 23
Internal power consumers	Page 27

NOTES

1) Requirements for the circuit wiring

General note

NOTICE

The connections have to be made by the aircraft manufacturer 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. battery) must be adequately protected by fuses. Using incorrectly 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.

1.1) Approval of electric and electronic components (Equipment Qualification according to RTCA/DO-160)

RTCA/DO-160

RTCA/DO-160 defines a series of minimum standard environmental test conditions and applicable test procedures for airborne equipment. The purpose of these tests is to provide a laboratory means of determining the performance characteristics of airborne equipment in environmental conditions representative of those which may be encountered in airborne operation of the equipment.

Electric and Electronic components (incl. wiring harness, ECU, Fuse Box, PMA, Sensors and Actuators) of the 912 iS / 912 iSc are deemed to be part of the Equipment and therefore tested and qualified according to the following table:

DO-160G, Section 4 - Temperature and Altitude	Cat. B3V
DO-160G, Section 5 - Temperature Variation	Cat.B
DO-160G, Section 6 - Humidity	Cat.B
DO-160G, Section 7 - Operational Shocks and Crash Safety	Cat.B
DO-160G, Section 8 - Vibration	Cat.S (L general, M for ECU)
DO-160G, Section 9 - Explosion Proofness	X
DO-160G, Section 10 - Water Proofness	Cat. S
DO-160G, Section 11 - Fluids Susceptibility	Cat. F
DO-160G, Section 12 - Sand and Dust	Cat. D
DO-160G, Section 13 - Fungus Resistance	X
DO-160G, Section 14 - Salt Spray	Cat. S
DO-160G, Section 15 - Magnetic Effect	Cat. A
DO-160G, Section 16 - Power Input	Cat.BXX
DO-160G, Section 17 - Voltage Spike	Cat.B
DO-160G, Section 18 - AF Cond. Susceptibility	Cat. Z
DO-160G, Section 19 - Induced Signal Susceptibility §19.3.5 Spikes Induced Into Interconnecting Cables	Cat. ZC
DO-160G, Section 20 - RF Susceptibility	Cat. R
DO-160F, Section 21 - Emission RF Energy	Cat.B
DO-160G, Section 22 - Lightening Induced Trans. Suscept.	Cat. A3G3L3
DO-160G, Section 23 - Lightening Direct Effects	X
DO-160G, Section 24 - Icing	X
DO-160G, Section 25 - Electrostatic Discharge	Cat. A

X.....Test not performed

1.2) Battery

1.2.1) Technical data

General note

Because of different installation options there is no limit for the battery.

NOTICE

The size of the battery will need to be adequate for essential flight equipment for the time defined in the airworthiness requirements.

Voltage

12V

NOTICE

The battery must be selected so that there is a min. voltage of 9 V on the ECU on start-up (also on cold weather conditions). The engine bus voltage is displayed via the CAN BUS. It can also be displayed using the BUDS Aircraft diagnostic tool.

NOTICE

It must also remain displayed when the electric starter is operated.
During its first installation in an aircraft model, the voltage must be measured at 3 places.

- Battery voltage (separate voltmeter)
- Voltage on electric starter (separate voltmeter)
- Engine bus voltage (displayed in BUDS diagnostic tool or on display).

---

2) Grounding cables (EMS ground point/aircraft ground point)

Introduction

During installation, a distinction is made between 2 circuits

- Aircraft circuit
- Electronic engine management circuit (EMS circuit).

When the engine is running (dynamic condition), the two circuits are connected to each other through the FUSE BOX.

The routing of the grounding cables (EMS ground and aircraft ground) is an essential point to be considered when installing the engine electronics.

NOTICE

In the static condition (LANE select SW: "**OFF**" engine not running), the EMS ground and the aircraft ground must not be connected. Components that are connected to the EMS ground must be installed in such a way that they are isolated from the aircraft ground.

Components that must not be connected to the aircraft ground or that can be installed isolated on the firewall:

- ECU
- Regulator A of FUSE BOX
- Starter relay

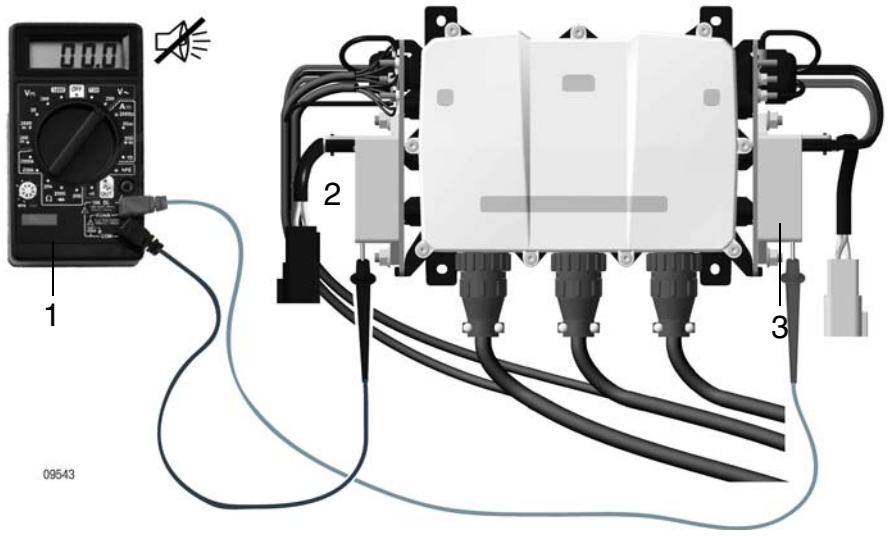
Checks

For checking purposes, use a multimeter to carry out a continuity test between rectifier regulator A and rectifier regulator B in the static condition.

NOTE: A continuity must not be present. See Fig. 1.

Graphic

FUSE BOX



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Part	Function
1	Multimeter
2	Rectifier regulator A
3	Rectifier regulator B

Fig. 1

2.1) Controller boards on the FUSE BOX

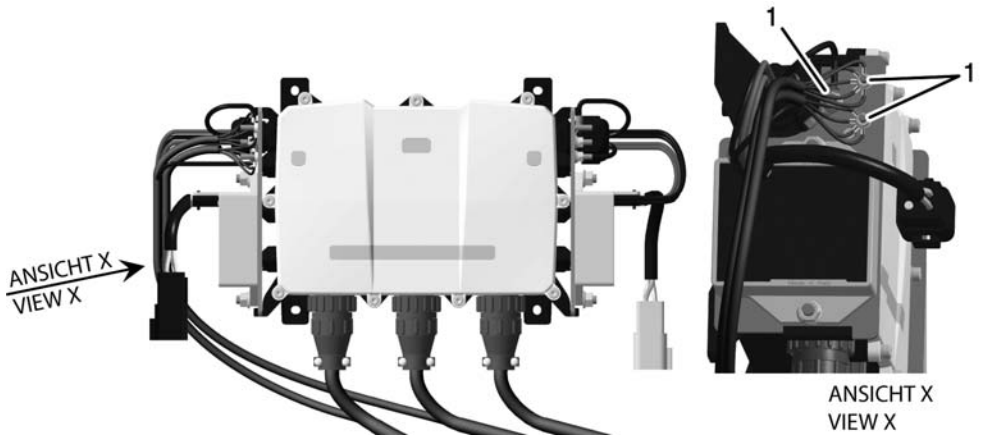
See Fig. 2 and Fig. 3.

The EMS grounding cables of the wiring harness (labelled: "Regulator A“ or cables with cable lugs) must be connected to the 3 attachment points of the EMS ground. Each side of the FUSE BOX has three ground lugs. Side A, EMS ground, has 3 lugs which are connected and may be used interchangeably. Side A must NOT be connected to the airframe ground.

Side B, airframe ground, also has 3 ground lugs that are interconnected and may be used interchangeably, one of the lugs on side B must be connected to the airframe ground.

NOTE: Side B is independent of side A and must NOT be interconnected.

Graphic FUSE BOX



Part	Function
1	EMS ground attachment points

Fig. 2 09544

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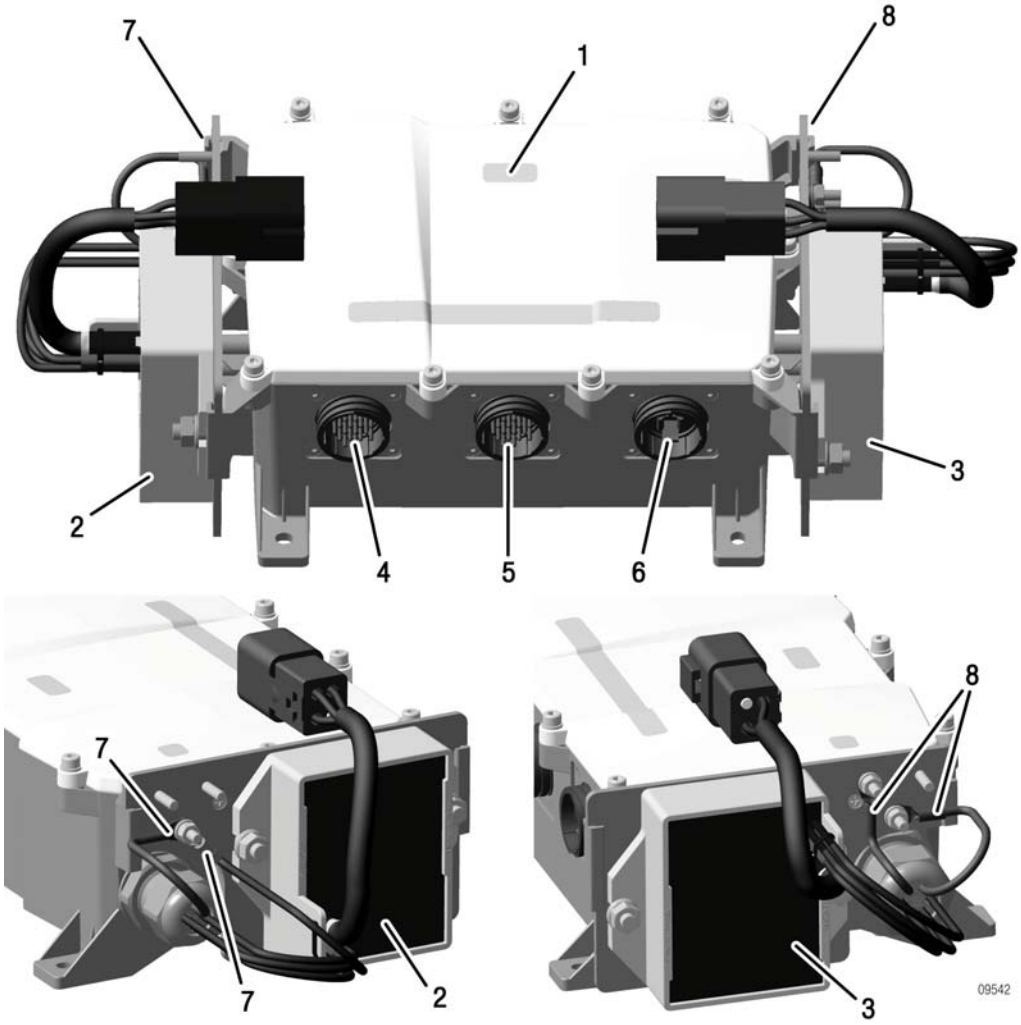
2.2) FUSE BOX connections

Graphic Connections



Part	Function
1	FUSE BOX assy.
2	Rectifier regulator alternator A
3	Rectifier regulator alternator B
4	Plug connection LANE A
5	Plug connection LANE B
6	Plug connection POWER (X3)
7	EMS ground LANE A
8	Aircraft ground LANE B

Fig. 3

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3) Technical data and connection of the electric components

3.1) Internal generator

General note

See Fig. 4.

Two generators are built into the stator. Generator A is only used for electronic engine components (ignition, injection and sensors). Generator B is used primarily to start the engine (Generator B is in use till 2700 rpm longer than 5 sec, then the ECU automatically switch over to generator A) and to charge the aircraft battery.

While the engine is running, alternator B can be used for the on-board instruments.

- Generator A 14 V/16 A (220 W nominal capacity at 20°C/68 °F)
- Generator B 14 V/30 A (420 W nominal capacity at 20°C/68 °F)

NOTICE

If generator A fails, generator B takes over its functions. This means that the battery will no longer be charged and no voltage will be available for the on-board instruments.

NOTICE

If generator B fails, the battery will noo longer be charged. The engine still runs on generator A, however instruments can collapse because of the nonexistence of generator B.

For monitoring the battery voltage and to ensure that the battery is charged, a voltmeter and amperemeter is necessary. See Fig. 13. / Fig. 14.

Graphic

Performance diagram showing engine speed against amps

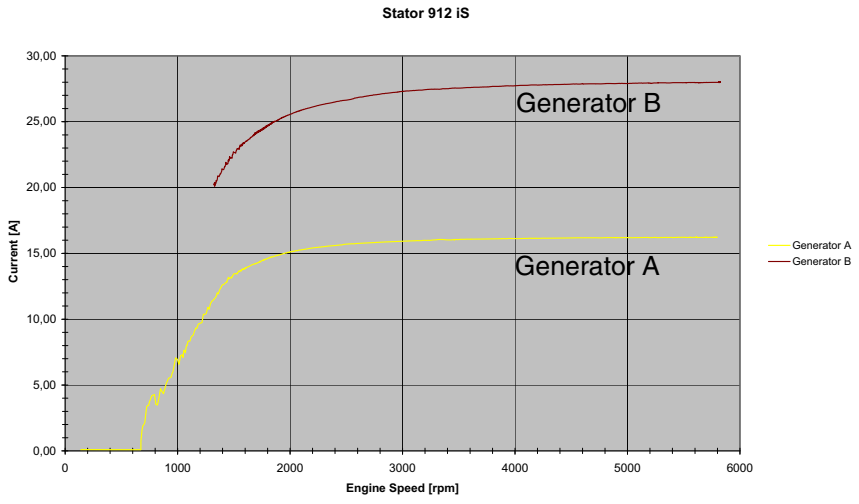

Fig. 4

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NOTE: The measurement is taken at an oil temperature of 135 °C (275 °F).

Connections

See Fig. 5.

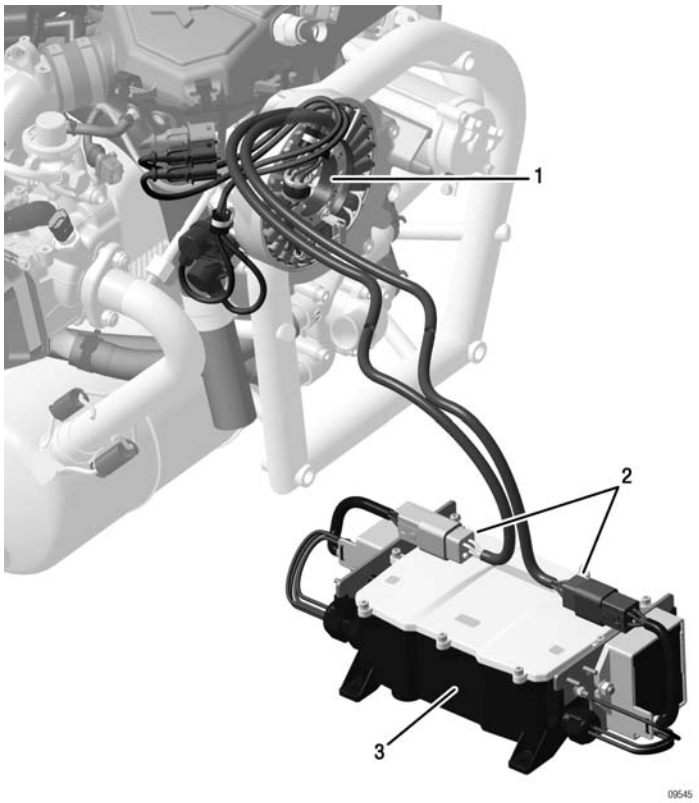
Power supply wires (1) from the internal generator to rectifier regulator on left side (cylinders 2/4) of the ignition housing .

DEUTSCH connector:

- black for generator A/regulator A
- grey for generator B/regulator B

Graphic

Connections



Part	Function
1	Stator
2	DEUTSCH connector
3	FUSE BOX with rectifier regulator

Fig. 5

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3.2) Rectifier regulator

See Fig. 6.

Version

Three-phase short rectifier regulator.

Output voltage

14.2 V± 0.3 (from 1000 ± 250 r.p.m).

Component temperature

Max. permissible component temperature:

80 °C (176 °F) (measured in area (2)).

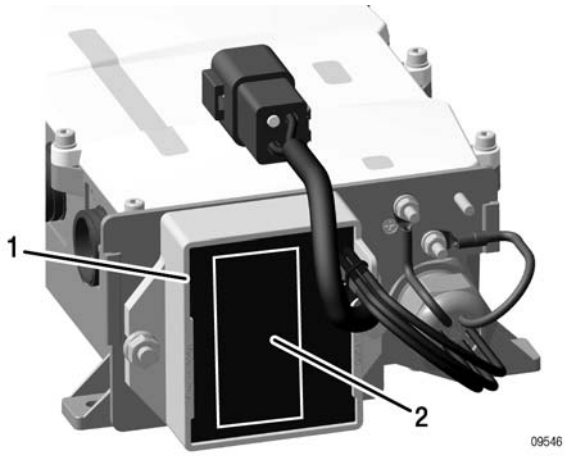
NOTE: The performance specifications are given for optimal cooled components.

Weight

See chap. 72-00-00 section: Weight.

Graphic

Component temperature measurement area



Part	Function
1	Rectifier regulator LANE B
2	Component temperature measuring area

Fig. 6 *06385*

NOTES

4) External alternator (optional extra)

General note See Fig. 7.

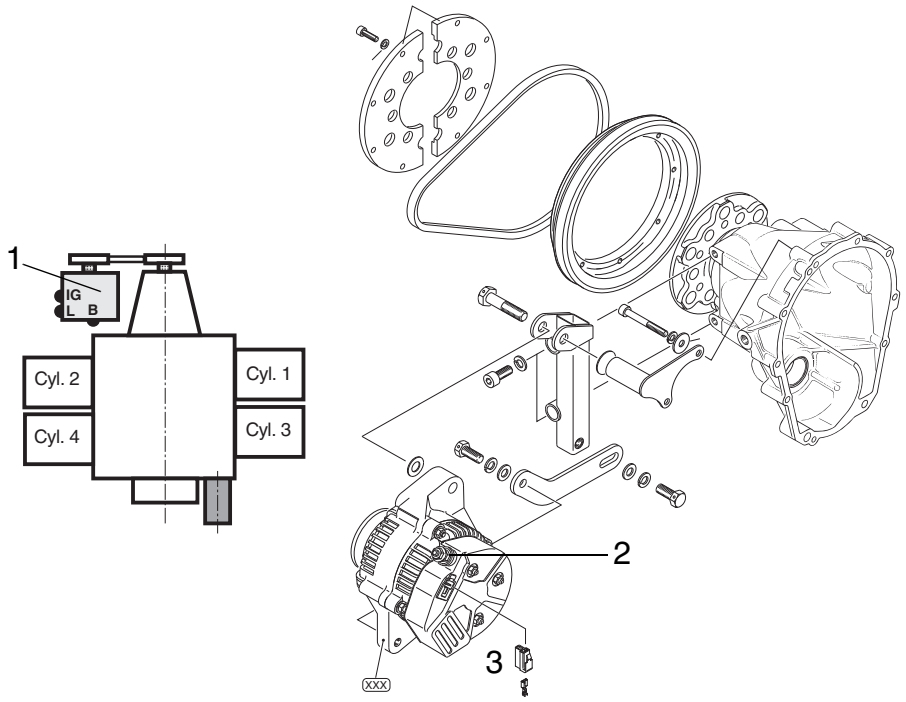
4.1) Technical data

General note	NOTE: The voltage regulator 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 temperature range	Ambient temperature: Min. -30 °C (-22 °F) Max. +90 °C (194 °F)
Weight	See chap. 72-00-00 section: Technical data.

4.2) Connections

Power supply wires	Power supply wires to external alternator (1) located on the outside of propeller gearbox.
Positive terminal	Positive terminal (2): - M6 screw connection suitable for cable terminal according to DIN 46225 (tightening torque 4 Nm (35 in.lb)).
Grounding	Via engine block.
Control wiring	Control wiring (3): - via supplied standard plug (Sumitomo 6111-2568) and 6.3 x 0.8 Faston connectors (female).

Graphic External alternator



Part	Function
1	External alternator
2	Positive terminal
3	Control wiring

Fig. 7 *03199,02764,00547*

4.2.1) Requirements for correct operation of the integrated rectifier regulator

Fuse The rectifier regulator must be protected by a slow blowing fuse or circuit breaker. Fuse or circuit breaker rating must be determined by load, wire size and length.

Cross section Wire size of the main circuit of at least 4 mm^2 (0.006 in2).

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

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Amperage

NOTICE The current over engine speed graph was determined and is only effective under the following conditions:

- Ambient temperature: 20 °C (68 °F)
- Voltage: constant 13.5 V
- Tolerance: max. ± 5 %

NOTE: The speed of the external alternator is 1.24 times the crankshaft speed or 3 times the propeller speed.

Graphic

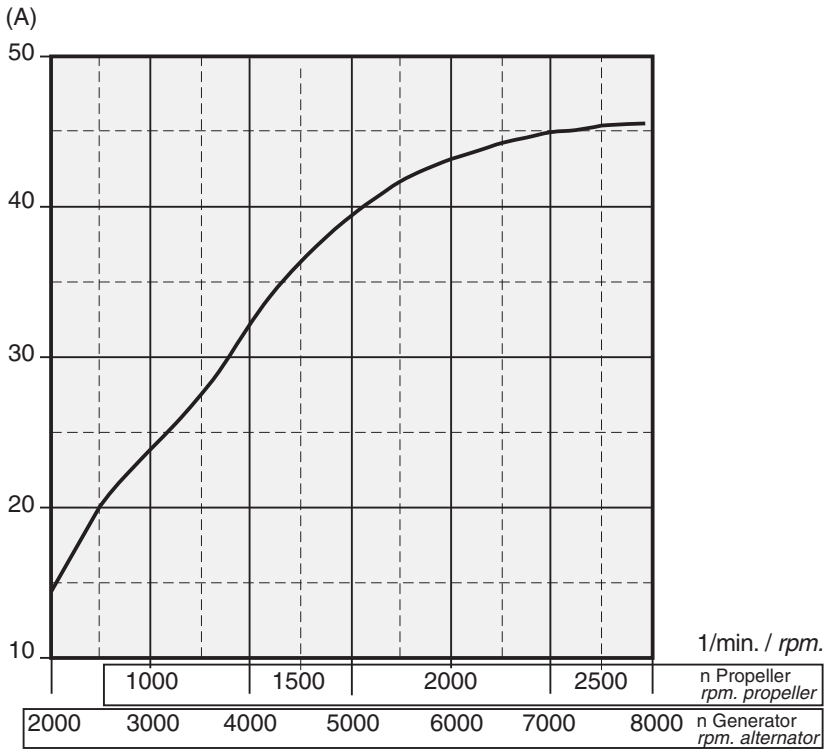

Fig. 8 00547

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4.3) External alternator engine bus system

Graphic

tbd

Fig. 9 *00000*

5) Wiring harness

General note

The wiring harness connects the engine control and the

- Control unit (ECU)
- FUSE BOX assy.
- Cockpit (switch, instruments, maintenance connection)
- Engine (sensors, injectors, ignition coils)

NOTICE The wiring harness must not be shortened or modified.

Sensors

The sensors are fitted by BRP-Powertrain and connected to the wiring harness. The exhaust gas temperature sensors are included according to the version or already fitted on GENUINE-ROTAX exhaust systems.

ECU/FUSE BOX connector

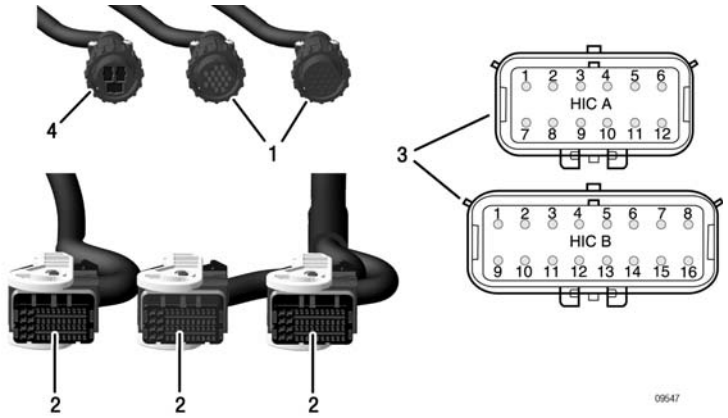
The ECU/FUSE BOX connectors must be easy to install, excessive force is not permissible and may damage the connector or component.

HIC

The HIC (Harness Interface Connectors) connects the cockpit instruments and maintenance ports with the engine.

Graphic

Connector



Part	Function
1	FUSE BOX LANE A, LANE B
2	ECU connector A1, A2, B
3	Harness Interface Connector A, B
4	FUSE BOX power supply (X3)

Fig. 10

d05393.fm

5.1) Fitting the Faston connector to the Harness Interface Connector

General note

See Fig. 11.

NOTE: Faston connectors (1) are supplied loose. The Faston connectors and connector receptacles for the airframe are included in the scope of delivery.

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
n.a.	MOLEX Disassembly tool 63813-1500

Procedure

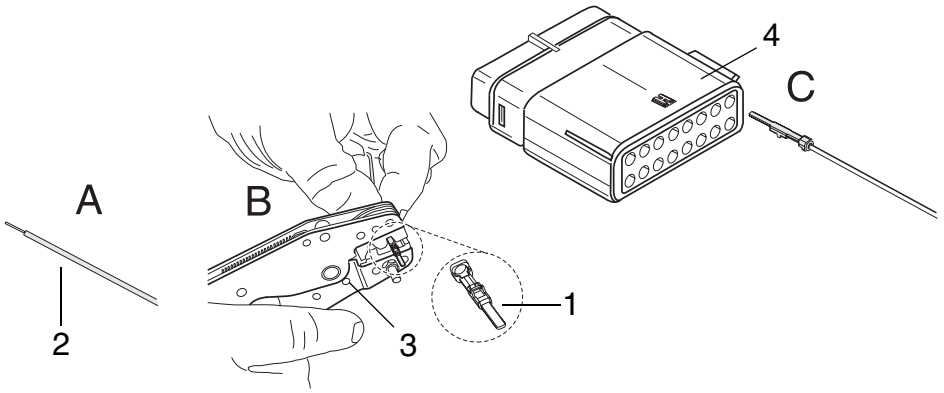
Fitting the Faston connector

Step	Procedure
1	Strip cable (2) as required (**A**).
2	Use suitable crimping pliers (3) to fit the Faston connector (**B**).
3	Push the Faston connector in the corresponding slot (4) of the Harness Interface Connector receptacle until it is locked in place (**C**).
4	Check for tight fit.
5	Press the pin holder (white) downwards using the long nose pliers.

NOTE: The pin holder must not be pressed with excessive force.

Graphic

Fitting the Faston connector



Part	Function
1	Faston connector
2	Wiring (airframe)
3	Crimping pliers
4	Harness Interface Connector

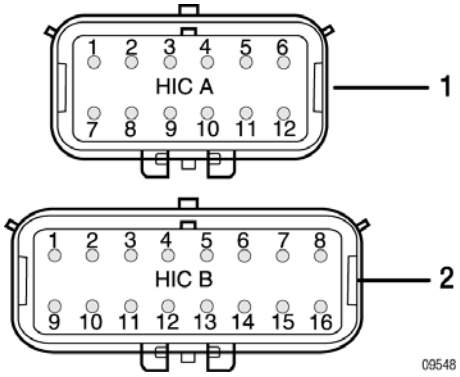
Fig. 11 *06334*

Harness Interface Connector

Pin assignment

	Pin assignment	
PIN No.	**HIC A**	**HIC B**
1	LANE_SEL_SW_A_1	LANE_SEL_SW_B_1
2	SUPP_WARN_LAMP_A	SUPP_WARN_LAMP_B
3	SIG_FUEL_PUMP_1	SIG_FUEL_PUMP_2
4	CAN_GND_1_LA	CONN_STARTER_REL_SW
5	CAN_LOW_1_LA	-
6	CAN_HIGH_1_LA	CAN_GND_1_LB
7	LANE_SEL_SW_A_2	CAN_LOW_1_LB
8	WARN_LAMP_A	CAN_HIGH_1_LB
9	GND_FUEL_PUMP_1	LANE_SEL_SW_B_2
10	CAN_GND_2_LA	WARN_LAMP_B
11	CAN_LOW_2_LA	GND_FUEL_PUMP_2
12	CAN_HIGH_2_LA	SUPP_START_SWITCH
13	-	-
14	-	CAN_GND_2_LB
15	-	CAN_LOW_2_LB
16	-	CAN_HIGH_2_LB

Graphic Harness Interface Connector (HIC)



Part	Function
1	HIC A-pin 1 to 12
2	HIC B-pin 1 to 16

Fig. 12

5.2) Switch requirements

Requirements See following table.

LANE SELECT SWITCH A	Requirement	Connector/slot
Connector type	Toggle	HIC A
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	5 A	
How many poles?	1-pole	
Designation on wiring harness	LANE_SEL_SW_A_1	1
	LANE_SEL_SW_A_2	7

LANE SELECT SWITCH B	Requirement	Connector/slot
Connector type	Toggle	HIC B
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	5 A	
How many poles?	1-pole	
Designation on wiring harness	LANE_SEL_SW_B_1	1
	LANE_SEL_SW_B_2	9

Backup Battery SWITCH A	Requirement	Connector/slot
Connector type	Toggle (but with mechanical interlock to prevent switch on during standard operation).	FUSE BOX Battery (+)
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	20 A	
How many poles?	2-pole	
Designation on wiring harness	Not connected to the wiring harness.	
FUSE BOX	Must be installed by the aircraft manufacturer.	

FUEL PUMP SWITCH 1	Requirement	Connector/slot
Connector type	Toggle	HIC A
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	10 A	
How many poles?	1-pole	
Designation on wiring harness	SIG_FUEL_PUMP_1	3
	GND_FUEL_PUMP_1	9
Main Switch	**Tbd**	

FUEL PUMP SWITCH 2	Requirement	Connector/slot
Connector type	Toggle	HIC B
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	10 A	
How many poles?	1-pole	
Designation on wiring harness	-SIG_FUEL_PUMP_2	3
	+SUB_FUEL_PUMP_2	11

START POWER SWITCH	Requirement	Connector/slot
Connector type	Toggle (momentary)	
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	20 A	
How many poles?	2-pole	
Designation on wiring harness	Not connected to the wiring harness.	
FUSE BOX	Must be installed by the aircraft manufacturer.	

WARN/ALARM LAMP A	Requirement	Connector/slot
Lamp colour	Red	HIC A
Output voltage	12 V	
Output current	Maximum 120 mA	
Designation on wiring harness	SUPP_WARN_LAMP_A	2
	WARN_LAMP_A	8

WARN/ALARM LAMP B	Requirement	Connector/slot
Lamp colour	Red	HIC B
Output voltage	12 V	
Output current	Maximum 120 mA	
Designation on wiring harness	SUPP_WARN_LAMP_B	2
	WARN_LAMP_B	10

NOTICE

If using LED they will always glow, even no alarm or warning is shown!
Remedy: The use of 2 resistances as in Fig. 15 shown.

START SWITCH	Requirement	Connector/slot
Connector type	Push button	HIC B
Min. switching voltage	250 VAC/30 VDC	
Min. switching current	5 A	
How many poles?	1-pole	

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START SWITCH	Requirement	Connector/slot
Designation on wiring harness	CONN_STARTER_REL_SW	4
	SUPP_START_SWITCH	12

5.3) Wiring diagram

General note

See Fig. 13, Fig. 14 and Fig. 15

EMS diagram see 24-00-00 page 24.
Wiring power side see 24-00-00 page 25.
Wiring HIC connector and warning lamps see 24-00-00 page 26.

Scope of delivery

NOTICE

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 regulations, such as FAR or EASA.

Graphic

EMS diagram

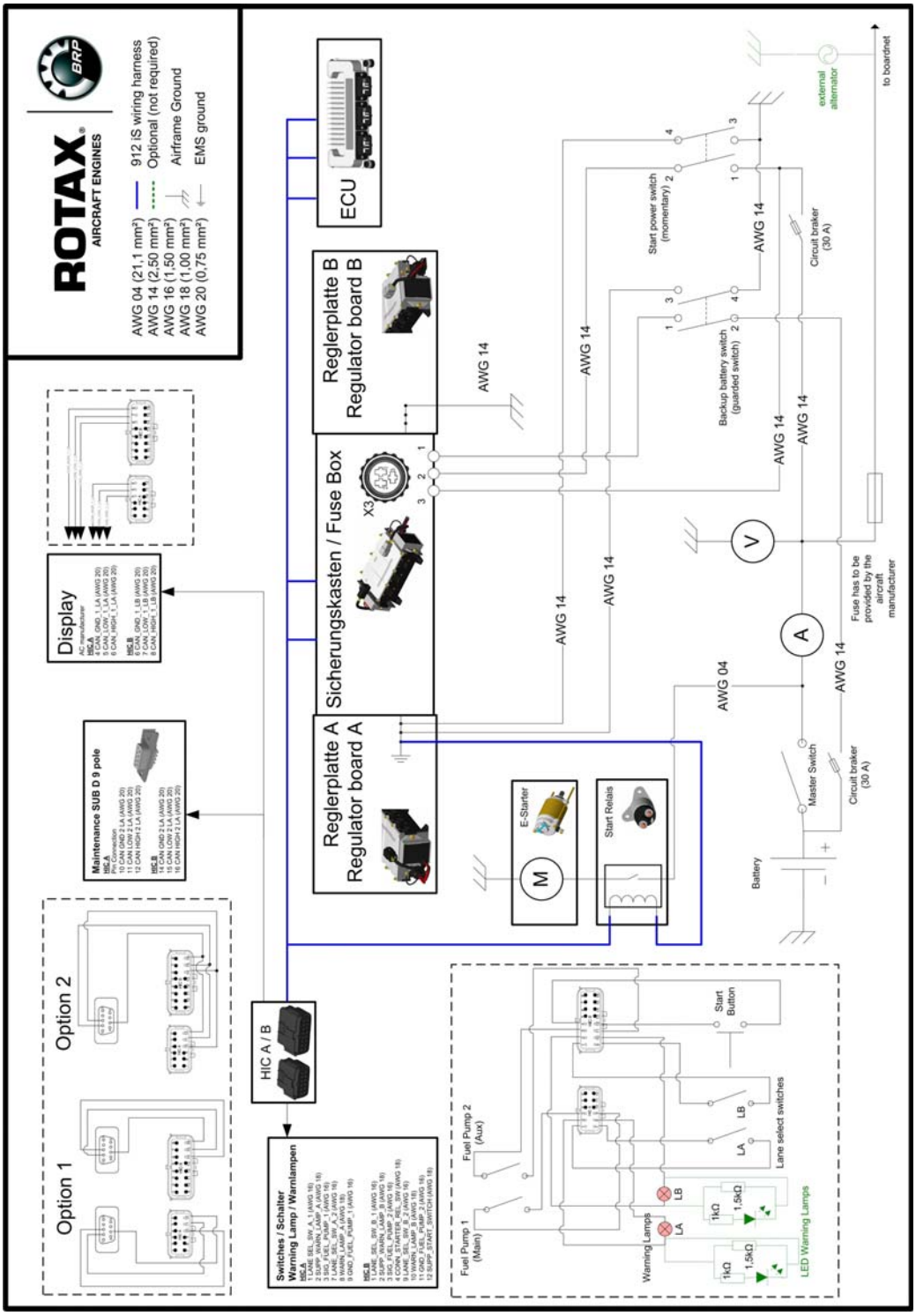

Fig. 13

08587

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Graphic Wiring powerside

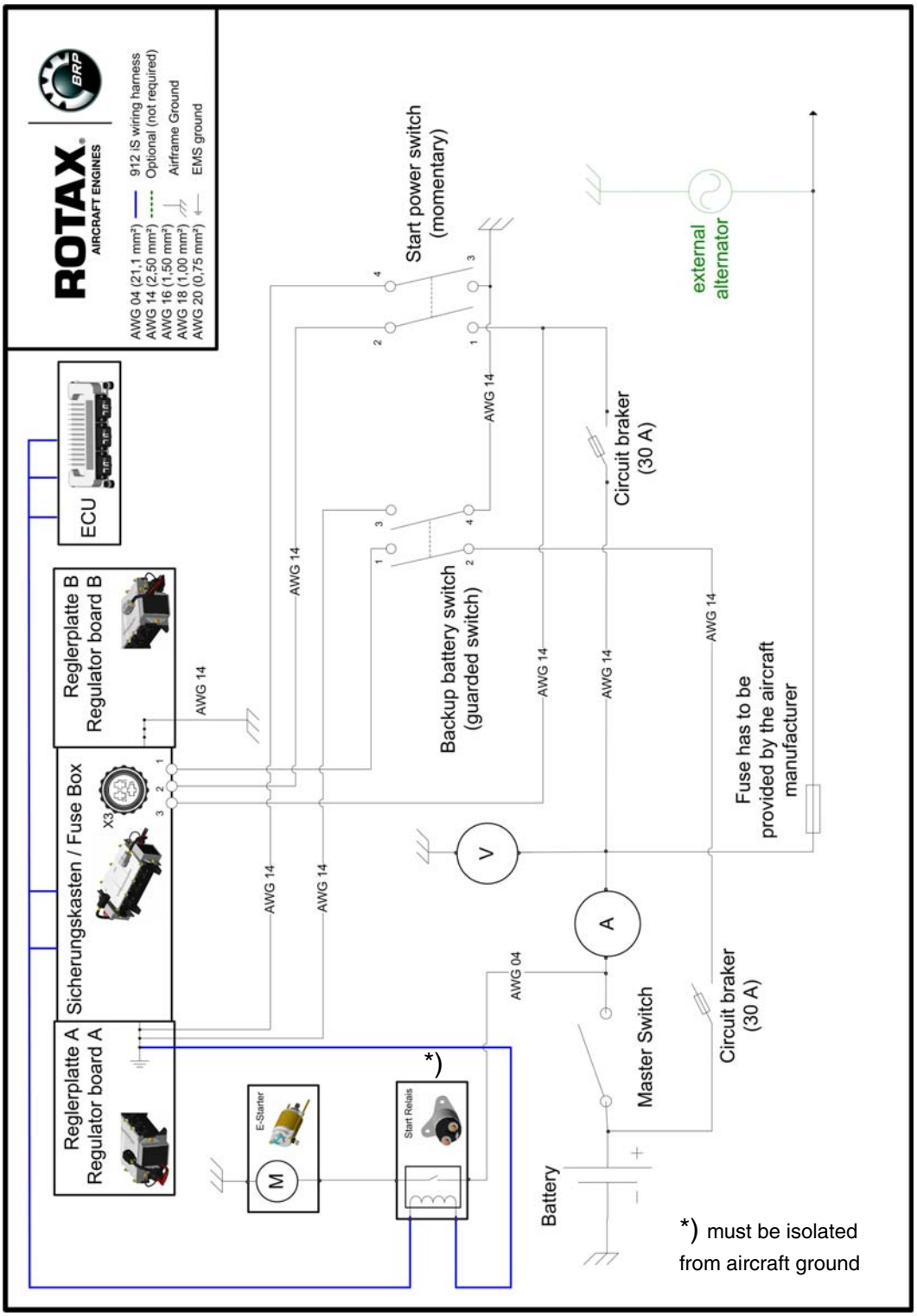

Fig. 14 08588

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Graphic Wiring HIC connector and warning lamps

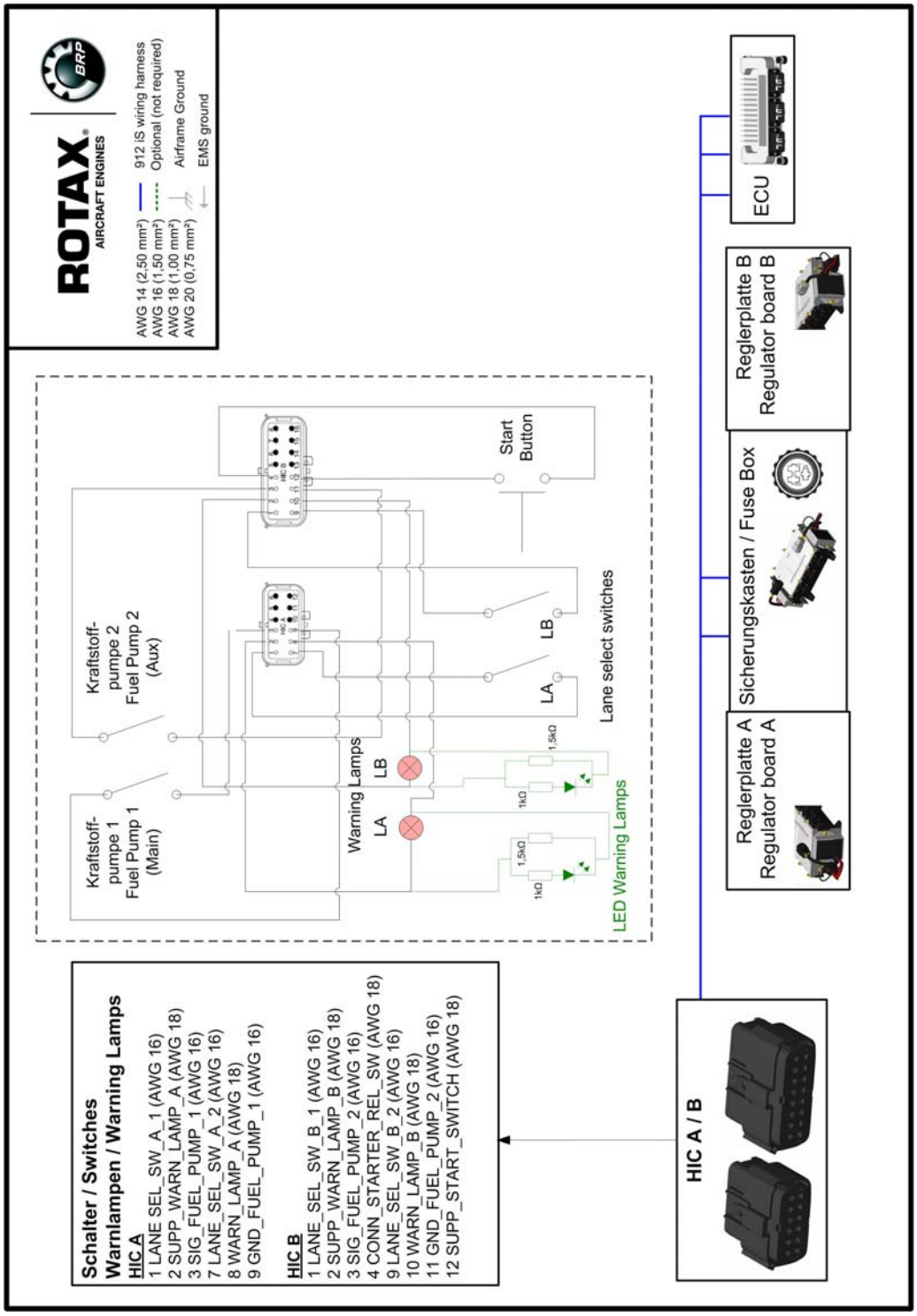

Fig. 15 08589

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6) Internal power consumers

General note

⚠WARNING Non-compliance can result in serious injuries or death!
The current consumption of the remaining consumers is to be limited so as to ensure that power is supplied to the internal consumers (e.g. fuel pumps, ECU, servomotors, etc.) at all times.
See the performance diagrams of the internal and external alternators as a function of engine speed.

Components

Current consumption

Components	Current consumption
Fuel pump (main pump)	min. 10 A
Fuel pump (additional pump)	min. 10 A
ECU	~ 1.2 A
Warning lamp A	max. 200 mA
Warning lamp B	max. 200 mA
FUSE BOX	**tbd**
Total	

NOTE: A complete analysis of the current consumption of all the fitted consumers is to be carried out by the aircraft or airframe manufacturer.

NOTES

Chapter: 61-00-00

PROPELLER DRIVE

Introduction

⚠WARNING

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 Technical data Operating limits	Page 3 Page 3 Page 4
Hydraulic governor for constant speed propeller Technical data for connections	Page 5 Page 5

NOTES

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 rotation

See Fig. 1

Direction of rotation of the propeller flange:

- left, counter clockwise, looking towards face of flange

Graphic

Direction of rotation

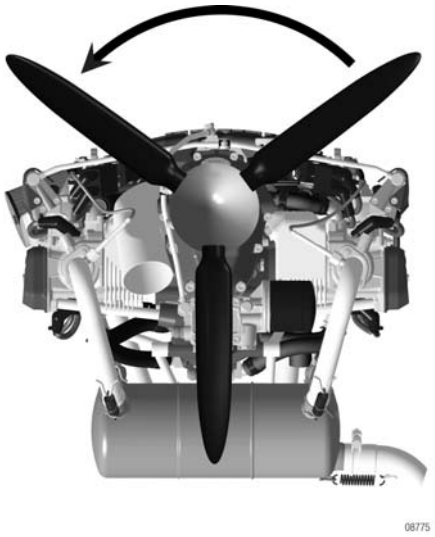

Fig. 1

Transmission

Gear transmission:

- i= 2.4286 (51 Teeth/21 T)

Vibration analysis

NOTE: Vibration analysis of the whole system (engine, suspension, 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 r.p.m. can be assumed.

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

Propeller shaft flange

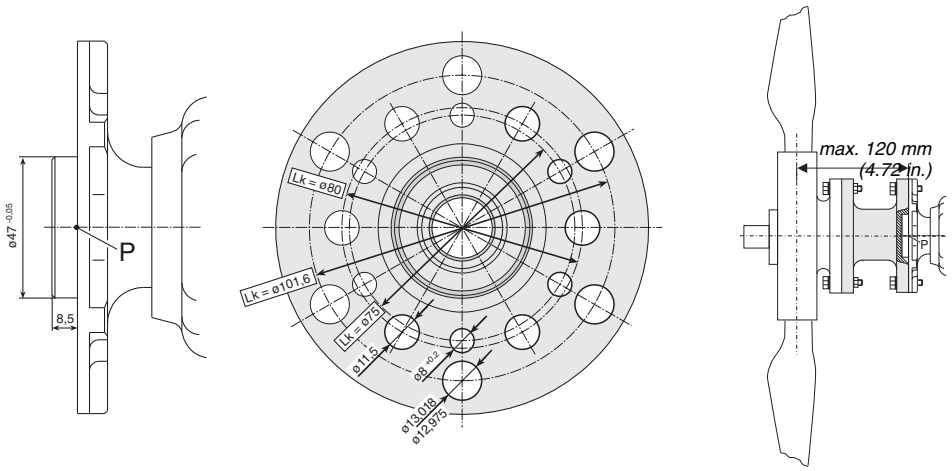

Fig. 2 *02581, 09193*

1.2) Operating limits

Torque

NOTICE Modification of the propeller shaft is not permitted.

Max. torque:

- 340 Nm (250.77 ft.lb.) (on propeller)

Max. moment of inertia

Max. permissible moment of inertia on propeller:

- 6000 kgcm^2 (14.238 lb ft^2)
- Normal between 1500 kg cm^2 and 6000 kg cm^2 (3.559 lb ft^2 and 14.238 lb/ft^2)

Extension of propeller shaft

- Max. extension of the propeller shaft: 120 mm (4.72 in.)

Out of balance

Dynamic balancing of the propeller as specified by the propeller manufacturer must be carried out.

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2) Hydraulic governor for constant speed propeller

2.1) Technical data for connections

General note

See Fig. 3

NOTE: See also SB-912-052 “Installation/use of governors for ROTAX engine type 912 Series“, latest issue.

Drive

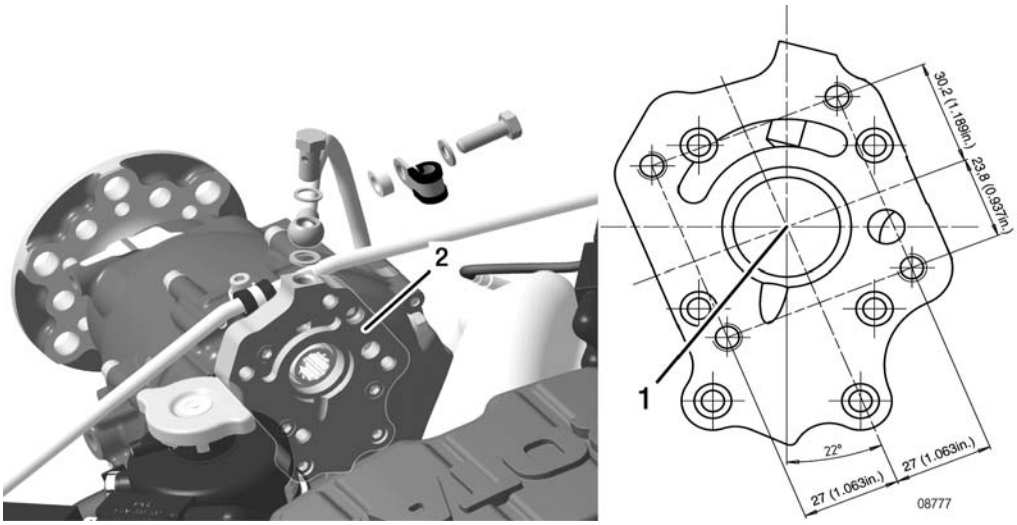
Drive via propeller gearbox.

- 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 propeller governor
2	Governor flange

Fig. 3

Connection

NOTICE Pay attention to manufacturers specifications!

Gear ratio

NOTE: Gear ratio from crankshaft to hydraulic governor is 1.842, i.e. the propeller governor runs at 0.54 times engine speed.

Mounting pad	AND20010
Thread	M8
Thread length	Max. 14 mm (0.55 in.)
Governor drive	Internal spline 20/40 SMS 1834 NA 14x1.27x30x12
Power consumption	Max. 600 W
Operating pressure	Max. 30 bar (435 psi)

Chapter: 72-00-00

ENGINE

Introduction

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

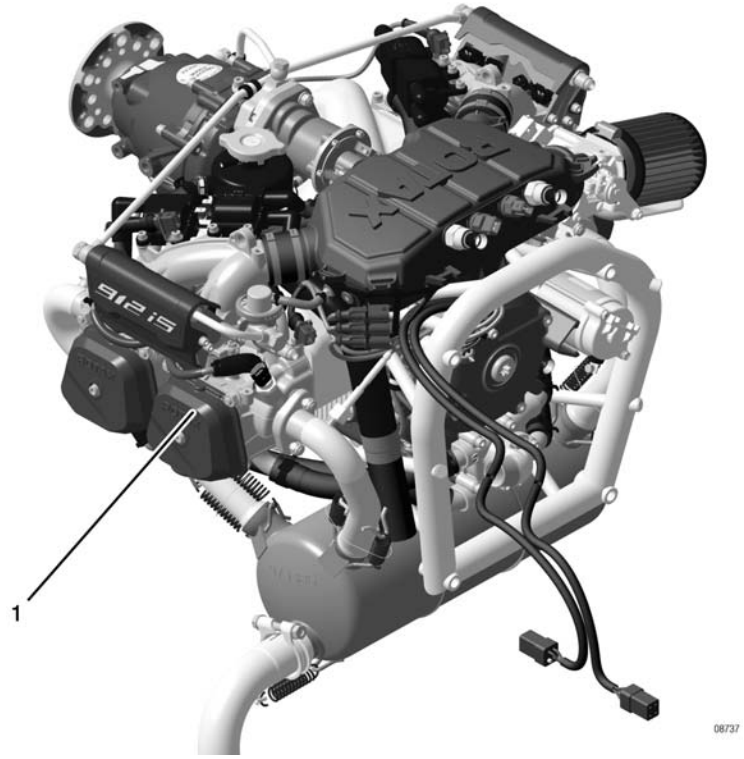
Table of contents

This section of the Installation Manual contains views of the aircraft engine, technical data and installation dimensions of the engine.

Subject	Page
Engine components, engine views, cylinder designation	Page 3
Side view	Page 3
Front view	Page 4
Top view, rear view	Page 5
Technical data	Page 7
Weight	Page 7
Installation dimensions	Page 8
Centre of gravity of engine and standard accessories	Page 8
Moments of inertia	Page 8
Operating limits	Page 9
Deviation from the apparent perpendicular	Page 9
Crankshaft drive	Page 11

I

Overview Engine



Part	Function
1	Engine Type 912 i Series

Fig. 1

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1) Engine components, engine views, cylinder designation

General note

See Fig. 2 to Fig. 4

PTO power take off side

MS magneto side

A points of attachment (for engine transport) - centre of gravity

P zero reference point for all dimensions

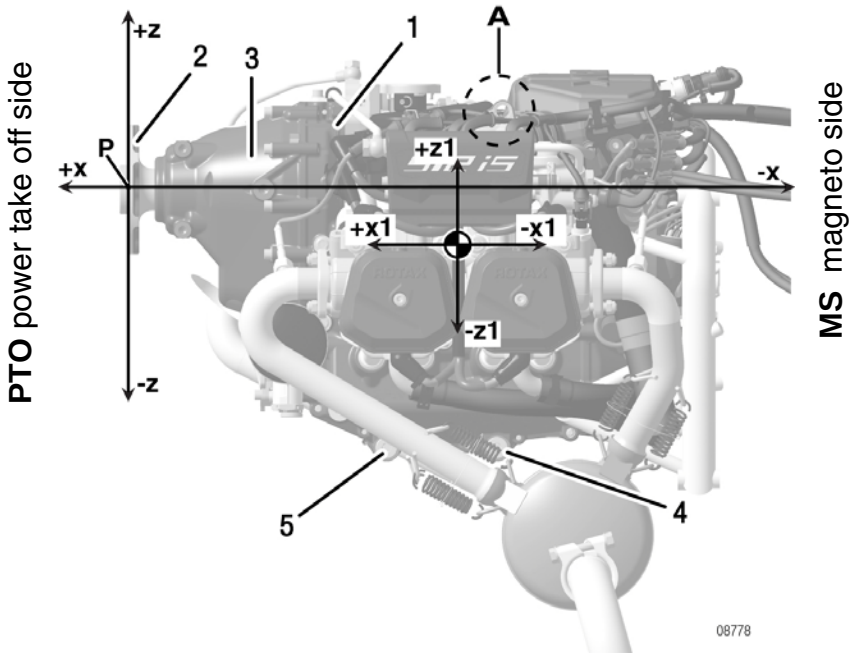
NOTE: Allow ± 1 mm on all stated dimensions as manufacturing tolerance.

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



Part	Function
1	Engine number
2	Propeller flange
3	Propeller gearbox
4	Connection for return line (tractor)
5	Connection for return line (pusher)

Fig. 2

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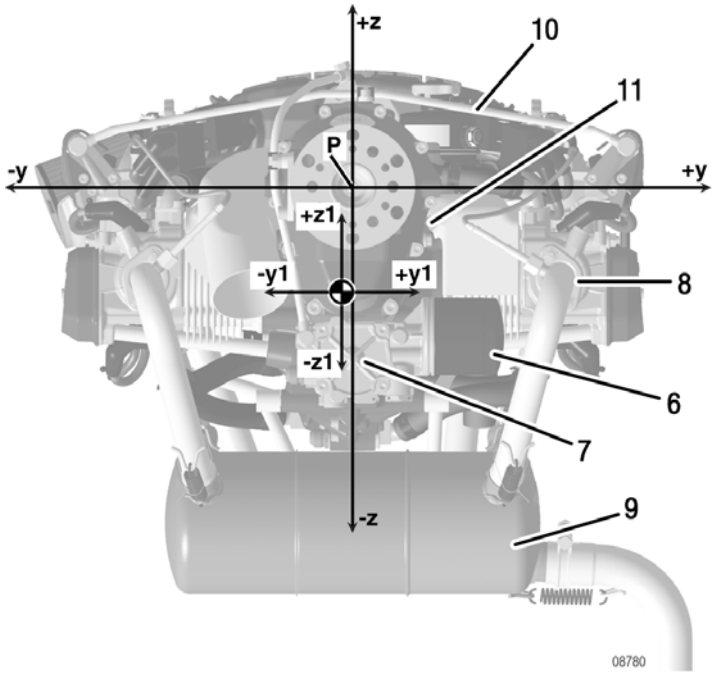
Front view



Part	Function
6	Oil filter
7	Oil pump
8	Exhaust flange
9	Muffler assy.
10	Fuel hose assy.
11	Crankshaft locking screw position

Fig. 3 *08780*

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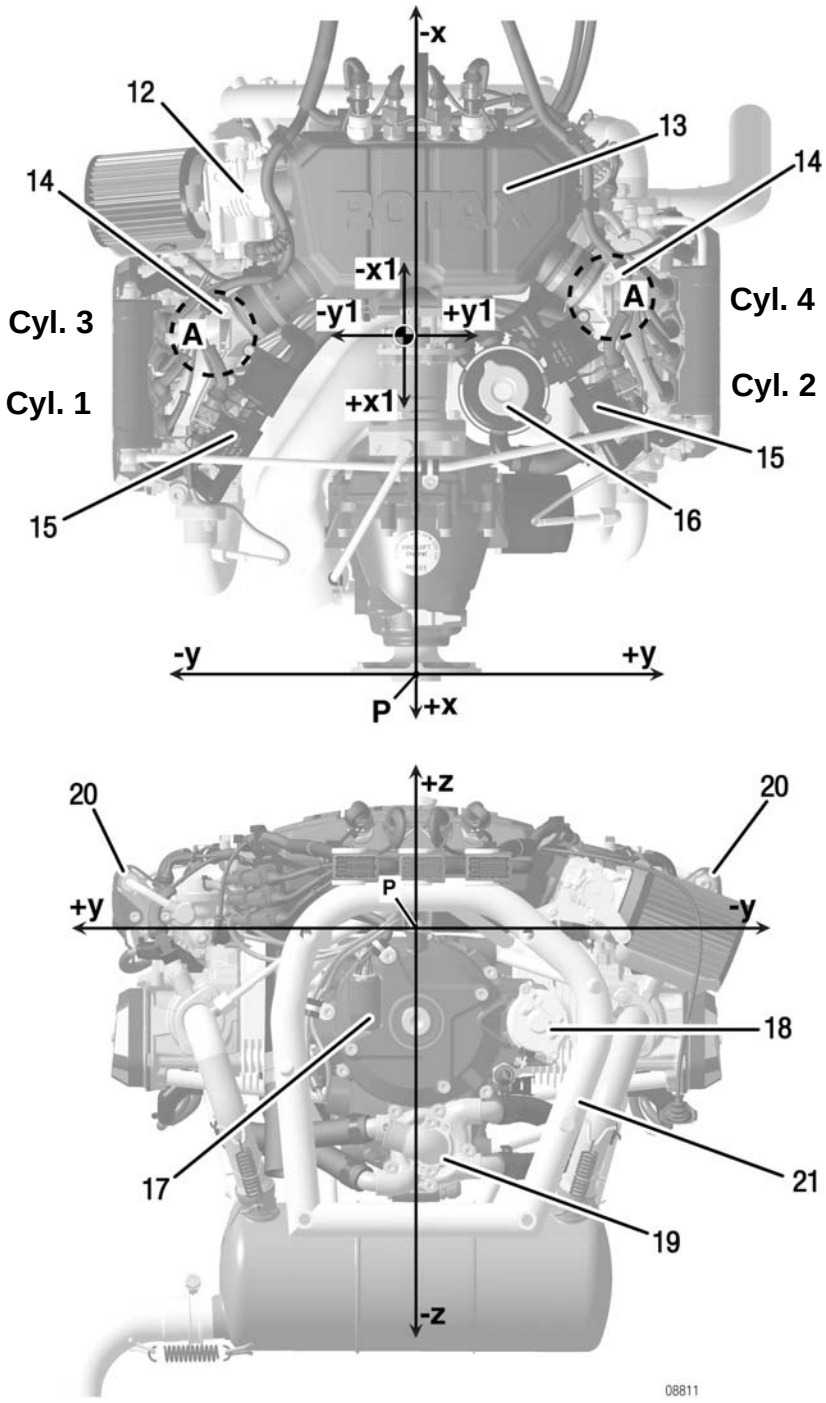
Top view, rear view



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Part	Function
12	Throttle valve support assy.
13	Airbox
14	Suspension points
15	Dual ignition coils
16	Expansion tank assy.
17	Ignition housing
18	Electric starter
19	Water pump housing
20	Fuel rail (right, left)
21	Engine suspension frame (ring mount)

Fig. 4

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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:

- incl. oil tank
- incl. electrical system: wiring harness, ECU, FUSE BOX, starter relay

Version

Overview

Version	Weight
912 iSc/iS	63,6 kg (139.33 lb)

Accessories

Overview

Accessories	Weight	spare part	optional*
Engine suspension frame	2.0 kg (4.41 lb)	X	X
Exhaust system	4.3 kg (9.48 lb)	X	X
Fuel pumps assy.	1.6 kg (3.53 lb)	X	X
Cooling air baffle	0.36 kg (0.79 lb)	X	X
External alternator	3.0 kg (6.61 lb)	X	
Radiator	1.0 kg (2.2 lb)	X	
Air filter	0.15 kg (0.33 lb)	X	
Oil cooler	0.6 kg (1.32 lb)	X	

* Can be installed original to the engine at the factory (also available as a spare part).

2.2) Installation dimensions

Standard engine version

See Fig. 2 to Fig. 4.

NOTE: All dimensions from zero reference point (P).

	Standard engine version		
	Pos. (+)	**Neg. (-)**	**Total**
Max. dimension along x-axis (mm)	8.5 (0.33 in.)	-656.6 (-25.85 in.)	665.1 (26.19 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)	220 (8.66 in.)	-311 (-12.24 in.)	531 (20.91 in.)

2.3) Centre of gravity of engine and standard accessories

See Fig. 2 to Fig. 4.

NOTE: All dimensions from zero reference point (P).

	Standard engine version 3	**External alternator**	**Hydraulic governor**
Centre of gravity on x-axis (mm)	-327 (-12.87 in.)	-100 (-3.94 in.)	-276 (-10.87 in.)
Centre of gravity on y-axis (mm)	-9 (-0.35 in.)	139 (5.47 in.)	0
Centre of gravity on z-axis (mm)	-102 (-4.02 in.)	6 (0.24 in.)	56 (2.20 in.)

2.4) Moments of inertia

See Fig. 2 to Fig. 4.

	Engine version 2/4	**Engine version 3**
Moment of inertia around axis x1-x1 (kg cm^2)	20470 (48.576 lb ft^2)	21210 (50.332 lb ft^2)
Moment of inertia around axis y1-y1 (kg cm^2)	24560 (58.282 lb ft^2)	25450 (60.394 lb ft^2)
Moment of inertia around axis z1-z1 (kg cm^2)	26520 (62.933 lb ft^2	27480 (65.211 lb ft^2)

3) Operating limits

Manual Documentation overview

Operating limits	Manual
Engine speed	See OM 912 iSc/iS section 2.1
Acceleration	See OM 912 iSc/iS section 2.1
Oil pressure	See OM 912 iSc/iS section 2.1
Oil temperature	See OM 912 iSc/iS section 2.1
Coolant temperature	See OM 912 iSc/iS section 2.1
Ambient temperature for start up	See OM 912 iSc/iS section 2.1
Fuel pressure	See OM 912 iSc/iS section 2.1
Governor	See OM 912 iSc/iS section 2.1
External alternator	See OM 912 iSc/iS section 2.1
Deviation from the apparent perpendicular	See OM 912 iSc/iS section 2.1

3.1) Deviation from the apparent perpendicular

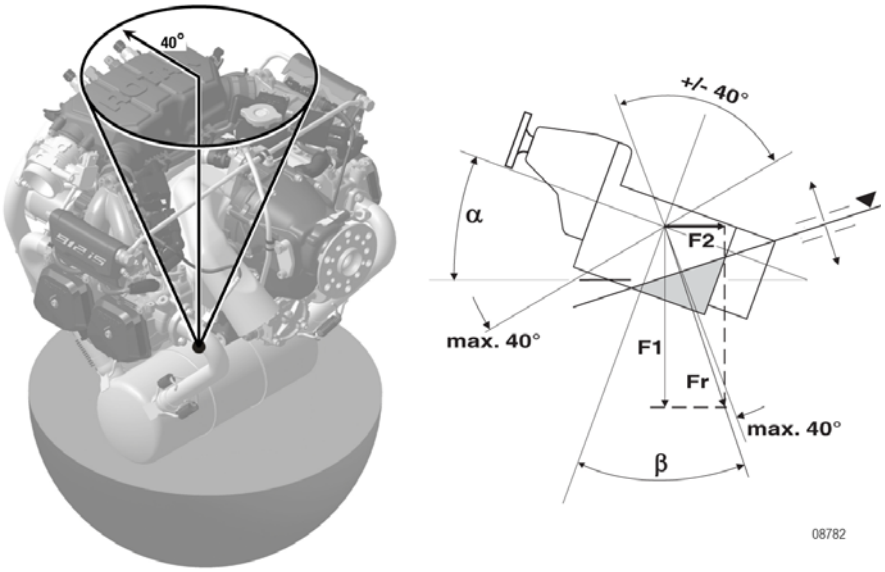
General note See Fig. 5.

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 The resulting bank angle β (depending on acceleration/deceleration) may never exceed the max. bank angle.

NOTE: Pitch or role angle α is not equal with β, except stabilized condition (without acceleration).

Graphic Bank angle



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

Fig. 5

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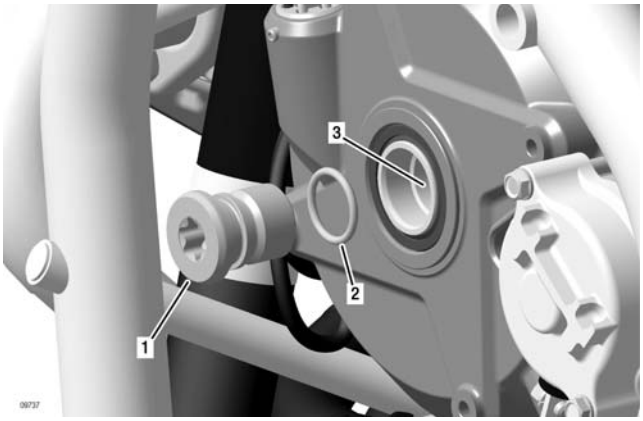
3.2) Crankshaft drive

See Fig. 6 to Fig. 7.

Max. moment of inertia 15 kg cm^2 (0.036 lb ft^2).



Part	Function
1	Plug screw M22x1,5
2	O-Ring 18x2.5
3	Support bearing

Crankshaft

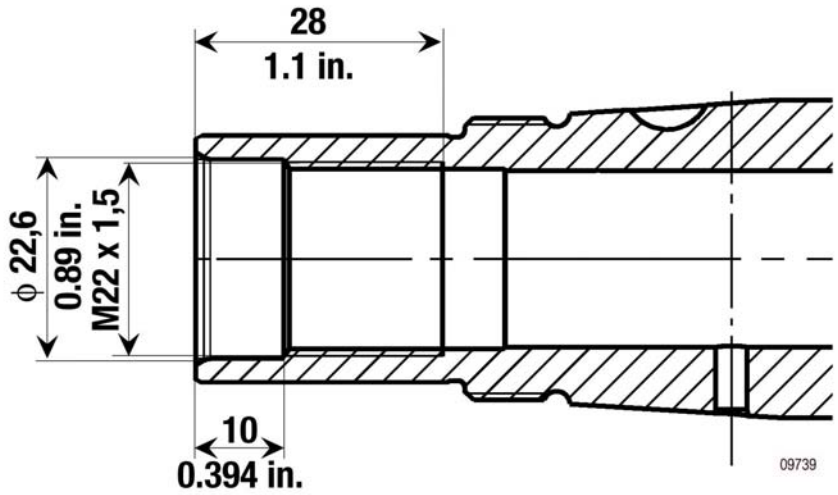


Fig. 6

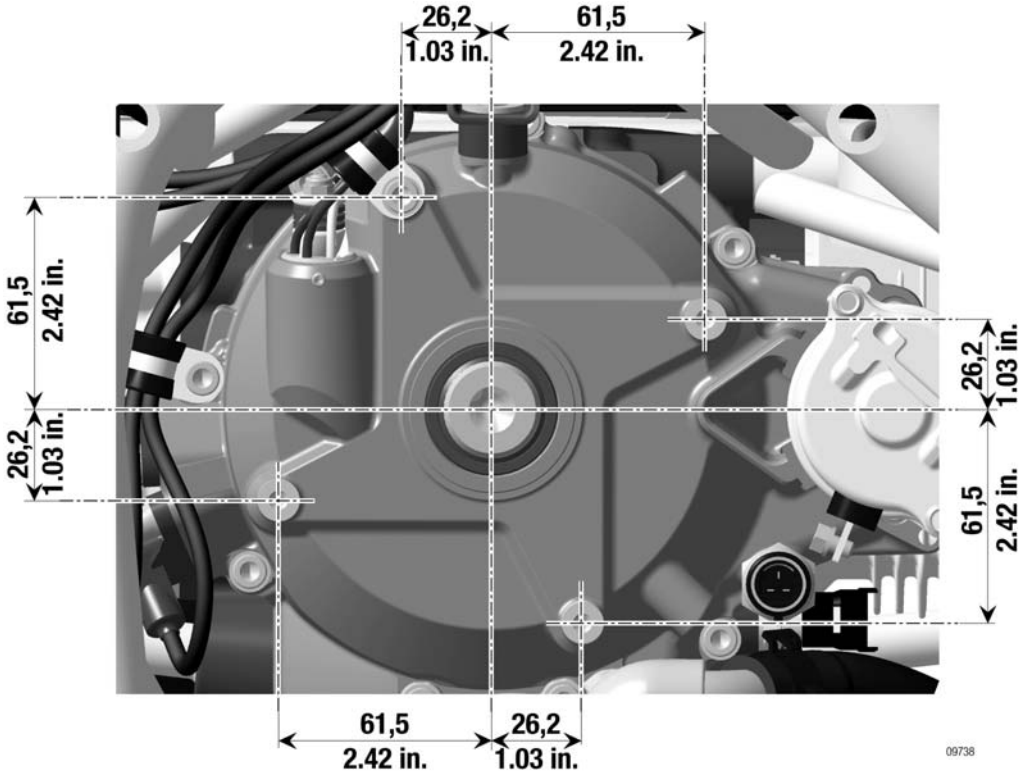


Fig. 7

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Chapter: 73-00-00

FUEL SYSTEM

Introduction

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!

The fuel delivery is provided by two electric pumps connected in series with bypass valves and engine will operate with either or both pumps running. The pumps are manually selected. There are 2 injectors per cylinder (8 in. total). Both injectors on each cylinder are running all the time. If a fault is detected in any one injector the injection period of the other one on that cylinder is adjusted to compensate.

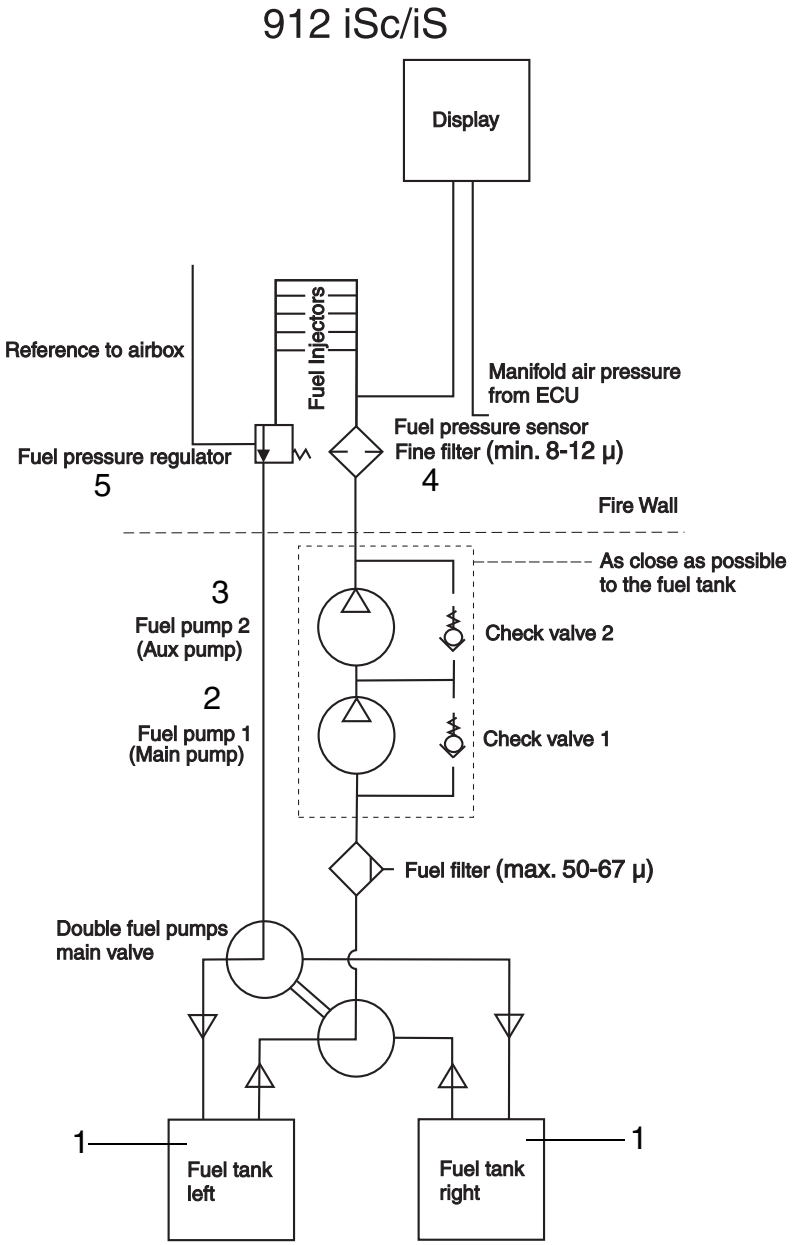
Either of the ECU‘s can operate any or all the injectors. A single blocked injector would be compensated for automatically. If a problem is detected with a fuel injector the fault is reported to the ECU and the operator will be informed of a fault through the pilot display.

Table of contents

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

Subject	Page
Requirements of the fuel system	Page 3
Operating limits	Page 3
Fuel temperature	Page 3
Fuel pressure indicator	Page 3
Technical data	Page 3
Fuel lines	Page 5
Coarse filter	Page 5
Water trap	Page 5
GENUINE- ROTAX fuel pump assy.	Page 5
General requirements placed on the fuel pump	Page 6
Connections for Bowden cable actuation and permissible load	Page 7
Technical data	Page 7
Requirements on cable actuation	Page 7

Overview Fuel system



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

Fig. 1 06293

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1) Requirements of the fuel system

1.1) 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 i series Operators Manual, section 2.1) Operating Limits.

1.2) Fuel temperature

To avoid vapour locks, the temperature of the fuel lines must not exceed 45 °C (113 °F).

Vapour locks may form at fuel temperatures above 45 °C (113 °F). The fuel system must be installed in such a way to avoid vapour lock. Vapour lock may result in engine stoppage.

Should such problems occur during the test period, than the affected components, such as the supply line to the fuel pumps, must be cooled.

1.3) Fuel pressure indicator

NOTICE

A fuel pressure indicator must be installed in the aircraft in such a way that it is clearly visible to the pilot. Pressure range: 3 bar ±0.1 bar (43.51 ±1.45 psi)

1.3.1) The following limits apply to instruments

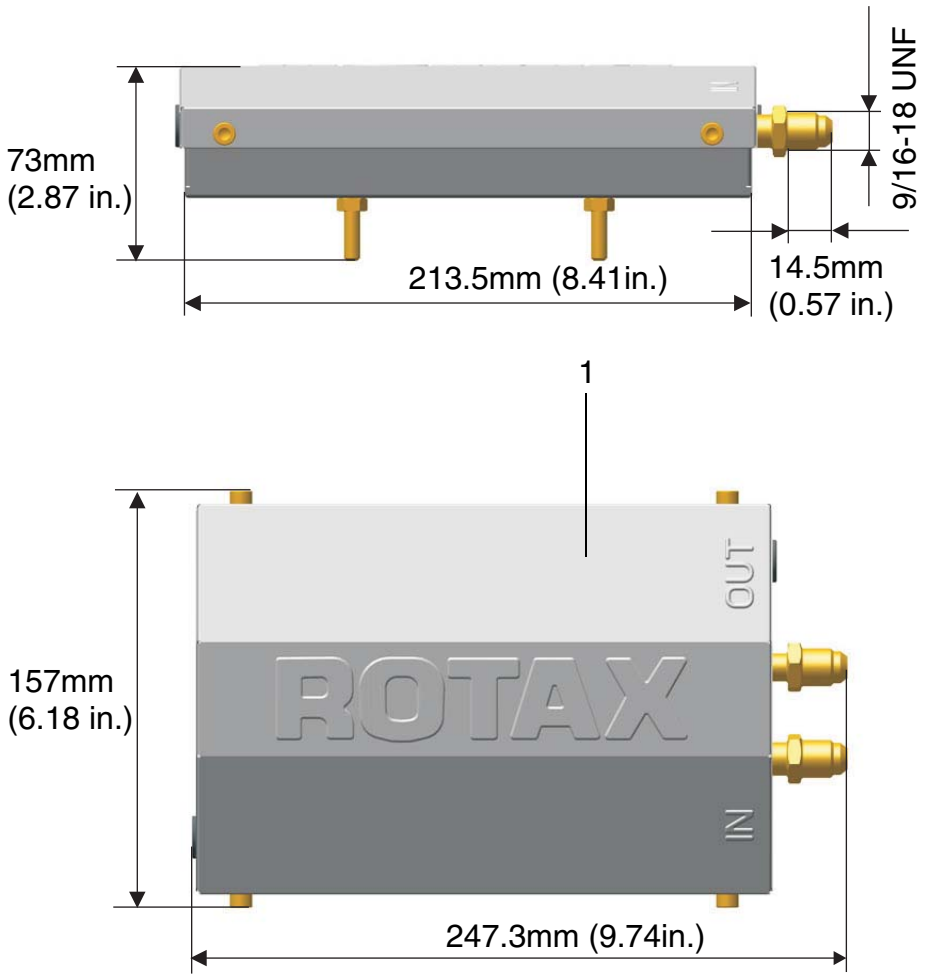
Colour	Pressure
RED	< 2.8 bar (40.61 psi)
YELLOW	2.8 - 2.9 bar (40.61 - 42.06 psi)
GREEN	2.9 - 3.1 bar (42.06 - 44.96 psi)
YELLOW	3.1 - 3.2 bar (44.96 - 46.41 psi)
RED	> 3.2 bar (46.41 psi)

1.3.2) Technical data

Graphic

The technical data of the fuel pumps provided by ROTAX is shown below. See Fig. 2.

a) Dimensions:



Part	Function
1	Fuel pump assy.

Fig. 2 06333

Housing:	stainless steel
Nominal voltage:	12 V
Capacity:	approx. 120 l/h (31.7 gal/h)
Pressure:	min. 4.5 bar (65.3 psi) (absolute pressure)
Absorption capacity:	up to -400 mbar (-5.8 psi) compared to ambient (depending on the vapor pressure of the fuel used)
Check valves:	a) opening pressure max. 70 mbar (1.02 psi) b) resistance max. 70 mbar at 75 l/h (19.8 gal/h) c) pressure safe up to 20 bar (290 psi)

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1.4) Fuel lines

Safety

⚠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.

NOTICE To prevent problems with vapour locks, all the fuel lines must be insulated against heat in the engine compartment, routed at distance from hot engine components, without kinks and protected appropriately.

Inlet line

Connection thread on the right-hand injection line (Cyl. 1/3):
M14x1.5 or 9/16-18 UNF

Return line

NOTICE With the engine switched off (idle and with both fuel pumps switched on), the pressure on the output of the fuel pressure regulator must not exceed 0.7 bar (10.15 psi) (relative to ambient pressure).

Connection thread on fuel pressure regulator: 9/16-18 UNF.

Screw clamp

Secure fuel lines with suitable screw clamps or by crimp connection.

1.5) Coarse filter

The coarse filter must be installed such that it is easily accessible for maintenance work and can be inspected as per the maintenance overview.

A coarse filter with mesh size from 0.050 mm-0.067 mm (0.0019 in.-0.0026 in.) must be provided in the supply line between the tank and the fuel pumps.

1.6) Water trap

A suitable water trap must be installed at the lowest point in the fuel supply system between the tank and the pumps.

1.7) GENUINE-ROTAX fuel pump assy.

The electrical fuel pump must be attached near the tank, taking advantage of a "cool" installation position in order to ensure a safe fuel supply, especially with regard to the risk of vapour locks. The pump must be free of vibrations and installed low, if possible below the level of the fuel tank outlet.

1.7.1) Current input (measured with both fuel pumps ON)

Voltage	Amperage
12 V	9.1 A
14 V	10.1 A
16 V	11.2 A

1.7.2) Fine filter

The fine filter must be installed such that it is easily accessible for maintenance work and can be inspected as per the maintenance overview.

The fine filter must be installed between the pumps and the injection valves.

An additional filter with mesh size 0.008-0.012 mm (0.0003-0.0005 in.) must be installed in the supply line between the tank and the fuel pumps.

A combination of filter/water trap is recommended.

1.8) General requirements placed on the fuel pumps

⚠WARNING Non-compliance can result in serious injuries or death!
The pressure in the return line must not exceed the value stipulated in section 1.4.

Requirement	regarding delivery
Min. delivery rate	56 l/h (14.79 USgal)
Min. fuel pump pressure	4.5 bar (65.26 psi) (at sea level)

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2) Connections for Bowden cable actuation and permissible load

General note

NOTICE The specified permissible loads must never be exceeded!

2.1) Technical data

Connections

Connection for throttle valve:

Connection on throttle lever:	Set screw M6x12
Tightening torque:	4 Nm (3.32 lbft) (suitable for flexible cable, 1.5 mm (0.06 in.) steel rope or single-strand wire)
Cable travel:	65 mm (2.56 in.)
Actuating force:	Min. 7.5 N (1.69 lb-force) Max. 20 N (4.5 lb-force)
Max. permissible actuating force:	20 N (4.5 lb-force)

2.2) Requirements on cable actuation

Throttle lever not connected

⚠WARNING Non-compliance can result in serious injuries or death! With throttle lever not connected the throttle valve will remain fully open. **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.

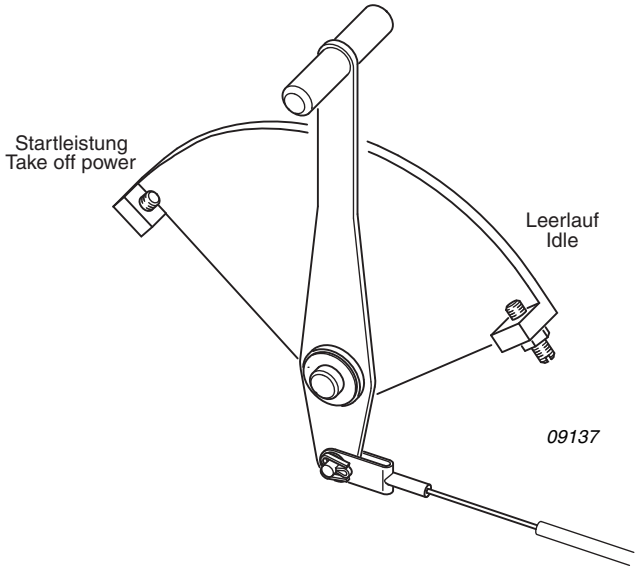
Bowden cable

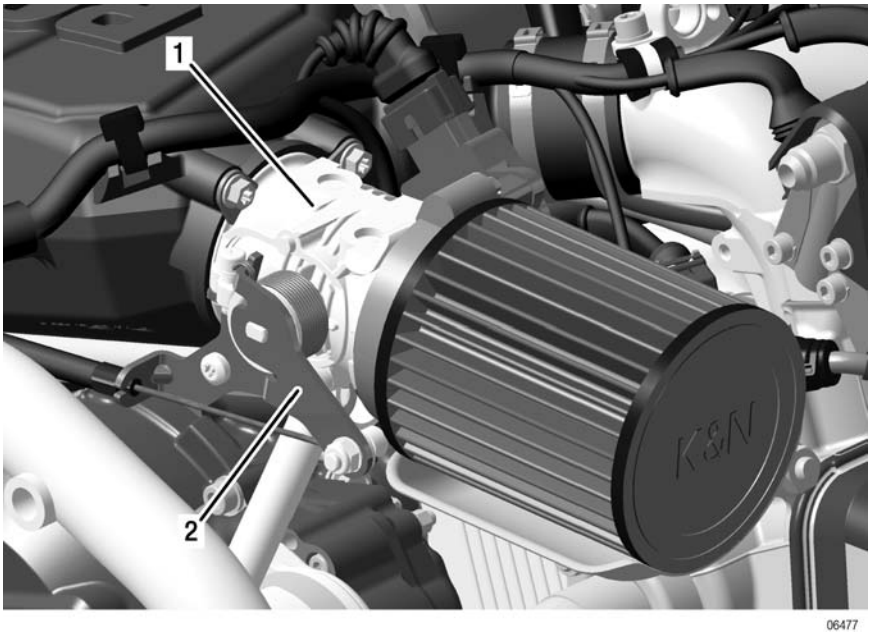
The Bowden cable must be adjusted so there is free travel of 1 mm (0.039 in).

Throttle lever stop

A throttle lever stop is to be provided in the cockpit to prevent the throttle valve from closing.

Graphic Cable actuation





Part	Function
1	Throttle valve
2	Throttle lever

Fig. 3

⚠WARNING Non-compliance can result in serious injuries or death! Adjust Bowden cable such that throttle valve can be fully opened and closed. Use Bowden cable with minimized friction so that the return spring on the throttle valve can open the throttle valve completely.

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Chapter: 74-00-00

IGNITION SYSTEM

Introduction

The ignition system is powered by the ECU and has fully mapped variable timing. It is completely doubled up. Either of the ECU's can operate the double ignition coils. If a fault occurs with the ignition system the ECU informs the pilot by warning lamps through the display in the instrument panel.

NOTE: All components are installed on the aircraft engine as standard.

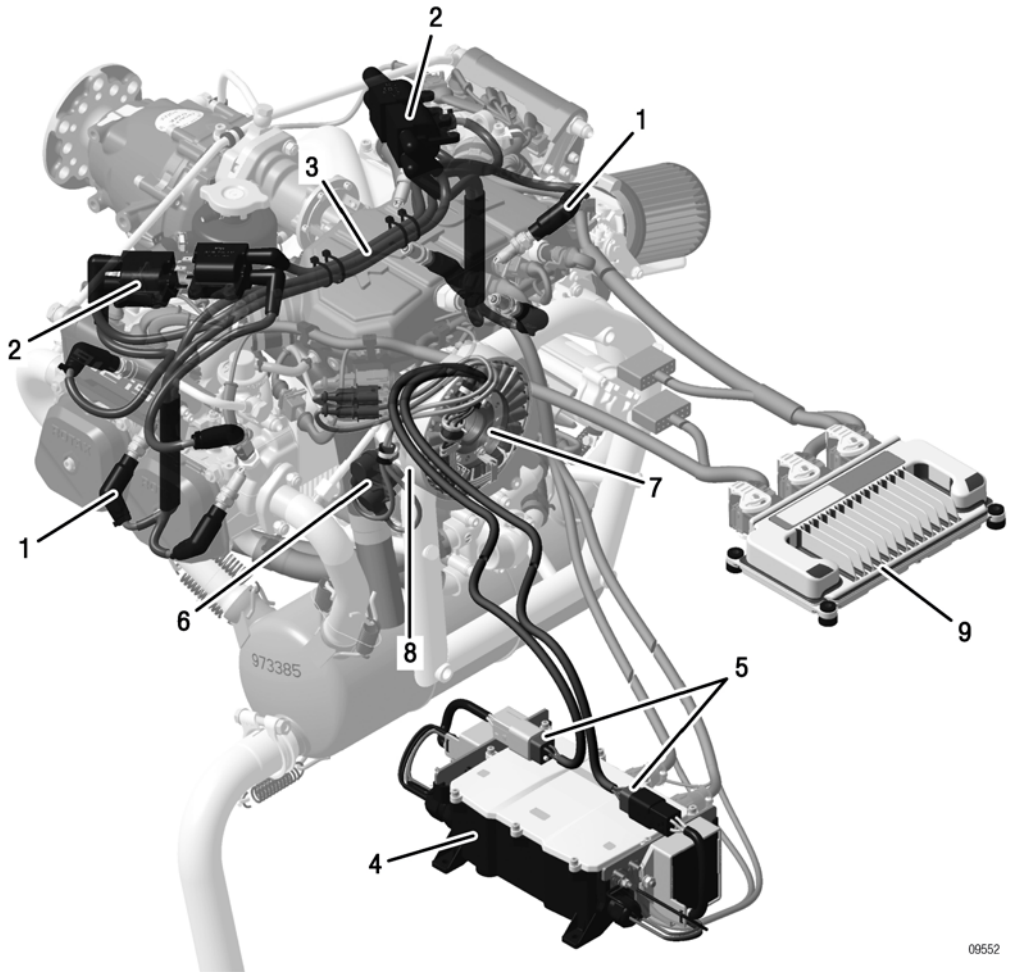
Table of contents

This section of the Installation Manual contains information on the aircraft engine ignition system.

Subject	Page
Connection to rectifier regulator	Page 3

Overview

Ignition system



Part	Function
1	Resistance spark plug connector
2	Dual ignition coil
3	Ignition cable
4	FUSE BOX assy.
5	Electrical LINE A+B with connectors
6	Crankshaft position sensors
7	Stator assy.
8	Fly wheel
9	ECU

Fig. 1

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1) Connection to rectifier regulator

General note

⚠WARNING Non-compliance can result in serious injuries or death!
The general safety information must be observed for all work on the aircraft engine and its surrounding components.

The following components must be connected for proper operation of the ignition system.

NOTICE Connecting the components incorrectly will mean that there will not be enough energy for the on-board power supply or to charge the battery!

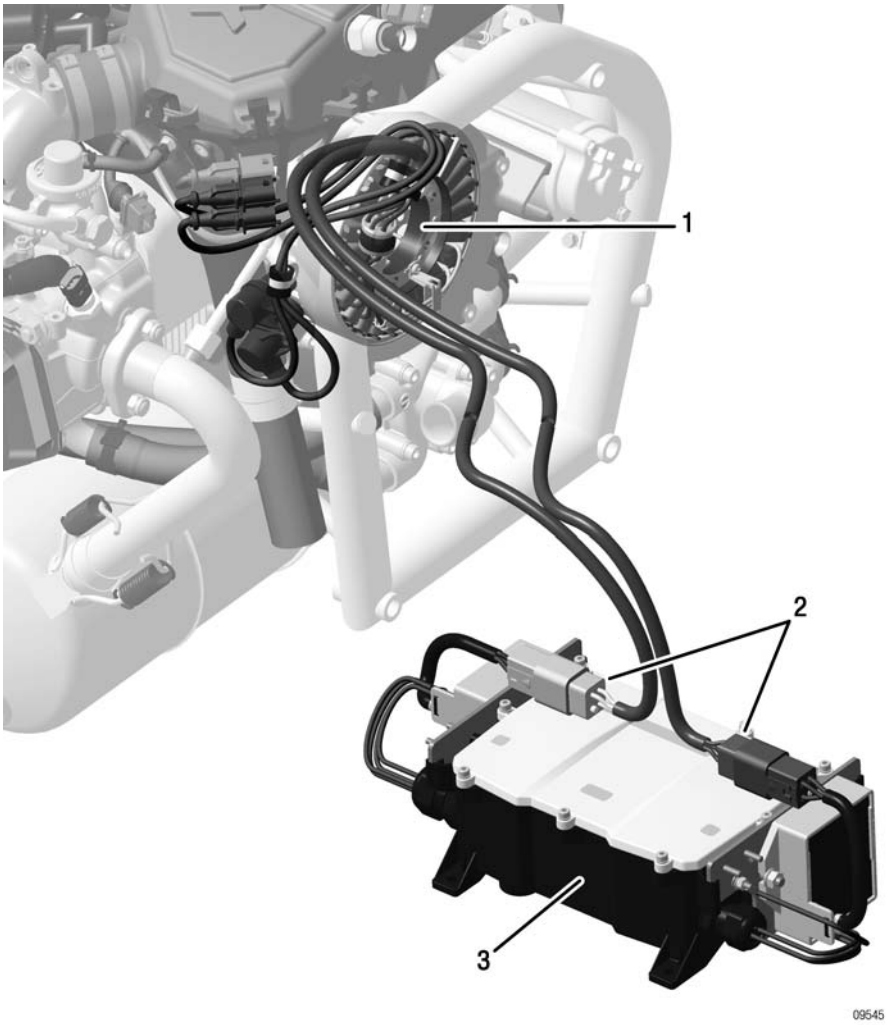
NOTICE The two connectors are coloured differently to prevent them being connected incorrectly:

- Black for generator A LINE - rectifier regulator (A)
- Grey for generator B LINE - rectifier regulator (B)

NOTE: Generator A is only used for electronic engine components (ignition, injection and sensors).

Generator B is used primarily to start the engine (Generator B is in use till 2700 rpm longer than 5 sec, then the ECU automatically switch over to generator A) and to charge the aircraft battery.

Graphic Ignition system



Part	Function
1	Internal generator
2	Electrical LINE A+B with connectors
3	FUSE BOX assy.

Fig. 2 *06326*

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.

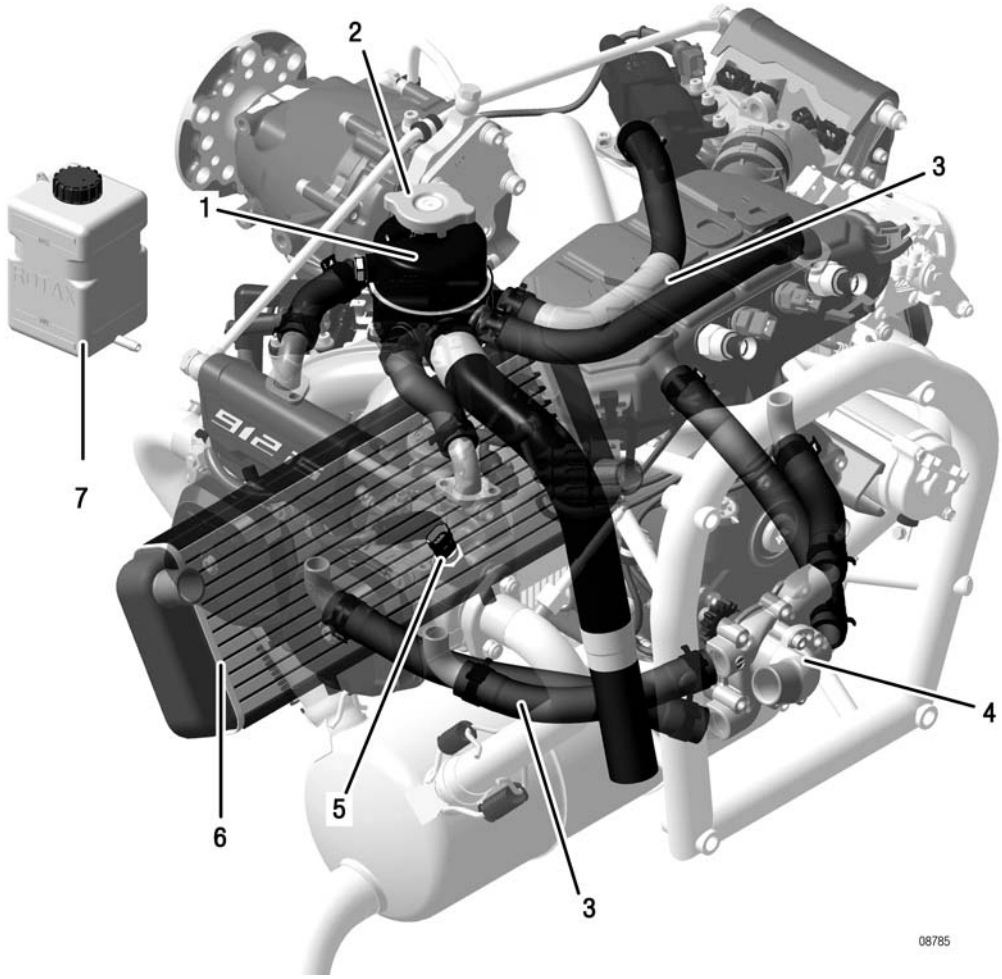
When correctly installed in the aircraft, the optionally available BRP-Powertrain radiator has enough cooling capacity to keep within the standard specified operating limits. The flow resistance of the radiator coolant is correctly adjusted to the cooling system. The tube size must be sufficient. The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

Table of contents

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

Subject	Procedure
Cooling system	Page 3
System description	Page 3
Operating limits	Page 5
Coolant types	Page 6
Checking the efficiency of the cooling system	Page 7
Cooling system requirements	Page 8
Connecting sizes and position of connections	Page 11
Requirements, permissible position and installation position of radiator, expansion tank, overflow bottle	Page 12
ROTAX overflow bottle	Page 15
General notes on the cooling system	Page 17
Coolant capacity	Page 17
Cooling air duct	Page 18
General notes on the cooling air ducts	Page 19
Data for optional components of cooling system	Page 20

Overview Cooling system



Part	Function
1	Expansion tank
2	Radiator cap
3	Coolant hose
4	Water pump housing
5	Temperature sensor
6	Radiator
7	Overflow bottle

Fig. 1

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 **closed** 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 standard 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 position

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

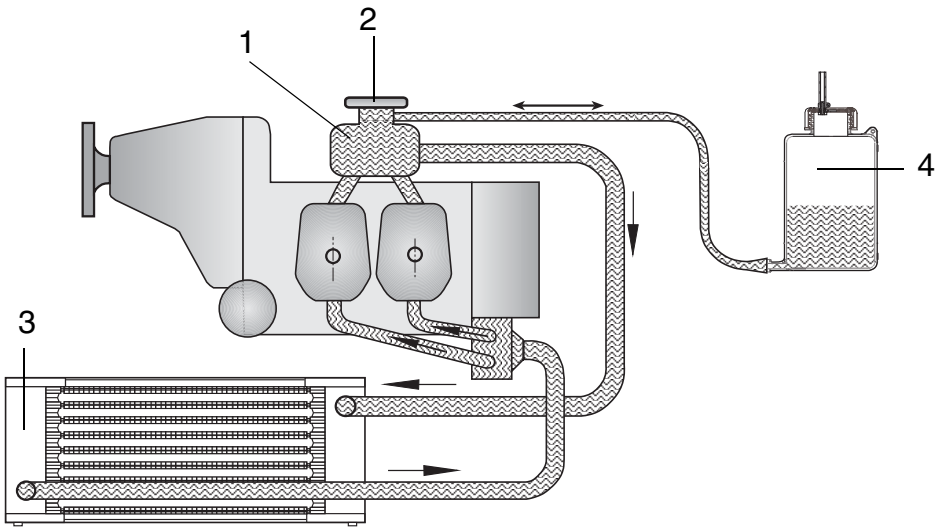
Measuring the coolant temp.

NOTE: The coolant temperature sensor is in cylinder head 4.

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 generated by the oil system.

Graphic Cooling system



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

Fig. 2 *09152*

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1.2) Operating limits

General note

⚠WARNING Non-compliance can result in serious injuries or death! The cooling system must be designed so that operating 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 standard specified operating limits. The flow resistance of the radiator coolant is correctly adjusted to the cooling system. The tube size must be sufficient.

Boiling point of the coolant

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.

The boiling point of the coolant is mainly influenced by:

- the type of coolant
- mixture ratio (percentage water rate)
- the system pressure (opening pressure of radiator cap)

Coolant temperature

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

1.3) Coolant types

General note

NOTICE Using waterless coolant is not permitted (e.g. Evans).

Permissible coolant types:

Description	
1	Conventional coolant based on ethylene glycol

NOTICE When selecting a suitable coolant, the information in Service Instruction SI-912 i-001, 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.

Mixing ratio

NOTICE The manufacturers instructions regarding the coolant must be observed.

	Mixture ratio	
Description	**Concentration**	**Water**
Conventional coolant	50 %	50 %
Some conventional coolants are available pre-mixed by the manufacturer. In this case do not mix with water, instead follow the manufacturers instructions.		

Boiling point

Conventional coolant:

Conventional coolant mixed with 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).

Marking

Marking of the coolant to be used

NOTICE The coolant to be used and its concentration (percentage water rate) must be correctly communicated to the owner.

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2) Checking the efficiency of the cooling system

General note

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

Measurement of coolant temperature

See Fig. 3.

The coolant temperature is measured using temperature sensor (1), which is installed on cylinder 4.

Graphic

Coolant temperature sensor

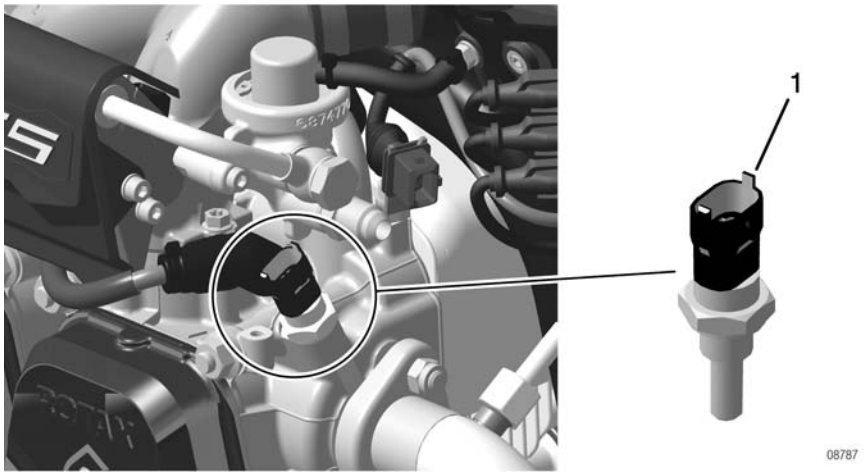

Fig. 3

Coolant exit temperature

See Fig. 4.

⚠WARNING

Non-compliance can result in serious injuries or death!
Do not restrict the coolant flow with the sensor.

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.

2.1) Cooling system requirements

Safety

⚠WARNING Non-compliance can result in serious injuries or death! The cooling system must be designed so that the operating 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 radiators. Be sure to use short hoses and pipelines.

NOTICE All components of the cooling system must be suitably secured.

Coolant hoses

See Fig. 4.

NOTICE Hoses exposed to direct heat radiation from the exhaust system, must be suitably protected with heat-resistant 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!

- Temperature resistance, min. 125 °C (257 °F)
- Pressure durability:min. 5 bar (72 psi)
- Inner diameter: 25 mm
- Bending radius: min. 175 mm (6.89 in.) (except moulded hoses)
- Material: 100 % resistant to glycol, antifreeze and ozone.

Graphic

Drawing aluminium tube

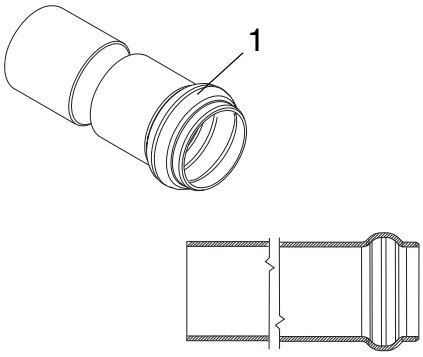

Fig. 4

09158

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Hose connecting expansion tank

Hose from expansion tank to overflow bottle:

See Fig. 5.

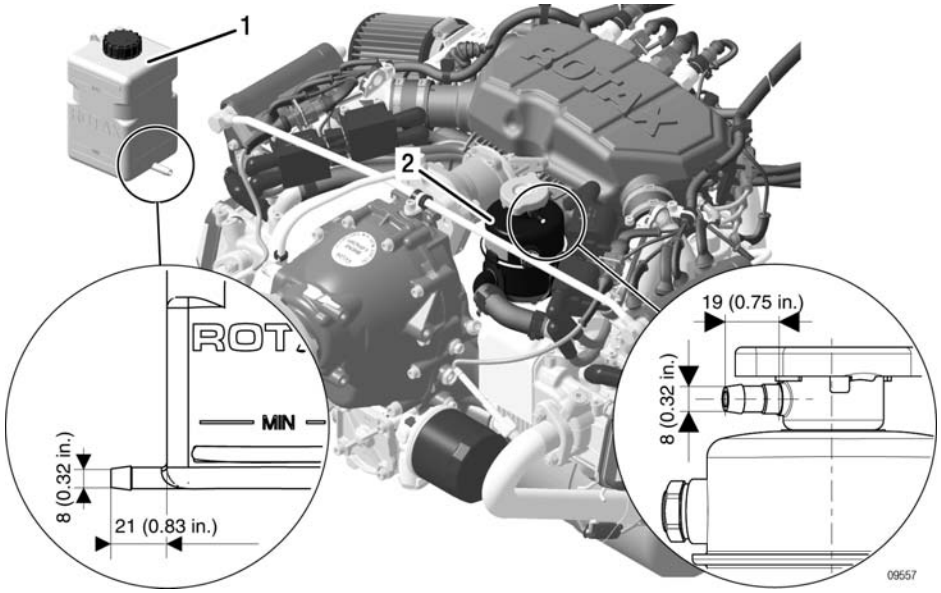
⚠WARNING Non-compliance can result in serious injuries or death! A soft walled hose is not suitable as it can collapse and cause cooling system failure.

- 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 i 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.

Graphic



Part	Function
1	Overflow bottle
2	Expansion tank assy.

Fig. 5

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NOTES

3) Connecting sizes and position of connections

General note

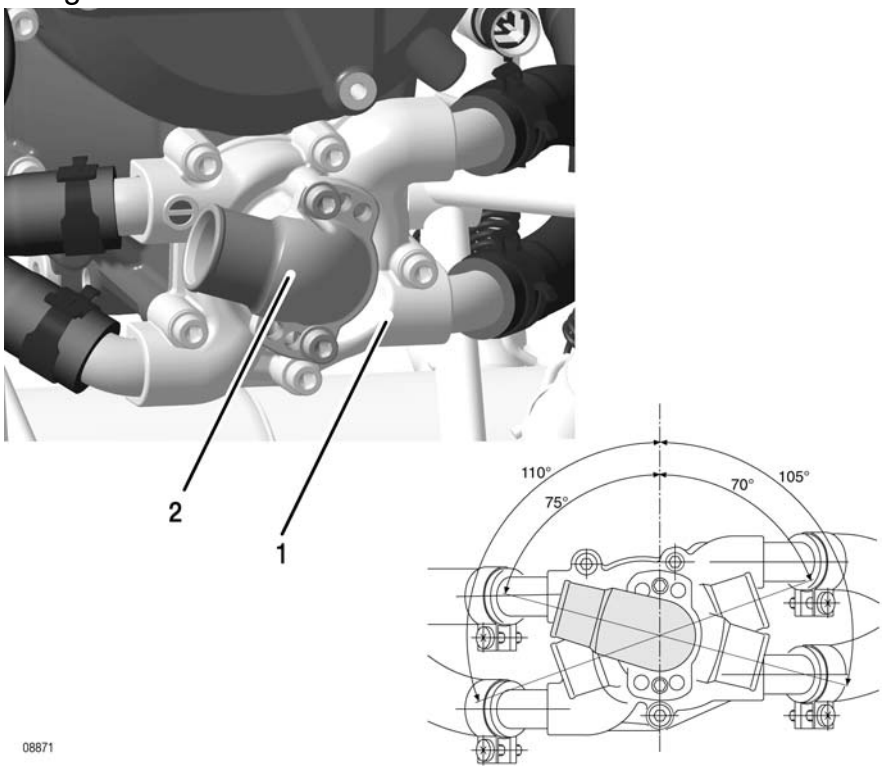
See Fig. 6.

NOTICE

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.

Graphic

Connecting sizes



Part	Function
1	Water pump housing
2	Water inlet elbow

Water inlet elbow: Outer diameter 27 mm (1.06 in.)

Slip-on length: max. 19 mm (0.75 in.)

Fig. 6

Water inlet elbow

NOTICE Use the total slip-on length for the water inlet elbow and expansion tank. Secure hoses with suitable spring or screw clamps.

NOTE: Choose between six possible installation positions of water inlet elbow (2) appropriate to specific installation (see illustration).

Use two M6x20 Allen screws and lock washers to attach the water inlet elbow. Tighten screws to 10 Nm (90 in.lb.).

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

Radiator

See Fig. 7.

⚠WARNING 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 condition**".

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).

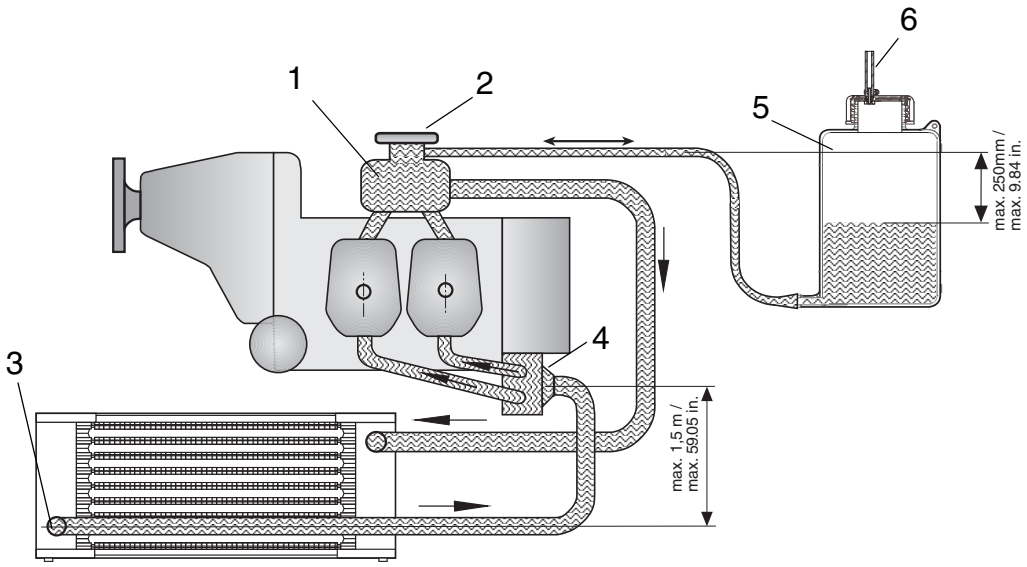
Expansion tank

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

Permitted installation positions



Part	Function
1	Expansion tank
2	Pressure cap
3	Radiator outlet
4	Water inlet elbow
5	Overflow bottle
6	Purging

Fig. 7 08319

Overflow bottle

The system also needs an overflow bottle in which surplus coolant is collected and returned to the coolant circuit during the cooling down period.

NOTICE To ensure proper operation of the cooling system, the suction height between overflow bottle and expansion tank must not exceed 250 mm (10 in.).

NOTE: For proper operation ensure that the hose to the overflow bottle is as short as possible.

Overflow bottle requirements

- Transparent material
- Temperature resistant from -40 °C to +130 °C (-40 °F to 266 °F)
- 100 % resistant to glycol and suitable for all other antifreeze agents
- Volume approx. 0.5 l. (0.13 USgal)
- With vent (6), diameter 2.5 mm (0.1 in.)

NOTE: The overflow bottle should be furnished with a label indicating function and content.

Capacity

⚠WARNING Non-compliance can result in serious injuries or death! The overflow bottle must never be empty, otherwise air will be sucked into the cooling circuit; this can have a negative effect on the safe operation of the engine.

Installation

NOTICE The overflow bottle and its supply and discharge must not be installed close to the exhaust system, as emerging coolant can be flammable under certain conditions.

3.2) ROTAX overflow bottle (optional extra)

General note

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

Retrofitting

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 (see Fig. 8).

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.

Work instruction

See Fig. 8.

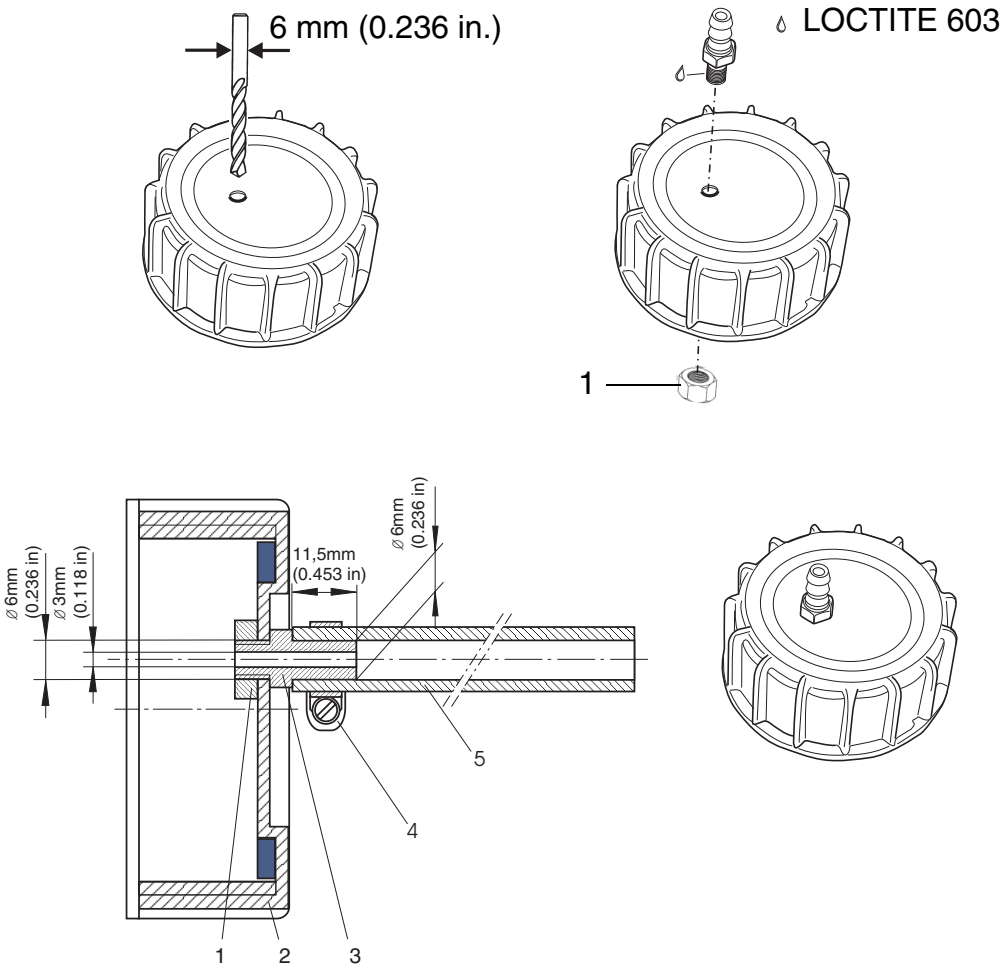
Procedure for attaching the hose nipple:

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.

Graphic Hose nipple



Part	Function
1	M6 hex. nut
2	Plug screw
3	Hose nipple
4	Gear-type hose clip
5	Hose

Fig. 8 *05033.09126*

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4) General notes on the cooling system

Certification

⚠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.

Essential parts of the cooling system, such as radiator, etc., are available for this engine from BRP-Powertrain.

Radiator

NOTICE The radiator must be designed to dissipate approx. 30 kW (7.58 BTU/s) of thermal energy at take-off performance.

NOTE: Experience has shown that with good airflow, a radiator with an area of 500 cm² (77.5 in²) is required for troublefree operation.

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 m³/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 correctly 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).

NOTICE 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

4 cylinder heads	560 cm³ (0.02 cu.ft)
Coolant pump	100 cm³ (0.004 cu.ft)
Expansion tank	250 cm³ (0.008 cu.ft)
2 m coolant hose (inner ⌀ 18 mm)	500 cm³ (0.018 cu.ft)
Total coolant quantity for engine	approx. 1.5 l (0.4 USgal)

4.2) Colling air ducts (optional)

General note

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

Hot day condition

See Fig. 9.

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

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

Graphic

Cooling air duct

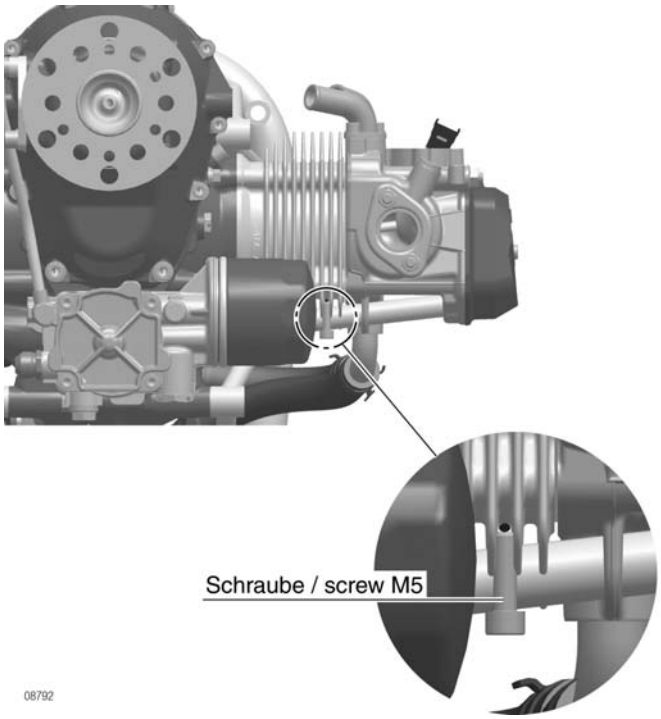

Fig. 9

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4.2.1) 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 cooling air ducts

The following recommendations should assist the aircraft or fuselage manufacturer 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 cm^2 (15.50 in^2).
Material	Glass fibre reinforced plastic or heat and fire resistant material.
Attachment options	Formlocking on engine block and mounting above the cylinder and the crankcase. HINWEIS: If formlocking attachment is not sufficient, additional attachment is possible 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.)).

d05171.fm

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 points
Max. permissible force (safe load) in (N) on x, y and z axis	2000 N (449.62 lb-force)
Max. permissible bending moment (safe load) in (Nm) in x, y and z axis	50 Nm (36.89 lbft)
Min. length of thread (mm)	15 mm (0.59 in.)

4.3) Data for optional components of cooling system

Overflow bottle See Fig. 10 to Fig. 12.

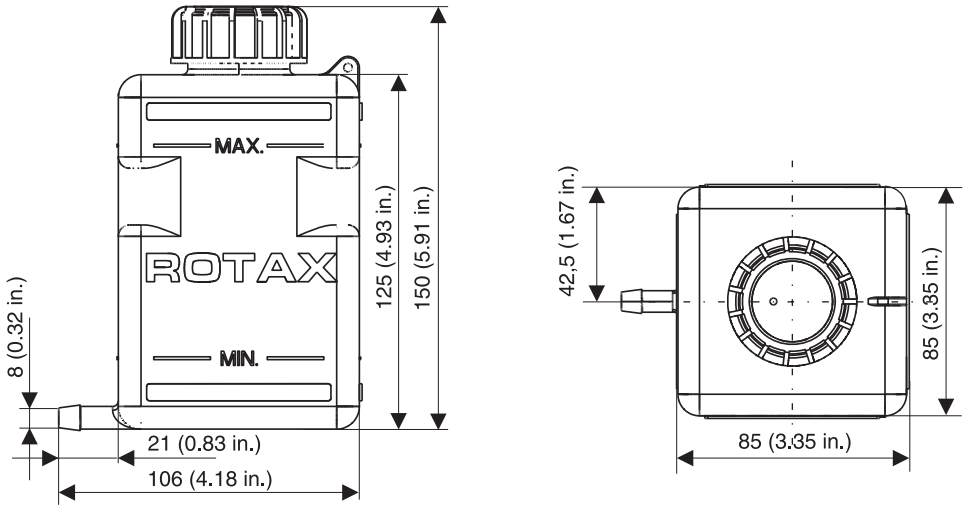

Fig. 10 09148

Radiator

Weight: see chap. 72-00-00 section: 2.1)

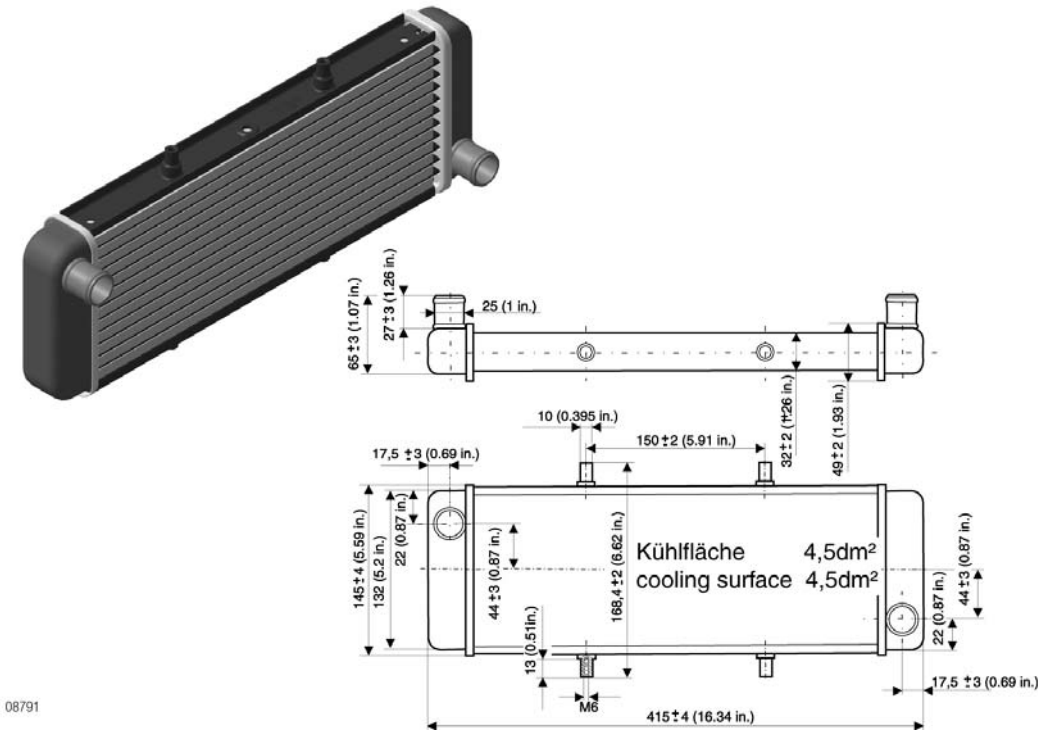

Fig. 11

Cooling air duct

Weight: see chap. 72-00-00 section: 2.1)

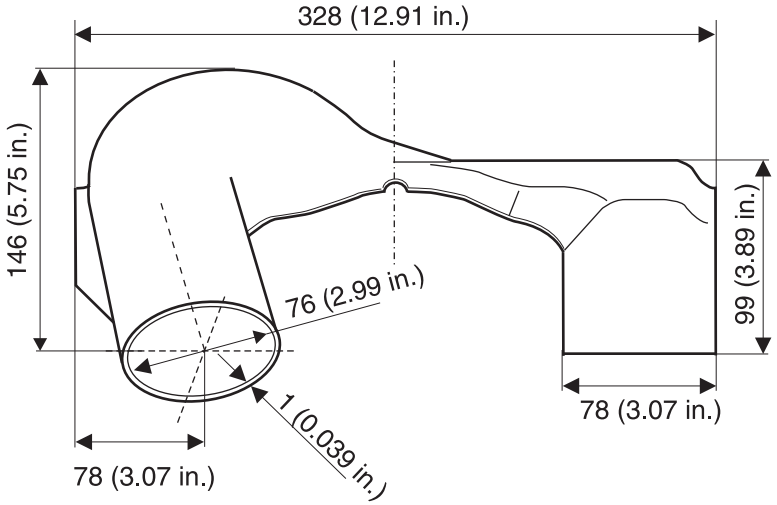

Fig. 12 *09165*

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NOTES

Chapter: 76-00-00

ENGINE MANAGEMENT

Introduction

The main components of the EMS are:

- ECU
- ECU actuators
- ECU sensors
- EMS current supply
- FUSE BOX
- Switches
- Wiring

During engine start the ECU is energised by battery power. Once the engine has started the system is switched over to generator B and performs a function check. At a predetermined point the ECU switches to generator A and performs a function check. This is carried out automatically. If a fault is detected it is reported via the display. The operator can carry out a system check using switches similar to MAG switches at any points.
This system check will select one ECU, half the injector and half the coils thus providing the operator with feedback about the injection and ignition system. The display in the instrument pane will indicate if any faults are detected.

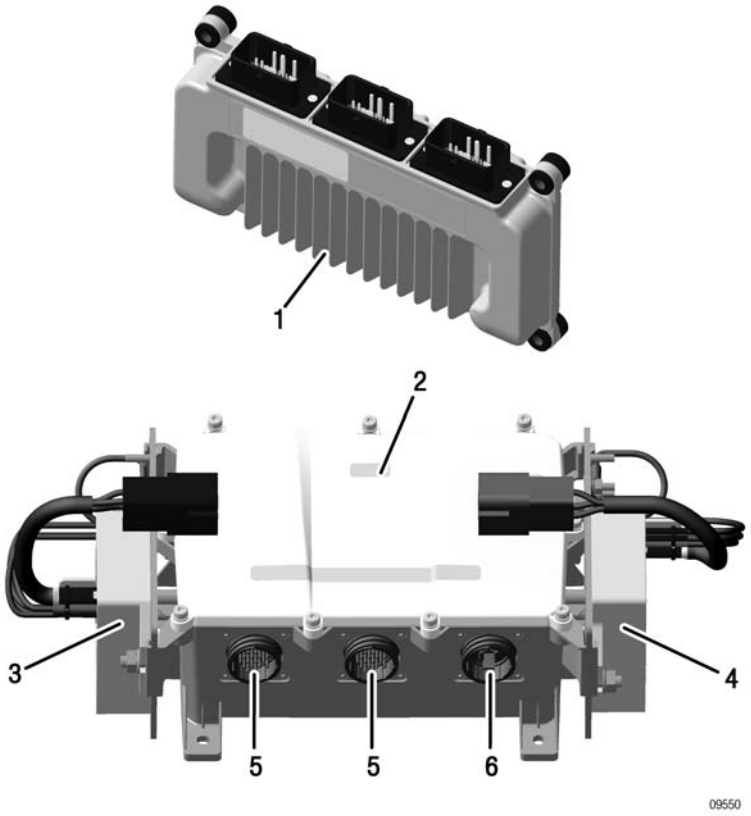
Table of contents

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

Subject	Page
ECU	Page 3
Technical data	Page 3
Connector	Page 4
Connections	Page 4
Installation position of the control unit assy.	Page 4
FUSE BOX assy.	Page 5
Technical data	Page 5
Connections	Page 6
Fitting the AMP connector	Page 6
Installation position of the FUSE BOX assy.	Page 7
Maintenance tool	Page 9
Maintenance tool pin assignment	Page 9
Display	Page 11
Display pin assignment	Page 11

Overview

Engine control



Part	Function
1	Control unit assy. (ECU)
2	FUSE BOX assy.
3	Rectifier regulator A (black connector)
4	Rectifier regulator B (grey connector)
5	LANE A / LANE B plug connection
6	Plug connection (X3)

Fig. 1 *08725*

d05396.fm

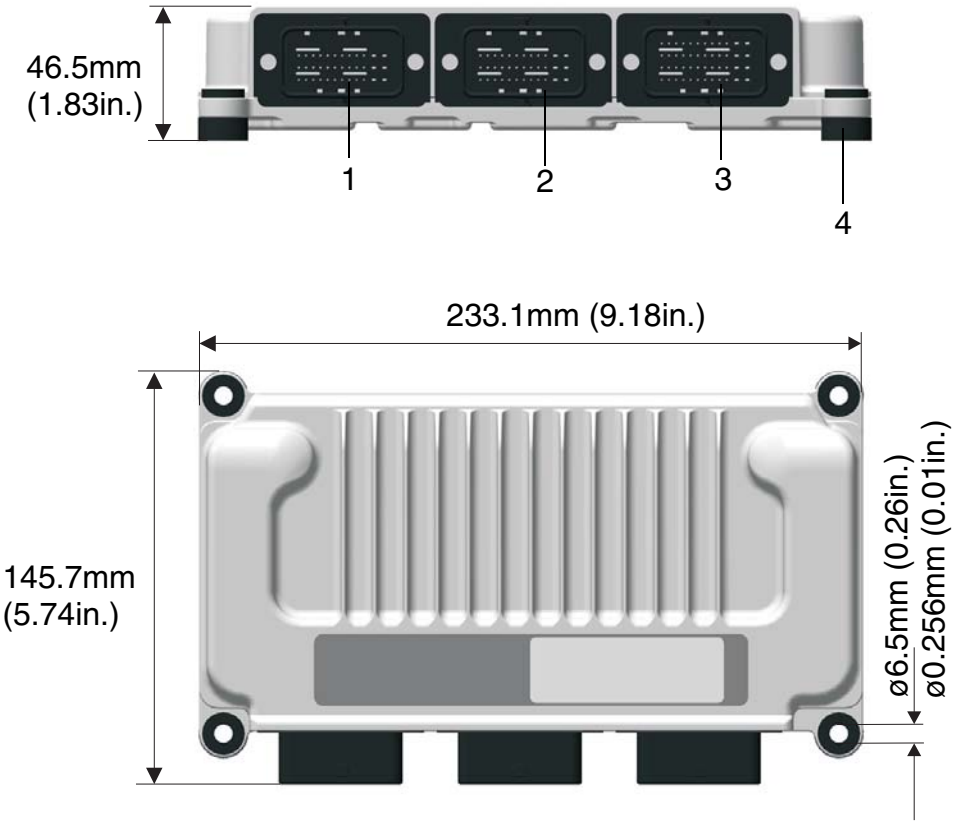
1) ECU

General There are two independent ECU‘s housed in a single waterproof box.

1.1) Technical data

See Fig. 2.

Graphic Connections and dimensions



Part	Function
1	Plug connection A1
2	Plug connection A2
3	Plug connection B
4	Rubber vibration damping/insulation material

Fig. 2 *06328*

d05396.fm

1.2) Connector

Connector

NOTICE

The connectors are indexed, i.e. connector A1 can only be connected to A1. Excessive force or incorrect positioning can result in bent pins, the ECU would then need to be replaced.

1.3) Connections

Connection

Insert the wiring harness plug in the correct position on the ECU.

NOTICE

The rubber vibration damping (insulation material) must not be removed. If the rubber dampers were removed, the engine ground and the aircraft ground would be short-circuited.

1.4) Installation position of the control unit assy. (ECU)

Installation position

The ECU must be housed in the cockpit. It must not be installed in the engine compartment.

NOTICE

Never install the control unit with the connectors pointing upwards!

Temperature

Permissible component temperature:

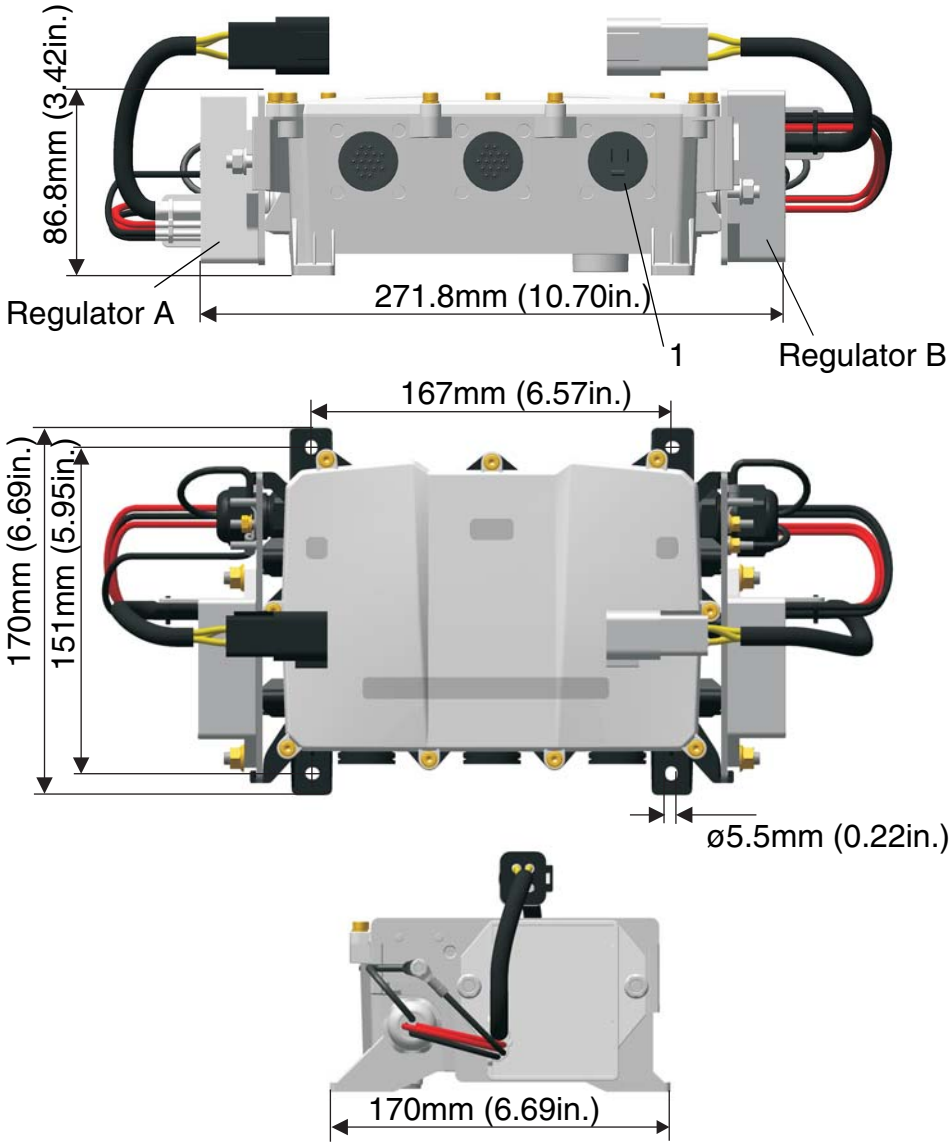
Max. +80 °C (176 °F)

2) FUSE BOX assy.

2.1) Technical data

Graphic See Fig. 3.

Connections and dimensions



Part	Function
1	Plug connection POWER (X3)

Fig. 3 06330

d05396.fm

2.2) Connections

Connection

See Fig. 4.

Insert the wiring harness plug in the correct position on the FUSE BOX assy.

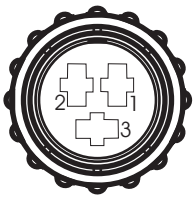
FUSE BOX supply:

- Power plug (X3)

The mating plug for the FUSE BOX is included in the scope of delivery.

NOTE: A set of spare fuses can be found in the FUSE BOX.

Graphic



PIN 1 backup battery switch
PIN 2 start power switch
PIN 3 start power switch

Fig. 4 06393

2.3) Fitting the AMP connector

General note

See Fig. 5.

NOTE: The AMP connector is included in the scope of delivery.

Special tools

The following special tools and equipment are necessary for fitting the AMP connector.

Part number	Description
n.a.	Crimping pliers TYCO-Connectivity 69710-1
n.a.	Tool TYCO-Connectivity 90145-1
n.a.	Disassembly tool TYCO-Connectivity 91124-1

Procedure

Fitting the AMP connector:

Step	Procedure
1	Feed line (1) through the connector receptacle (5), squeeze plate (6) and cable holder (7).
2	Strip insulation from line.
3	Install socket contact (2) using suitable crimping pliers.
4	Push the socket contact into the appropriate position in the AMP connector until it engages.

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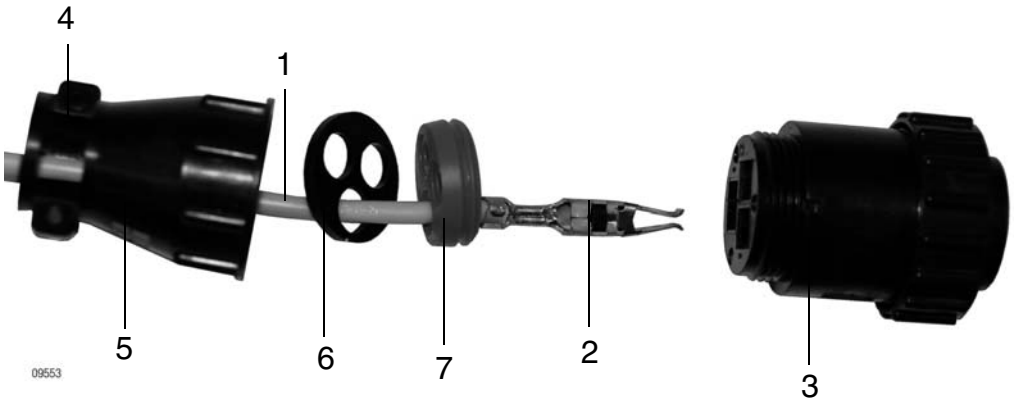
Step	Procedure
5	Check for tight fit.
6	Install strain relief clamp (4).

Graphic

Fitting the AMP connector



Part	Function
1	Line
2	Socket contact
3	Connector
4	Strain relief clamp
5	Connector receptacle
6	Squeeze plate
7	Cable holder

Fig. 5

2.4) Installation position of the FUSE BOX assy.

Temperature

The FUSE BOX must be placed that the maximum permissible component temperature must not exceed.

Permissible component temperature:

- Max. +80 °C (176 °F)

2.5) Ambient air, pressure, temperature sensor (AAPTS)

General

The AAPTS sensor is the all-in-one sensor for engine ambient temperature and engine ambient pressure. In cowled engine installations it has to be mounted in the engine compartment in a ram air free area and close to the air inlet. The sensor should measure the correct air inlet temperature and the air pressure right before the air filter.

NOTES

3) Maintenance tool

General

A maintenance program is available that allows to reading the stored data in the ECU. The maintenance program can display the status of components in the system. This simplifies fault finding.

3.1) Maintenance tool pin assignment

Pin assignment

See Fig. 7.

Pin assignment for Sub-D (9-pin).

NOTE: The positions of the individual pins on the 9-pin Sub-D connector are numbered.

Pin no.	Pin assignment
2	CAN_L A/B
3	CAN_GND A/B
7	CAN_H A/B

NOTE: The two Low (CAN_L A/B), High (CAN_H A/B) and Ground (CAN_GND A/B) must be connected to each other.

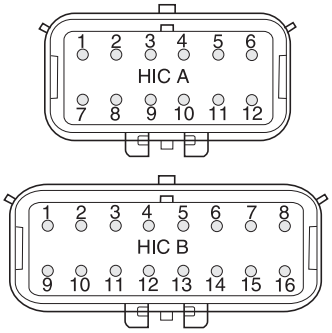
NOTICE

It is also possible to use two independent Sub D connectors. Then should be the Low (L) connector on every Sub D pin no. 2, the High (H) connector on pin no. 7 and the Ground (GND) connector on Sub D pin no. 3 connected.

Impedance

If the ECU is connected with the Maintenance Sub-D connector, the impedance between CAN_H (pin no. 7) and CAN_L (pin no. 2) will be ~60 Ohm.

Graphic **Pin assignment for Harness Interface Connector (HIC A/B)**



Pin no.	HIC A	Pin no.	HIC B
10	CAN_GND_2_LA	14	CAN_GND_2_LB
11	CAN_LOW_2_LA	15	CAN_LOW_2_LB
12	CAN_HIGH_2_LA	16	CAN_HIGH_2_LB

Fig. 6 *06325*

d05396.fm

4) Display

Indicating instruments

The only indicating instruments that can be used are those with a CAN Aerospace interface; they must also be able to use this data.
For instruments and the data for the CAN Aerospace protocol, contact an authorised sales and service partner for ROTAX aircraft engines.

4.1) Display pin assignment

Display pin assignment

Display pin assignment for Harness Interface Connector (HIC A/B)

Pin no.	HIC A	Pin no.	HIC B
4	CAN_GND_1_LA	6	CAN_GND_1_LB
5	CAN_LOW_1_LA	7	CAN_LOW_1_LB
6	CAN_HIGH_1_LA	8	CAN_HIGH_1_LB

Graphic

Wiring HIC-Maintenance und Display

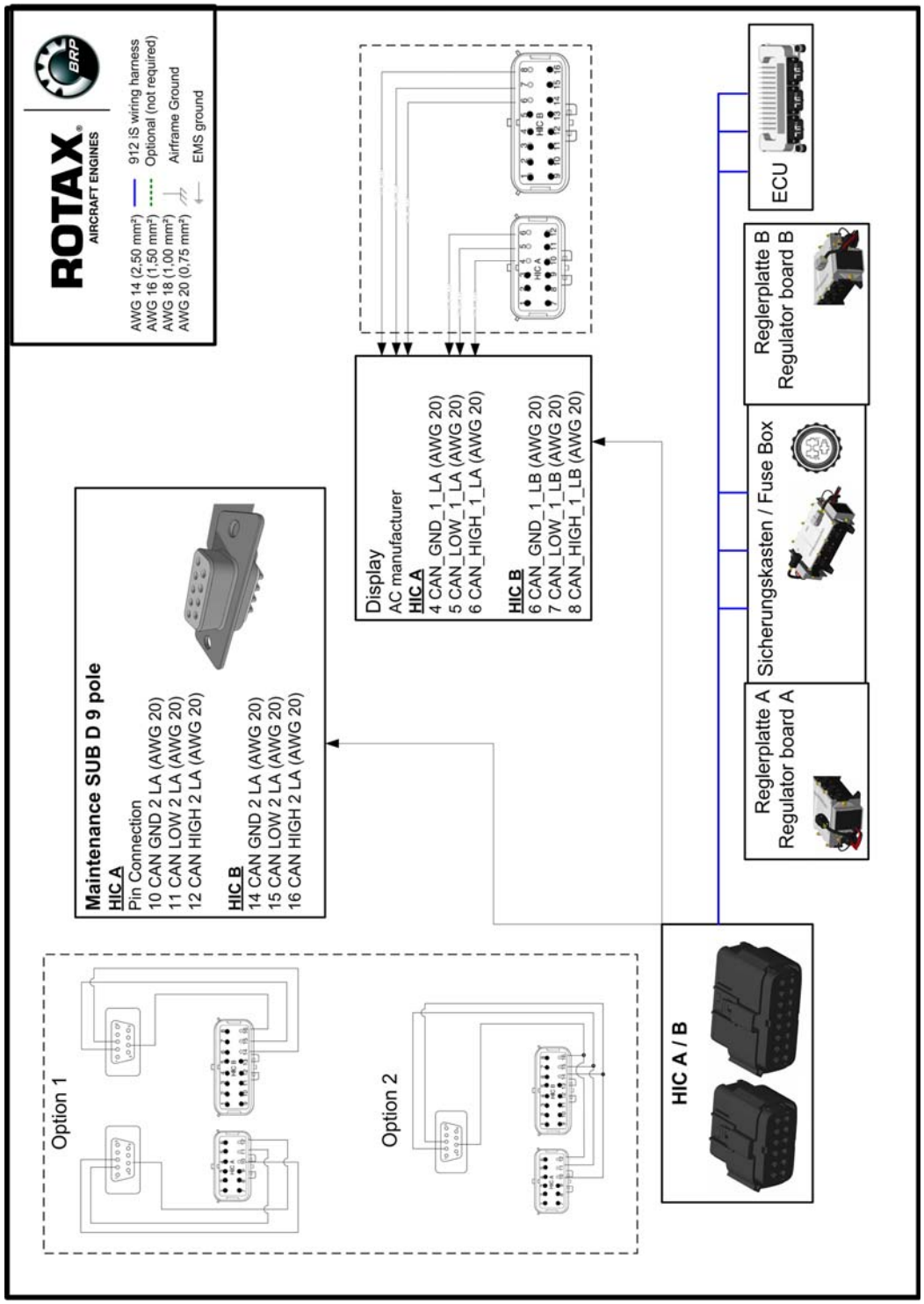


Fig. 7

08590

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Chapter: 78-00-00
EXHAUST SYSTEM

General note

See Fig. 1.

NOTICE

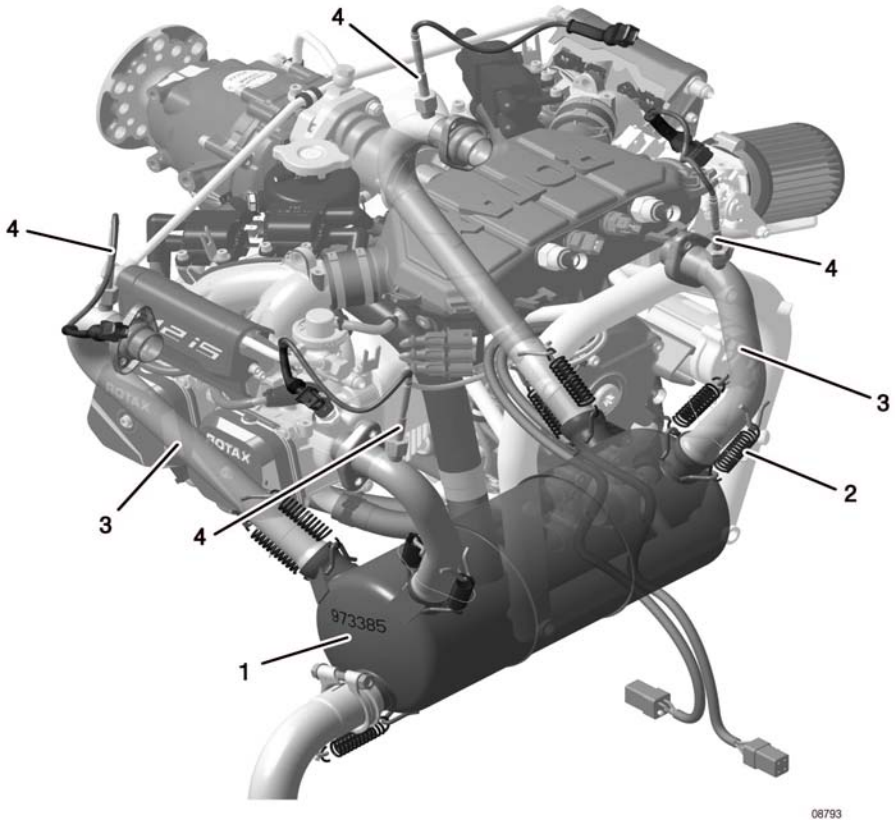
The exhaust system must be designed by the aircraft or fuselage manufacturer such that the permissible loads and bending moments on the points of attachment are not exceeded. The exhaust system may require additional support.

Table of contents

This section of the Installation Manual contains information on the 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 the exhaust system	Page 7
Operating limits Data for optional components of exhaust system	Page 9 Page 10

Overview Exhaust system



Part	Function
1	Muffler
2	Tension spring
3	Exhaust pipe
4	EGT temperature sensor

Fig. 1

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1) General notes on the exhaust system

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.

Damping element

The ideal is a common transversal damping element serving all 4 cylinders, positioned under the engine.

NOTE: Equal length of pipes from the cylinder to damping element is recommended for better tuning.

Distribution of the exhaust system

Distribution of the exhaust system into 2 separate systems is not recommended. Individual mufflers on either side cause power loss and increased engine noise.

Exhaust flange

During assembly, ensure that the flange is parallel to the cylinder head flange and is not protruding.

NOTE: Tighten the exhaust flange evenly and in parallel. There must be a gap of the same size all the way round.

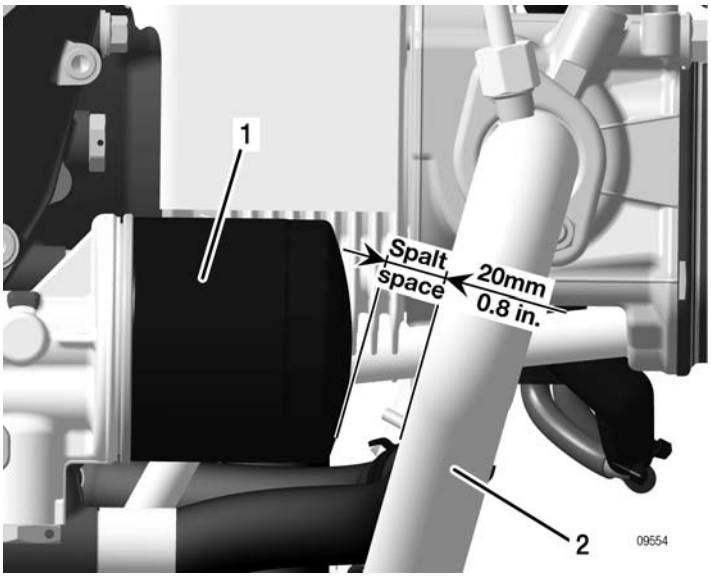
Oil filter

There must be a clearance of at least 20 mm (0.79 in.) between the exhaust pipe and the oil filter to allow the oil filter to be fitted and removed without having to slacken off the exhaust system. If a heat shield is fitted, this will also have to be taken into consideration.

NOTICE

The exhaust system must not adversely affect the operation or replacement of the oil filter.

Graphic



Part	Function
1	Oil filter
2	Exhaust manifold

Fig. 2

2) Exhaust system requirements

General note

NOTICE

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

- 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 l (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: min. 15 Nm (133 in.lb.)

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

Graphic

Exhaust sockets

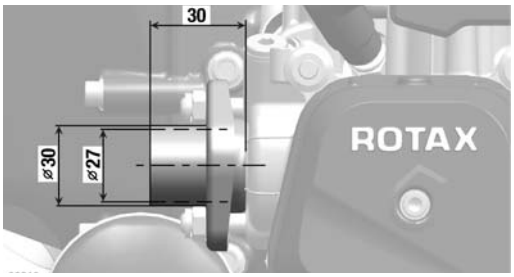


Fig. 3 08810

d05397.fm

NOTES

3) Attaching the exhaust system

General 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

NOTE: All dimensions from zero reference point (P).

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

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

Positioning the sensor

- The preferred installation angle is at least 15° to the vertical (with the electrical connection on top).
- The installation direction of the sensor element itself is immaterial.
- The tip of the sensor must not touch anything.

NOTES

4) Operating limits

Safety notes

See Fig. 4.

⚠WARNING

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.

Location and position of the temperature sensor

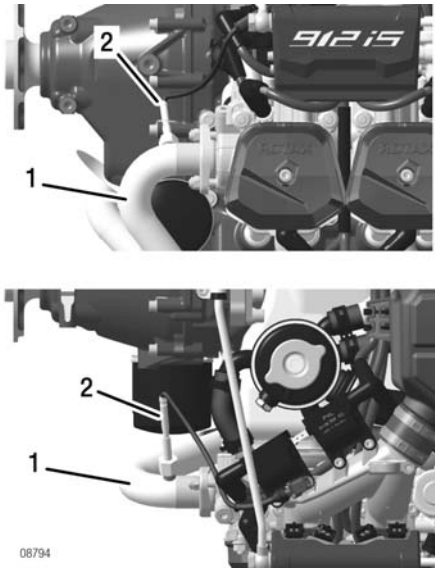
NOTICE

If the EGT sensor is fitted on a slope or with the sensor tip pointing upwards, then various fluids can lead to undesired corrosion. The sensor could then fail.

The temperature sensor must be fitted vertically.

Graphic

Exhaust gas measurements



Part	Function
1	Exhaust manifold
2	EGT sensor

Fig. 4

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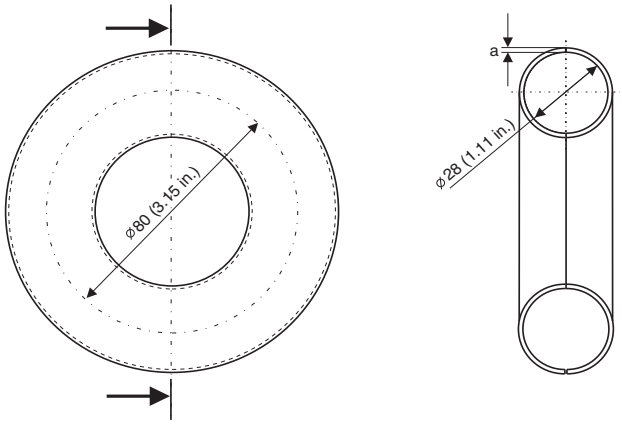
Values See the current 912 i Series Operators Manual.

4.1) Data for optional components of exhaust system

Weight See chap. 72-00-00 section: 2.1).

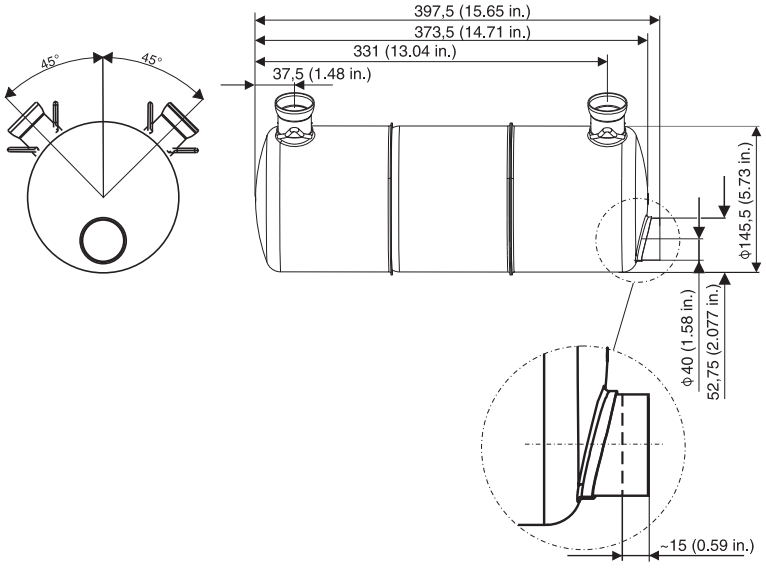
Graphic Exhaust elbow



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

Fig. 5 *09164*

Graphic Muffler



Material/strength: X 6CrNi 189 (DIN 1.4541) (stainless steel) a = 1 mm (0.04 in.)

Fig. 6 *06996*

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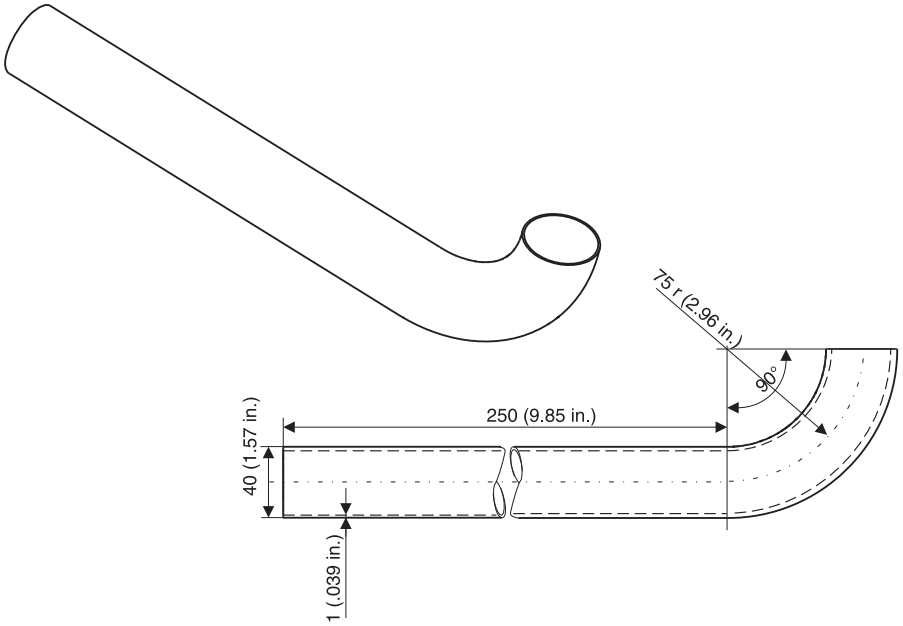
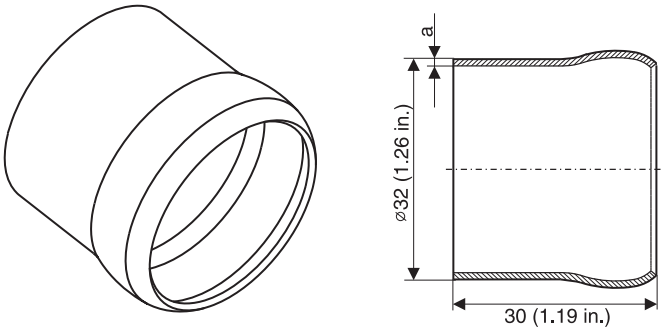
Graphic Tailpipe



Material/strength: X 5CrNi 189 (DIN 1.4301) (stainless steel) a = 1 mm (0.04 in.)

Fig. 7 *09153*

Graphic Ball joint (male)



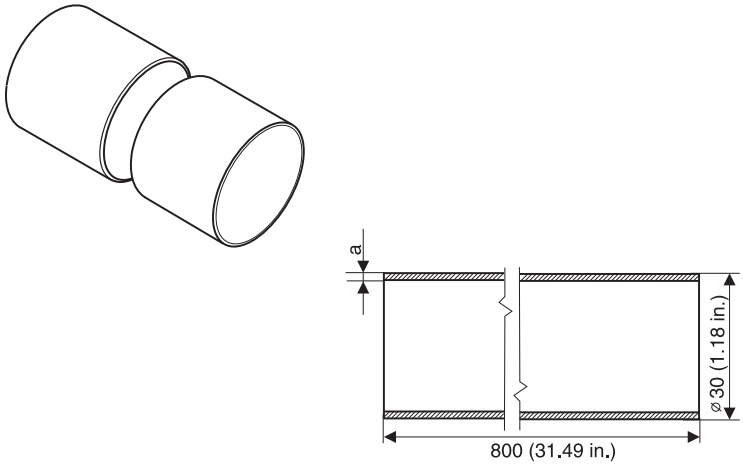
Material/strength: X 15CrNiSi 20, 12 (DIN 1.4301) (stainless steel) a = 1 mm (0.04 in.)

Fig. 8 *09166*

d05397.fm

Graphic

Exhaust pipe



Material/strength: X 15CrNiSi 20, 12 (DIN 1.4301) (stainless steel) a = 1 mm (0.04 in.)

Fig. 9 *09167*

d05397.fm

Chapter: 79-00-00

LUBRICATION SYSTEM

General note

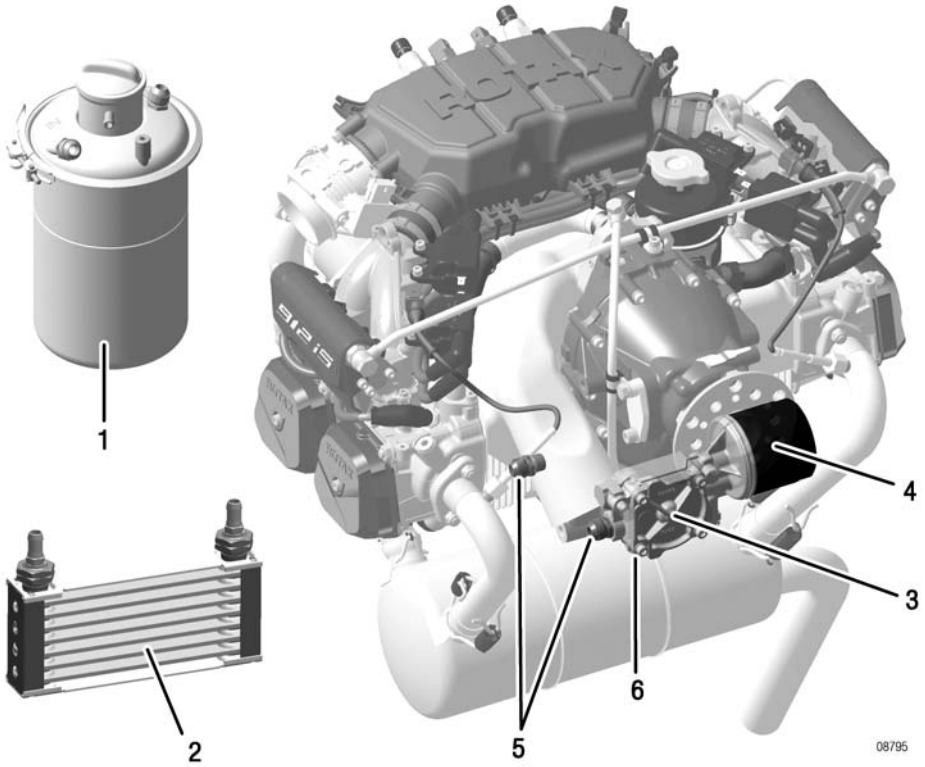
The ROTAX 912 i Series is fitted with a dry sump forced lubrication system with an oil pump and integrated pressure regulator.

Table of contents

This section of the Installation Manual describes the system, operating 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 13
Permissible position and location of the oil tank	Page 16
General notes on the oil cooler	Page 19
Permissible position and location of the oil cooler	Page 19
Capacity	Page 20
Purging the lubrication system	Page 21
Checking the hydraulic valve tappet for correct purging	Page 24
Replacement of components	Page 25
Data for optional components of lubrication system	Page 27
Oil cooler	Page 27
Variants of connectors	Page 27

Overview Lubrication system



Part	Function
1	Oil tank
2	Oil cooler
3	Oil pump
4	Oil filter
5	Screw socket
6	Plug screw

Fig. 1

NOTE: The suction line can also be connected to the bottom of the oil pump housing. In this case, the plug screw and gasket ring are to be replaced by the screw socket and gasket ring. See the current 912 i Series Heavy Maintenance Manual.

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1) Lubrication system (oil system)

1.1) System description

Drive

See Fig. 2.

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 (3) 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

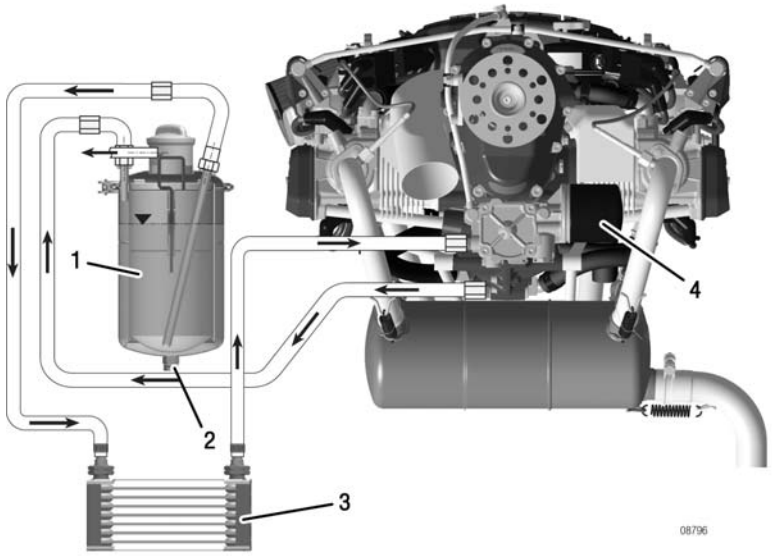
⚠WARNING Non-compliance can result in serious injuries or death!
The oil cooler and its connections must be certified according to the latest regulations, such as FAR and EASA, by the aircraft or fuselage manufacturer.

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

	Oil circuit, engine (main oil pump)
Connections from	Oil tank (outlet) to oil cooler
	Oil cooler to oil pump (inlet)
	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.

Graphic Oil system



Part	Function
1	Oil tank
2	Oil drain screw
3	Oil cooler
4	Oil filter

Fig. 2

1.2) Operating limits

General note

⚠WARNING 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.

Operating limits	Manual
Oil pressure	See OM 912 i Series, section 2.1
Oil temperature	See OM 912 i Series, section 2.1

⚠WARNING 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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Low temperatures

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

⚠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. 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

See Fig. 3.

NOTE: The required pressure gauges and connection parts are not included in the BRP-Powertrain delivery.

To check the oil circuit for correct function, the following readings have to be taken with the engine running.

Measurement of crankcase pressure

See Fig. 3.

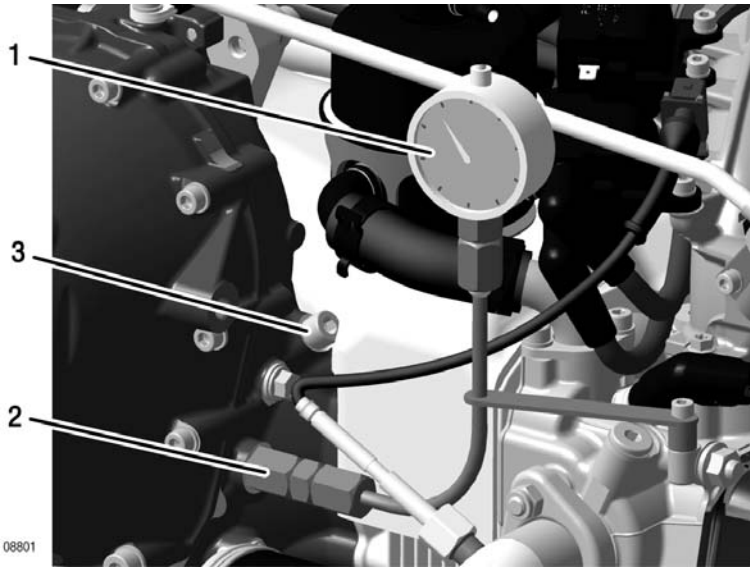
Measurement of the mean crankcase pressure at full throttle, this ensures correct oil return from crankcase (blow-by gas).

NOTICE Do not remove the magnetic plug for prolonged periods 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.

Graphic

Measurement of crankcase pressure



Part	Function
1	Pressure indicator
2	Magnetic plug
3	Crankshaft locking screw

Fig. 3

Magnetic plug

NOTE: The thread for the magnetic plug (2) must be M12x1.5 (metric) and M8 for the crankshaft locking screw (3) (use always new gasket).

Pressure values

The pressure in the crankcase at (full throttle) must not exceed the prevailing ambient pressure by more than 0.45 bar (6.53 psi) at 90 °C (194 °F) oil temperature.

⚠WARNING

Non-compliance can result in serious injuries or death! If the readings exceed the pressure limits, then the flow resistance in the oil return line from oil sump to oil tank is too high in the current engine installation (contamination, restrictions of cross-section, etc.). This condition is unsafe and must be rectified immediately.

If crankcase pressure and measuring pressure of the vacuum readings and all operational data (flight attitude, temperatures, etc.) are within the specified limits, then it can be assumed that the oil circuit is working correctly.

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1.4) Measuring of the vacuum

Measuring of the vacuum

See Fig. 4.

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).

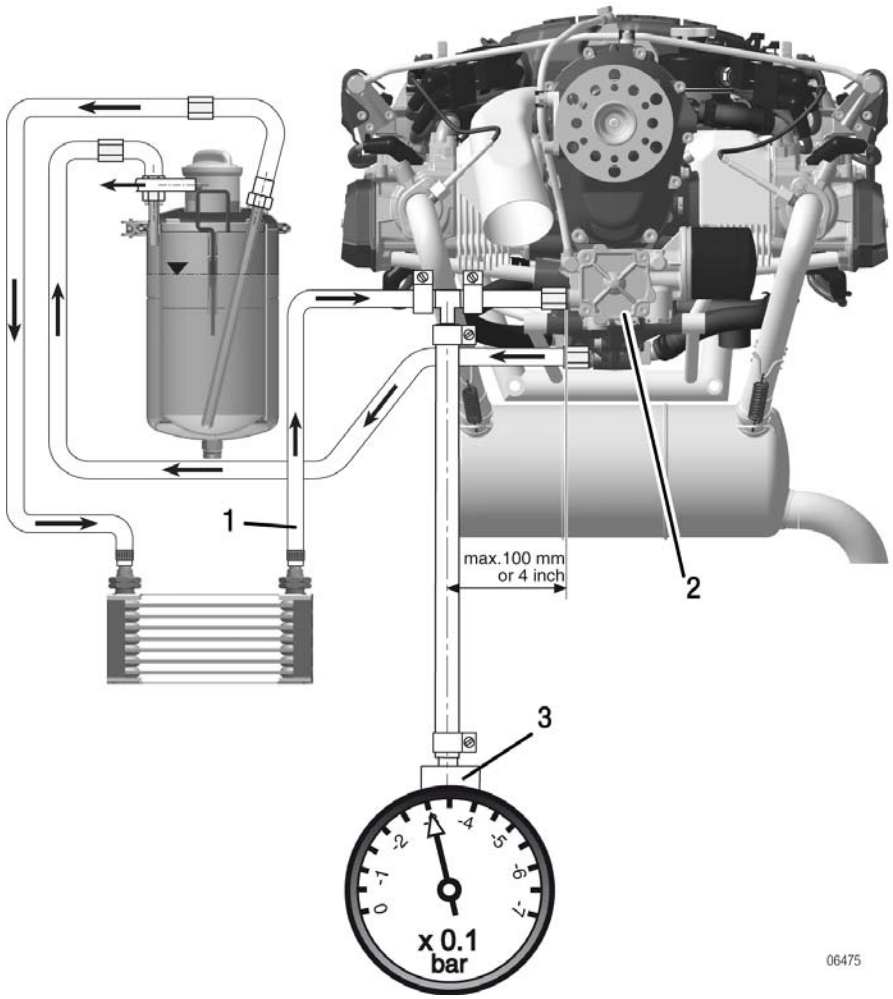
At full throttle, the indicated vacuum (3) upstream of the oil pump must not be less than 0.3 bar (4.35 psi), otherwise the oil hose (1) could collapse and block the oil supply to the engine.

⚠WARNING

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.

Graphic Measuring of the vacuum



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

Fig. 4

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1.5) Oil and purging line requirements

Oil lines

Oil circuit, engine (main oil pump)

- Temperature durability: min. 140 °C (284 °F)
- Pressure durability: min. 10 bar (73 psi.)
- Bending radius: min. 70 mm* (2.76 in.)

  * unless otherwise stated by the hose manufacturer
- Minimum inner dia. of oil lines in relation to total length

  up to 1 m (39.37 in.) inner diameter minimum 11 mm (0.43 in.)

  up to 2 m (78.74 in.) inner diameter minimum 12 mm (0.47 in.)

  up to 3 m (118.11 in.) inner diameter minimum 13 mm (0.51 in.)
- Length of individual oil line: max. 3 m (9.84 ft.)

Purging line

Purging line of oil tank

See Fig. 5.

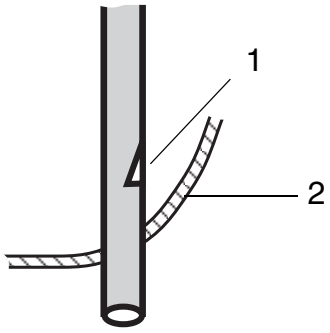
- Route the line without kinks and avoid sharp bends.

NOTE: Water is a by-product of the combustion of fuel. Most of this water will dissipate from the combustion chamber with the exhaust gases.

A small amount will reach the crankcase and must be disposed of through the purging line.

- The purging line must be routed in a continuous decline or furnished with a drain bore at its lowest point to drain any condensate.
- The purging 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 vent line with a bypass opening (1) before the cowling outlet (2).

Graphic Purging line.



Part	Function
1	Bypass opening
2	Outlet through the cowling

Fig. 5 *04874*

2) Connecting sizes and position of connections

General note

NOTICE Utilize the full slip-on length for all connections. Secure hoses with suitable screw clamps or crimp connections.

NOTE: The oil line connections are optionally available as UNF threads.

2.1) Oil circuit (engine)

General note

See Fig. 6.

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

- 912 iSc/iS thread M18 optional UNF thread

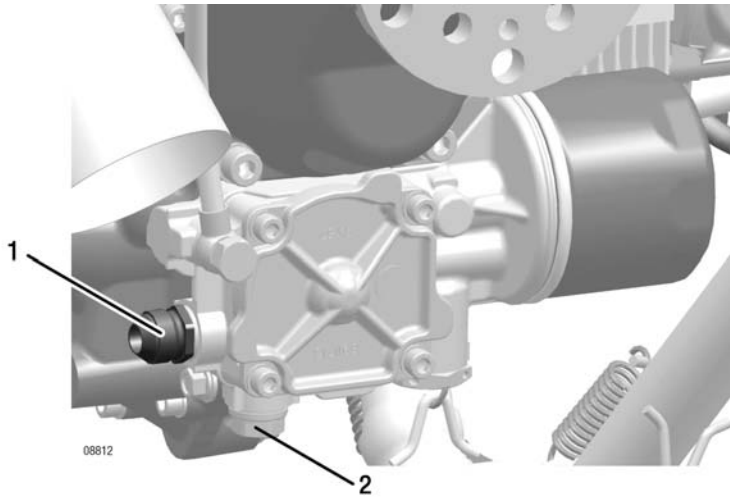
Oil pump (inlet)

Connection:

Oil pump (inlet)	
Screw socket (1)	3/4-16 UNF/M16x1.5
Tightening torque of inlet line	25 Nm (18.44 ft.lb.)

Graphic

Oil pump inlet



Part	Function
1	3/4-16 UNF/M16x1.5 screw socket
2	Alternative connection

Fig. 6

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Oil return

See Fig. 7.

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.

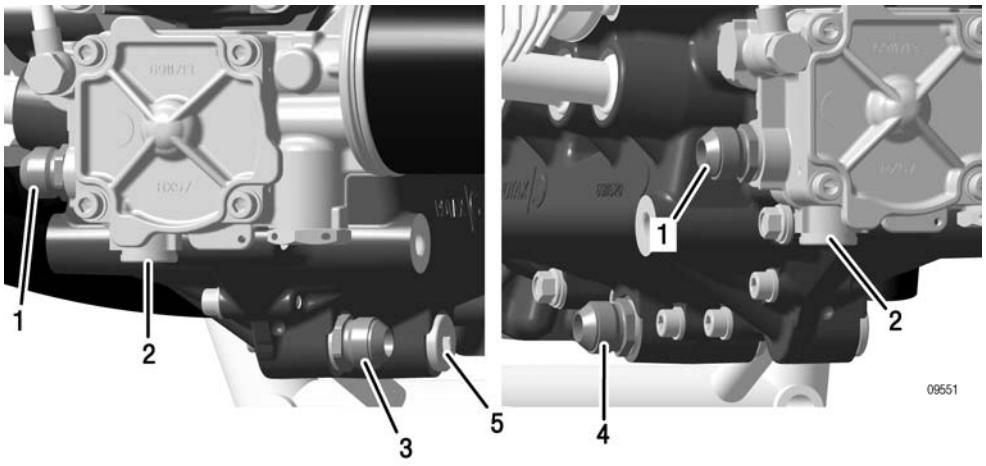
- Position **4, 5** for tractor arrangement
- Position **3** for pusher arrangement

NOTICE

Check that the connections for the oil feed and return lines are correct.

Graphic

Connections



Part	Function
1 or 2	Screw socket (oil feed line) from oil tank or oil cooler
3	Screw socket (oil return line) for pusher arrangement
4 or 5	Screw socket (oil return line) for tractor arrangement

Fig. 7

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Connections

Screw connection (optional)	
Thread	3/4-16 UNF/M16x1.5
Tightening torque of oil return line	25 Nm (18.44 ft.lb.)

2.2) Oil tank

Connections

See Fig. 8 and Fig. 9.

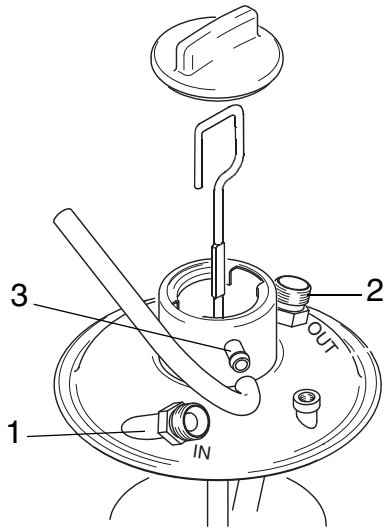
NOTICE Only use the oil tank provided in the scope of delivery, as its design has changed compared with older tanks.

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



Part	Function
1	Oil feed line
2	Oil outlet
3	Purging nipple

Fig. 8

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UNF thread Optional

Oil feed line and outlet have UNF threads

Screw connection	
Thread	3/4-16 UNF
Tightening torque of oil feed line and outlet	25 Nm (18.44 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	
Outer dia.	8 mm (0.31 in.)
Slip-on length	max. 15 mm (0.59 in.)

Bent socket 90° Optional

part no. 956580

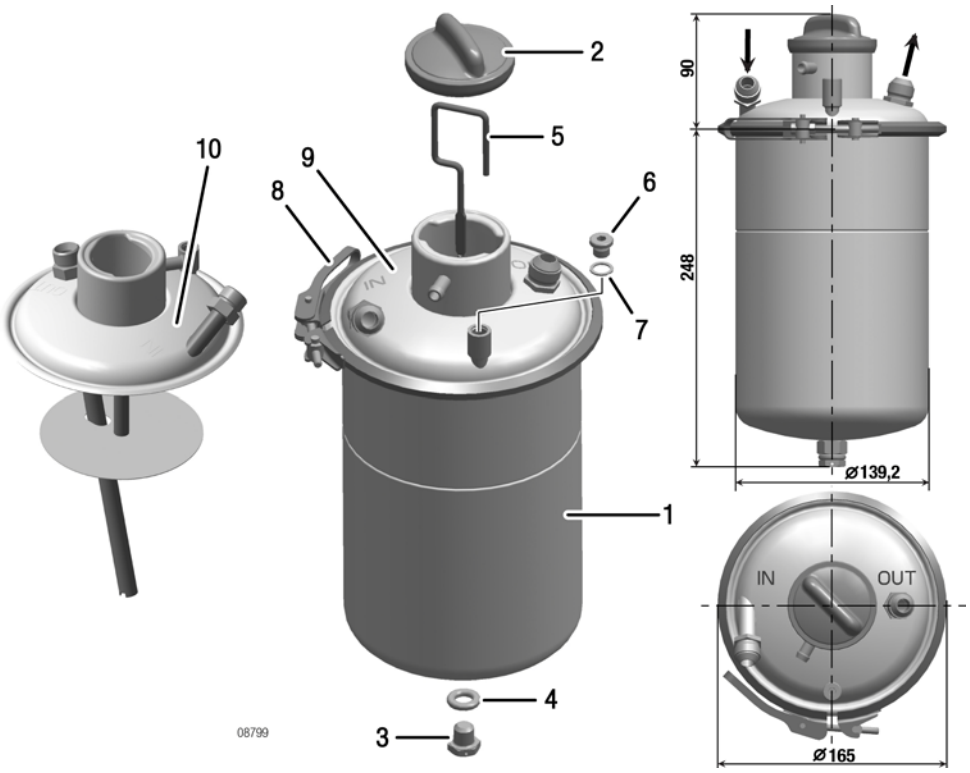
Bent socket 90° / M18x1.5	
Outer dia.	12 mm (0.47 in.)
Slip-on length	max. 24 mm (0.94 in.)
Tightening torque	25 Nm (18.44 ft.lb.)

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.)

Graphic Oil tank



Part	Function
1	Oil tank
2	Bayonet cap
3	M12x12 hex. screw
4	C12x18 gasket ring
5	Oil dipstick
6	M10x1 plug screw
7	A10x14 gasket ring
8	Profile clamp 163
9	Oil tank cover assy. (UNF 3/4-16)
10	Oil tank cover assy. (metric M18x1.5)

Fig. 9

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

2.3) Permissible position and location of the oil tank

Position and location

See Fig. 10.

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

  Permissible deviation from parallel: ±10°

NOTE: This applies to both planes.

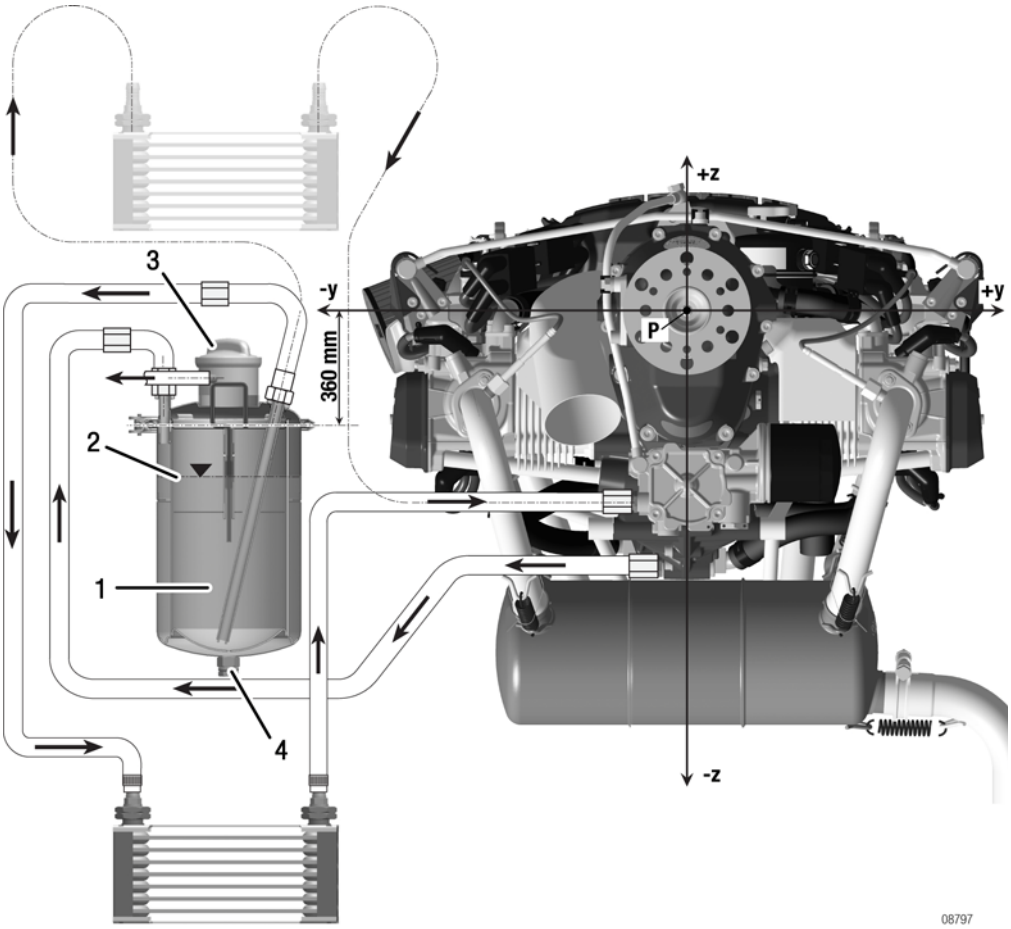
⚠WARNING Non-compliance can result in serious injuries or death! If the oil tank is located higher, oil might trickle through bearing clearances into the crankcase during longer periods of engine stop. If fitted too low it might damage the oil circuit.

- 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 on the engine.
- Oil tank cover (3) and oil drain screw (4) must be easily accessible.

Graphic Position and location of the oil tank



Part	Function
1	Oil tank
2	Oil level
3	Oil tank cover
4	Oil drain screw, hex. screw

Fig. 10

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NOTES

3) General notes on the oil cooler

General note

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

⚠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.

NOTICE The oil cooler must be designed to dissipate approx. 10 kW (7.58 BTU/s) of thermal energy at take-off performance.

NOTICE The oil cooler must not restrict oil flow. Test system as per chap. 79-00-00 section 1.3.

NOTE: Experience has shown that an oil cooler of at least 160 cm^2 (25 in^2) 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 cooler, etc.

- The oil cooler should always be installed below the engine oil pump.

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

- 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 l (0.8 USgal) depending on the respective installation.

Volume of oil tank	
Up to the MIN. mark	2.5 l (0.66 USgal)
Up to the MAX. mark	3.0 l (0.79 USgal)

- Perform oil level check and add oil if necessary.

3.3) Purging the lubrication system

Safety

See Fig. 11.

⚠WARNING

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:

NOTICE

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. ***NOTICE*** 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).

⚠WARNING

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.

NOTE: The oil tank cover 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.

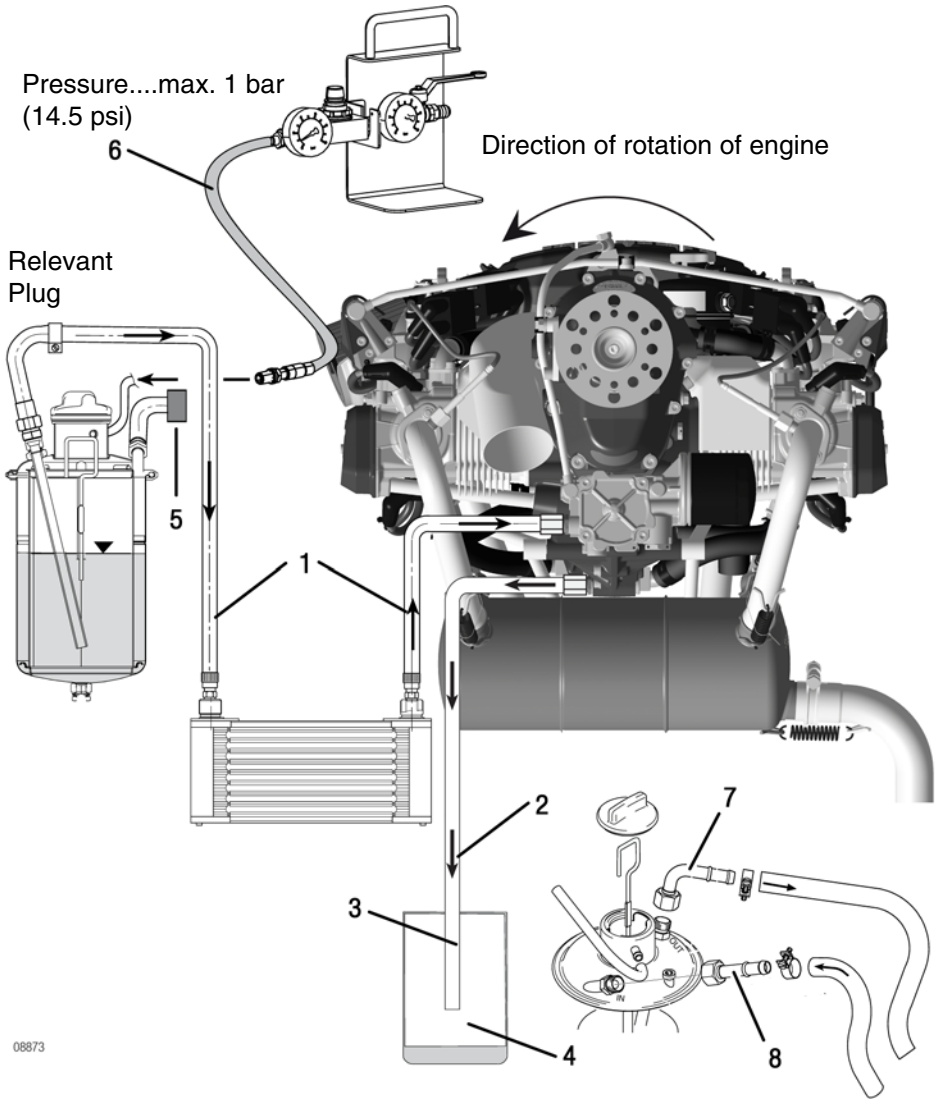
7	Turn the engine by hand in direction of normal rotation until the first pressure indication appears on the oil pressure gauge. Normally this will take approx. 20 turns. Depending on installation it may take up to 60 turns.
8	Stop the pressurisation.
9	Open the cap (5) for the oil return line on the oil tank and reconnect the engine oil return line (2) to the tank. **NOTICE** 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 (or SI-912 i-005 Oil level check, current issue).
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.

Graphic Lubrication system



Part	Function
1	Suction line
2	Oil return line
3	Free end
4	Tank
5	Plug
6	Purging connection
7	To oil pump
8	Return from engine

Fig. 11 02233

3.4) Checking the hydraulic valve tappet for correct purging

General note

See Fig. 12.

⚠WARNING

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 **top dead centre** 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 lb-force) 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.). ***NOTICE*** 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.

Graphic Hydraulic valve tappet

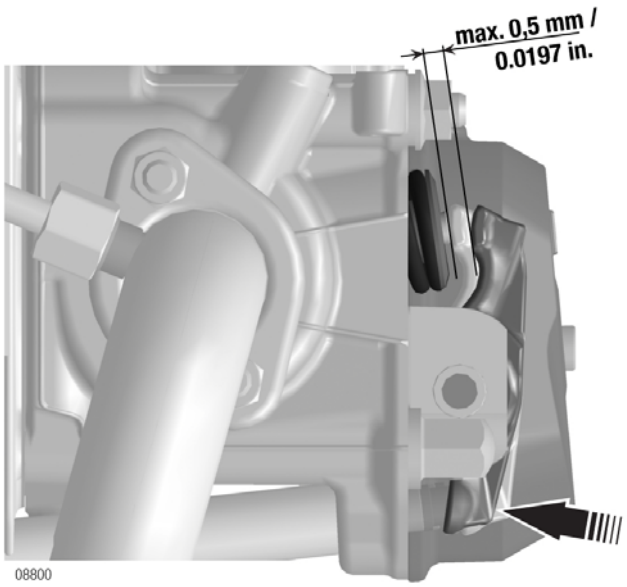


Fig. 12

3.5) Replacement of components

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 must be performed in accordance with the relevant Maintenance Manual.

NOTES

4) Data for optional components of lubrication system

4.1) Oil cooler

General note See Fig. 13.

Weight See chap. 72-00-00 section: 2.1).

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
Tightening torque	22 Nm (16.23 ft.lb.) and LOCTITE 648
Tightening torque of oil feed line and outlet	25 Nm (18.44 ft.lb.)

Nipple 13.2/9.5

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 sockets

NOTICE Counter hold screw sockets when securing the oil lines.

Metric screw sockets	
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 (18.44 ft.lb.)

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

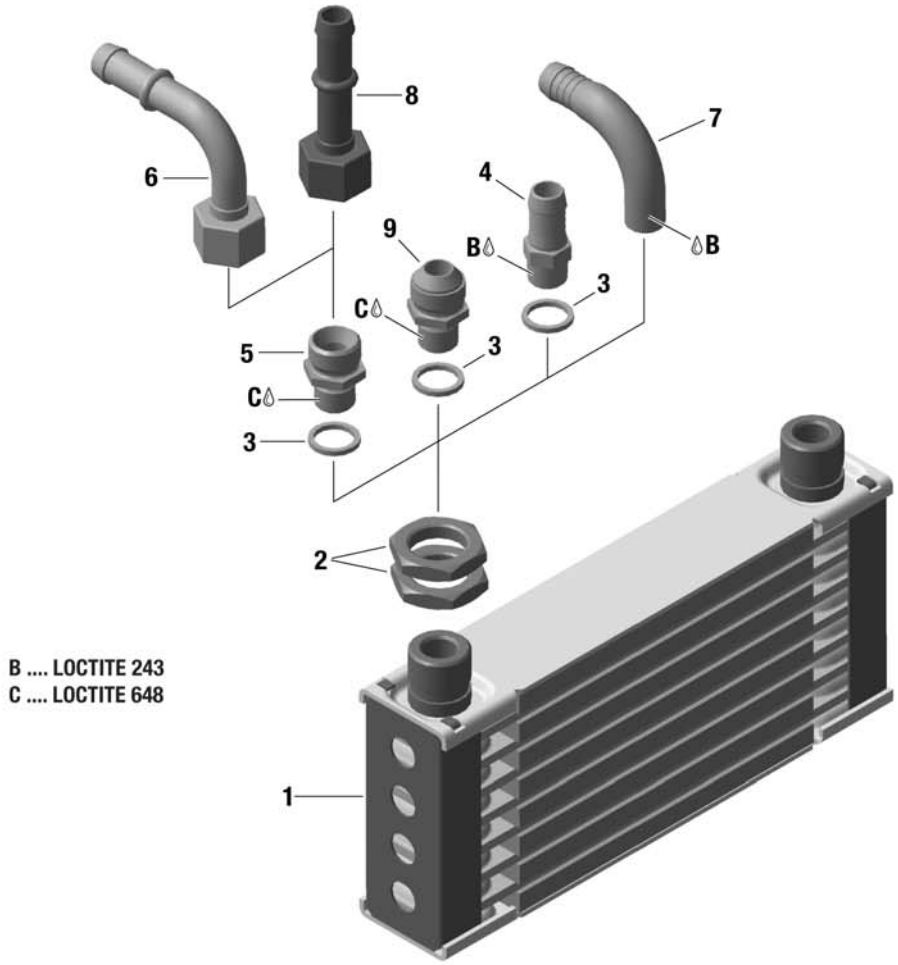
Bent socket

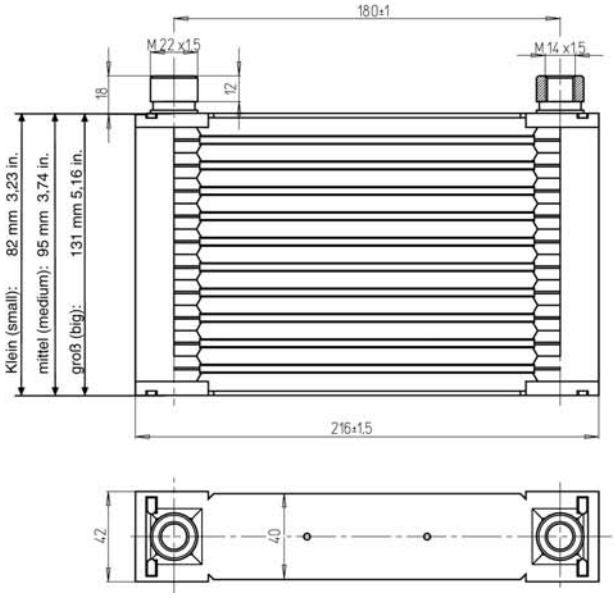
Bent socket (90°)	
Outer dia.	12 mm (0.47 in.)
Slip-on length	max. 24 mm (0.94 in.)
Tightening torque	25 Nm (18.44 ft.lb.)

Hose nipple with cap nut (straight nipple)

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

Connection variants





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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

Fig. 13 *08900*

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Chapter: 80-00-00

ELECTRIC STARTER

General note

⚠WARNING Non-compliance can result in serious injuries or death!
When working on the electric starter assy., there is a risk of short circuit and electrical fault.
All installation work on the electric starter assy. must be carried out with engine switched off and the battery (negative terminal) disconnected.
Ignition, main and lane selector switches must be set to OFF.

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 wires from starter relay to the electric starter	Page 3
Starter relay assy. technical data	Page 4

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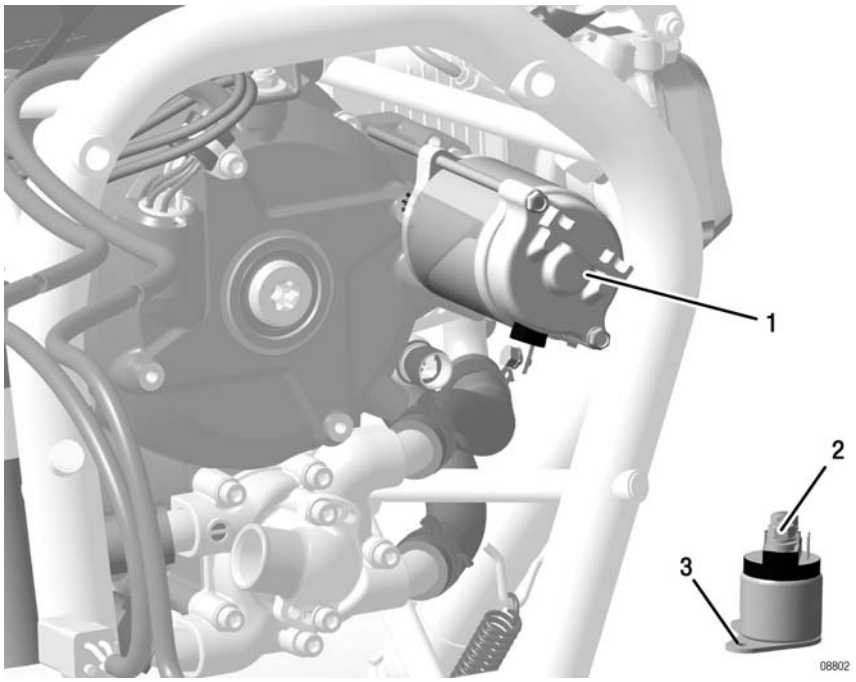
Overview Electric starter



Part	Function
1	Electric starter
2	Starter relay assy.
3	EMS ground

Fig. 1

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

Cross section

At least 16 mm^2 (2.48 in^2)

Output

0.8 kW (0.9 kW optional)

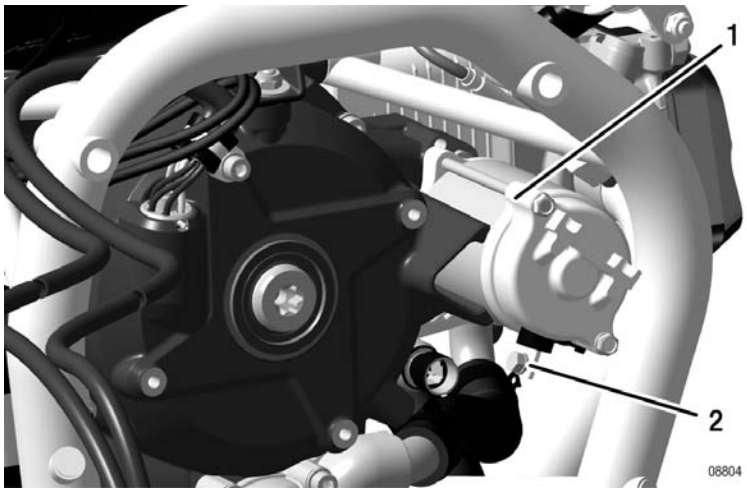
Connection

See Fig. 2.

Positive terminal (2): M6 screw connection (tightening torque 4 Nm (36 in.lb)) suitable for cable terminals according to DIN 46225 (MIL-T7928; PIDG or equivalent).

Graphic

Connection



Part	Function
1	Electric starter
2	Positive terminal

Fig. 2

Grounding cable

Grounding cable via engine block.

1.2) Starter relay assy. technical data

General note

See Fig. 3.

NOTICE 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 current

- Max. 75 A 8 (permanent)
- Max. 300 A/1 sec. (short duration)

Temperature

Permissible ambient temperature:

- Min. -40 °C (-40 °F)
- Max. +100 °C (212 °F)

Weight

See chap. 72-00-00 section: 2.1).

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).

Grounding

NOTICE The starter relay must be isolated from the aircraft ground. See chap. 24-00-00 section: FUSE BOX connections.

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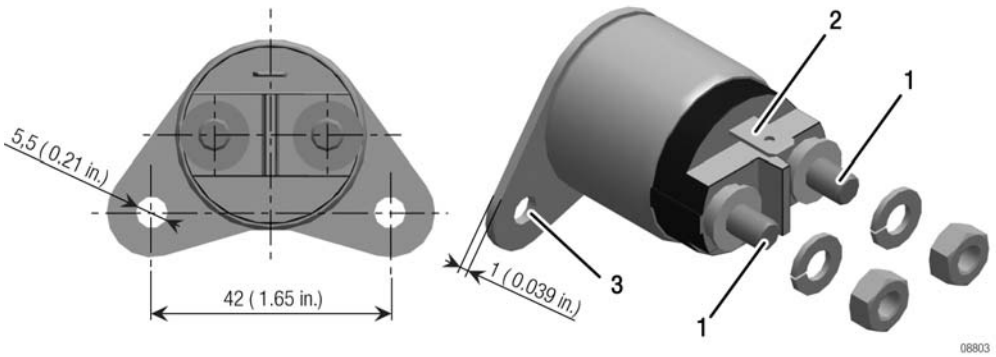
Graphic

Starter relay

NOTE: Starter relay must be installed isolated from airframe ground.



Part	Function
1	Main current connections
2	Control wiring
3	Ground

Fig. 3

NOTES

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Motornummer / Engine serial no.

Flugzeugtype / Type of aircraft

Flugzeugkennzeichen / Aircraft registration no.

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