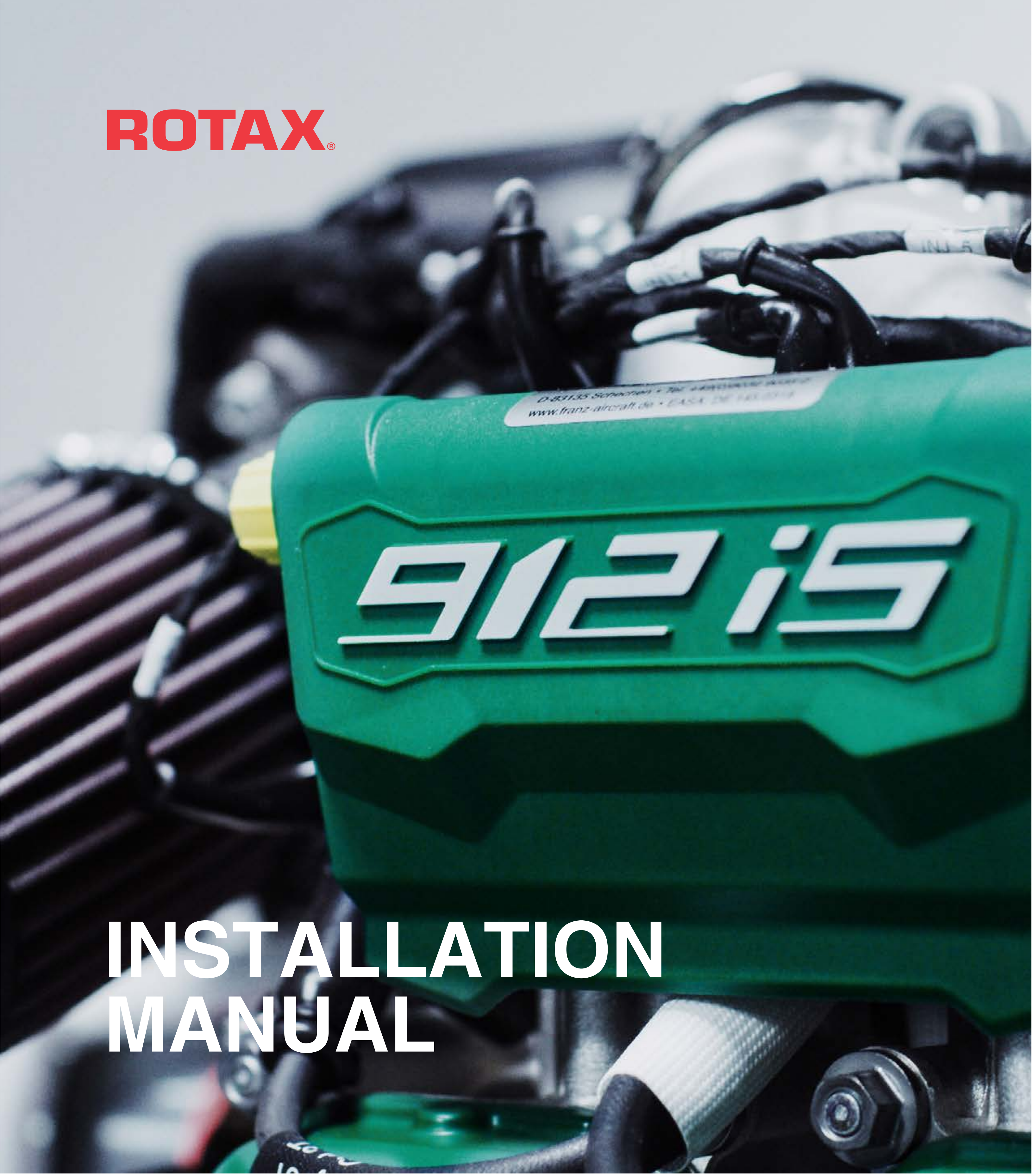
ROTAX®



INSTALLATION MANUAL

FOR ROTAX ENGINE TYPE 912 i SERIES
REF NO.: IM-912 i | PART NO.: 898648

A BRP BRAND
BRP

⚠ WARNING

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

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

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

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

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

Table of Content

INTENTIONALLY LEFT
BLANK

Chapter: INTRO
GENERAL NOTE

Foreword

Before carrying out engine installation related work on the engine, read this Installation Manual carefully. The manual will provide you with basic information on correct engine installation for safe engine operation.
If any passages of the manual are not clearly understood or if you have any questions, please contact a ROTAX® authorized distributor or their independent Service Center for ROTAX® aircraft engines.
BRP-Rotax GmbH & Co KG (hereinafter “BRP-Rotax“) wishes you much pleasure and satisfaction flying your aircraft powered by this ROTAX® aircraft engine.

The structure of the manual follows, whenever possible, the structure of the ATA (Air Transport Association) standards. The aim is the compatibility with the aircraft manufacturers documentation, which means they still must adapt or incorporate the documentation to their standard.

INTENTIONALLY LEFT
BLANK

Chapter: LEP
LIST OF EFFECTIVE PAGES

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

Chapter	Page	Date
	Title page	
INTRO	1	February 01 2020
	2	February 01 2020
LEP	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
TOA	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
00-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
	13	February 01 2020
	14	February 01 2020
	15	February 01 2020

Chapter	Page	Date
	16	February 01 2020
	17	February 01 2020
	18	February 01 2020
10-10-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
	13	February 01 2020
	14	February 01 2020
24-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020

Chapter	Page	Date
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
	13	February 01 2020
	14	February 01 2020
	15	February 01 2020
	16	February 01 2020
	17	February 01 2020
	18	February 01 2020
	19	February 01 2020
	20	February 01 2020
	21	February 01 2020
	22	February 01 2020
	23	February 01 2020
	24	February 01 2020
	25	February 01 2020
	26	February 01 2020
	27	February 01 2020
	28	February 01 2020
	29	February 01 2020
	30	February 01 2020
	31	February 01 2020
	32	February 01 2020
	33	February 01 2020
	34	February 01 2020
	35	February 01 2020
	36	February 01 2020
	37	February 01 2020
	38	February 01 2020
61-00-00	1	February 01 2020

Chapter	Page	Date
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
72-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
73-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
	13	February 01 2020

Chapter	Page	Date
	14	February 01 2020
	15	February 01 2020
	16	February 01 2020
	17	February 01 2020
	18	February 01 2020
74-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
75-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
	13	February 01 2020
	14	February 01 2020
	15	February 01 2020
	16	February 01 2020
	17	February 01 2020
	18	February 01 2020
76-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020

Chapter	Page	Date
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
78-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
79-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	7	February 01 2020
	8	February 01 2020
	9	February 01 2020

Chapter	Page	Date
	10	February 01 2020
	11	February 01 2020
	12	February 01 2020
	13	February 01 2020
	14	February 01 2020
	15	February 01 2020
	16	February 01 2020
	17	February 01 2020
	18	February 01 2020
	19	February 01 2020
	20	February 01 2020

Chapter	Page	Date
	21	February 01 2020
	22	February 01 2020
	23	February 01 2020
	24	February 01 2020
80-00-00	1	February 01 2020
	2	February 01 2020
	3	February 01 2020
	4	February 01 2020
	5	February 01 2020
	6	February 01 2020
	Index	
	Rear page	

Chapter: TOA
TABLE OF AMENDMENTS

Approval*
The technical content of this document is approved. It is issued under the authority of DOA ref. EASA. 21J.048.
This document is part of the ICA for product as specified in this manual.

Edition 2/Rev. 0	January 01 2019	Obsolete with Revision 1, which is a complete re-revision
Revision 1	February 01 2020	

no.	chapter	page	date of change	remark for approval	date of approval from authorities	date of inclusion	signature
0	INTRO	all	Jan. 01 2019	DOA*			
0	LEP	all	Jan. 01 2019	DOA*			
0	TOA	all	Jan. 01 2019	DOA*			
0	00-00-00	all	Jan. 01 2019	DOA*			
0	10-10-00	all	Jan. 01 2019	DOA*			
0	24-00-00	all	Jan. 01 2019	DOA*			
0	61-00-00	all	Jan. 01 2019	DOA*			
0	72-00-00	all	Jan. 01 2019	DOA*			
0	73-00-00	all	Jan. 01 2019	DOA*			
0	74-00-00	all	Jan. 01 2019	DOA*			
0	75-00-00	all	Jan. 01 2019	DOA*			
0	76-00-00	all	Jan. 01 2019	DOA*			
0	78-00-00	all	Jan. 01 2019	DOA*			
0	79-00-00	all	Jan. 01 2019	DOA*			
0	80-00-00	all	Jan. 01 2019	DOA*			

Current no.	Chapter	Page	Date of change	Remark for approval	Date of approval from authori-ties	Date of inclusion	Signature
1	LEP	all	February 01 2020	DOA*			
1	TOA	all	February 01 2020	DOA*			
1	10-10-00	5	February 01 2020	DOA*			
1	24-00-00	22-29	February 01 2020	DOA*			
1	61-00-00	3	February 01 2020	DOA*			
1	73-00-00	3-7, 17, 18	February 01 2020	DOA*			
1	75-00-00	13	February 01 2020	DOA*			
1	78-00-00	7	February 01 2020	DOA*			
1	79-00–00	6-9, 16, 18	February 01 2020	DOA*			

Summary of amendments

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

current no.	chapter	page	date of change	comment
0	all 76–00–00 24–00–00	all 5 6	Jan. 01 2019	New Edition, Change of company name, New text – Chap. 76–00–00, Installation position of the ECU. New rating – Chap. 24–00–00, Installation position of the ECU, RTCA/DO-160
1	10-10-00 24-00-00 61-00-00 73-00-00 75-00-00 78-00-00 79-00-00	5 22-29 3 3-7, 17, 18 13 7 6-9, 16, 18	February 01 2020	General: New text, correction of values. Chap. 73-00-00: Interface overview of tank system changed.

INTENTIONALLY LEFT
BLANK

Chapter: 00–00–00
GENERAL NOTE

TOPICS IN THIS CHAPTER

GENERAL

In this Manual all ROTAX® 912 i Series engines are described.

NOTE

ROTAX® 912 i Series includes 912 iS, 912 iS Sport and 912 iSc Sport.

Purpose

The purpose of this manual is to provide aircraft manufacturers with technical requirements (e.g. interface descriptions and limitations) that must be adhered to when installing this type of engine into an aircraft or certifying aircraft powered by this engine type. Furthermore it should allow independent ROTAX® Maintenance Technicians (iRMT) to install this engine into an airframe in compliance with the relevant installation and safety instructions provided by the engine manufacturer.

For detailed information related to aircraft and aircraft/engine installation, maintenance, safety or flight operation, consult the documentation provided by the aircraft manufacturer and/or its dealer.

For additional information on engines, their maintenance or parts, you can also contact your nearest ROTAX® authorized Aircraft Engine Distributor or their independent Service Center.

ROTAX Distributors

For ROTAX® Authorized Distributors for aircraft engines see latest Operators Manual or the official website www.FLYROTAX.com.

Engine serial number

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

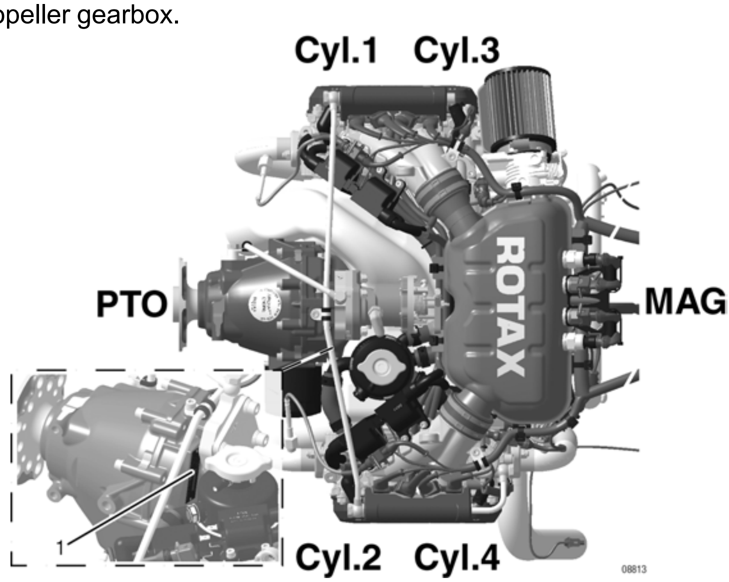


Figure 1.1: Engine serial number

1 *Engine serial number*

TYPE DESCRIPTION

The type description consists of the following parts:

e. g. **ROTAX**	**912**	**iSc**	**3**	
	type	certification	configuration	additional designation

Designation

Designation		Description
Type	**912**	4-cyl. horizontally opposed, normally aspirated engine.
Certification	**iSc**	Certified to EASA CS-E (TC No. EASA.E.121).
	iS	Approved according to ASTM F2339
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.
Additional designation		standard version
	Sport	version with improved torque curve

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

NOTE

Conversion of the version 2 to version 3 and vice versa may be accomplished by BRP-Rotax Authorized Distributors or their Service Center.

SCOPE OF SUPPLY

Basic

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

Optional

Preparation for hydraulic governor for constant speed propeller: (configuration 3 only)

- Exhaust system
- Cooling air baffle
- Engine suspension frame

AUXILIARY EQUIPMENT (OPTIONAL)

Any equipment not included as part of the standard engine version and thus not a fixed component of the engine is not in the volume of supply.
Components especially developed and tested for this engine are readily available at BRP-Rotax.

Auxiliary equipment certified

The following auxiliary equipment has been developed and tested for this engine.

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

Auxiliary equipment not certified

The following auxiliary equipment has not been developed and tested for this engine.

> **⚠ 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
- Starter relay

The representation of components that are not within scope of the delivery is purely symbolic. It does not constitute the specification of the engine version and shall therefore only be seen functionally. The actual interpretation/selection of corresponding regulations is the aircraft manufacturer’s responsibility.

ABBREVIATIONS AND TERMS (DEPENDING ON RESPECTIVE ENGINE TYPE)

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

Abbreviations	Description
CGSB	Canadian General Standards Board
DCDI	Dual Capacitor Discharge Ignition
DC	direct current
DOA	Design Organisation Approval
DOT	Department of Transport
EASA	European Aviation Safety Agency
IM	Installation Manual
ECU	Engine Control Unit
EGT	Exhaust Gas Temperature
INTRO	Introduction
EMS	Engine Management System
EMS GND	Engine system internal ground reference which is intended to be dis- connected from aircraft common ground during flight
EMC	Electromagnetic compatibility
EN	European Standard
ETFE	Ethylene Tetrafluoroethylene
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FOD	Foreign object damage
Fuse box	Power conditioning and distribution for the Engine Management System
hr.	hours
HIC A	Harness Interface Connector A
HIC B	Harness Interface Connector B
IAT	Indicated Air Temperature
ICA	Instructions for Continued Airworthiness
IFR	Instrument Flight Rules
IFSD	In-flight-shutdown
INJ 1–8	Injector 1–8
IPC	Illustrated Parts Catalog
ips	inch per second

Abbreviations	Description
iRMT	independent ROTAX Maintenance Training
ISA	International Standard Atmosphere
kg	Kilograms
KNOCK	Knock sensor
Lane A	System A of Engine Management System
Lane B	System B of Engine Management System
LOPC	Loss of power control
MAPS 1 & 2	Manifold Air Pressure Sensor 1 & 2
MATS 1 & 2	Manifold Air Temperature Sensor 1 & 2
MON	Motor Octane Number
MAG	Magneto Side
N	Newton
n.a.	not available
NDT	Non Destructive Testing
Nm	Newtonmeter
NVFR	Night Visual Flight Rules
OAT	Organic Acid (Additive) Technology
OHM	Overhaul Manual
OHV	Over Head Valve
OM	Operators Manual
OPS	Oil Pressure Sensor
OTS	Oil Temperature Sensor
PCD	Pitch Circle Diameters
PCV	Pressure Control Valve
PMA	Permanent magnet alternator
POA	Production Organisation Approval
PS	Power supply
PTFE	Polytetrafluoroethylene (Teflon)
PTO	Power Take Off
Rev.	Revision
ROTAX®	is a trademark of BRP-Rotax GmbH & Co KG

Abbreviations	**Description**
RON	Research Octane Number
RON 424	ROTAX® Standard 424
s.v.	still valid (only Illustrated Parts Catalog)
S/N	Serial Number
SAE	Society of Automotive Engineers
SEP	Single Engine Piston
SB	Service Bulletin
SI	Service Instruction
SI-PAC	Service Instruction Parts and Accessories
SPST	Single pole single throw
STP	Shielded twisted pair
SL	Service Letter
SMD	Surface Mounted Devices
TBO	Time Between Overhaul
TC	Type certificate
part no.	part number
TOA	Table Of Amendments
TOC	Table of content
TPS	Throttle Position Sensor
TSN	Time Since New
TSNP	Time Since New Part
TSO	Time Since Overhaul
V	Volt
VFR	Visual Flight Rules
LEP	List of Effective Pages
MM	Maintenance Manual
MEP	Multi Engine Piston
X3	Connector on Engine Management System wiring harness which serves as an interface for power supply
XXXX	shows the serial component number

WIRING COLOR CODES

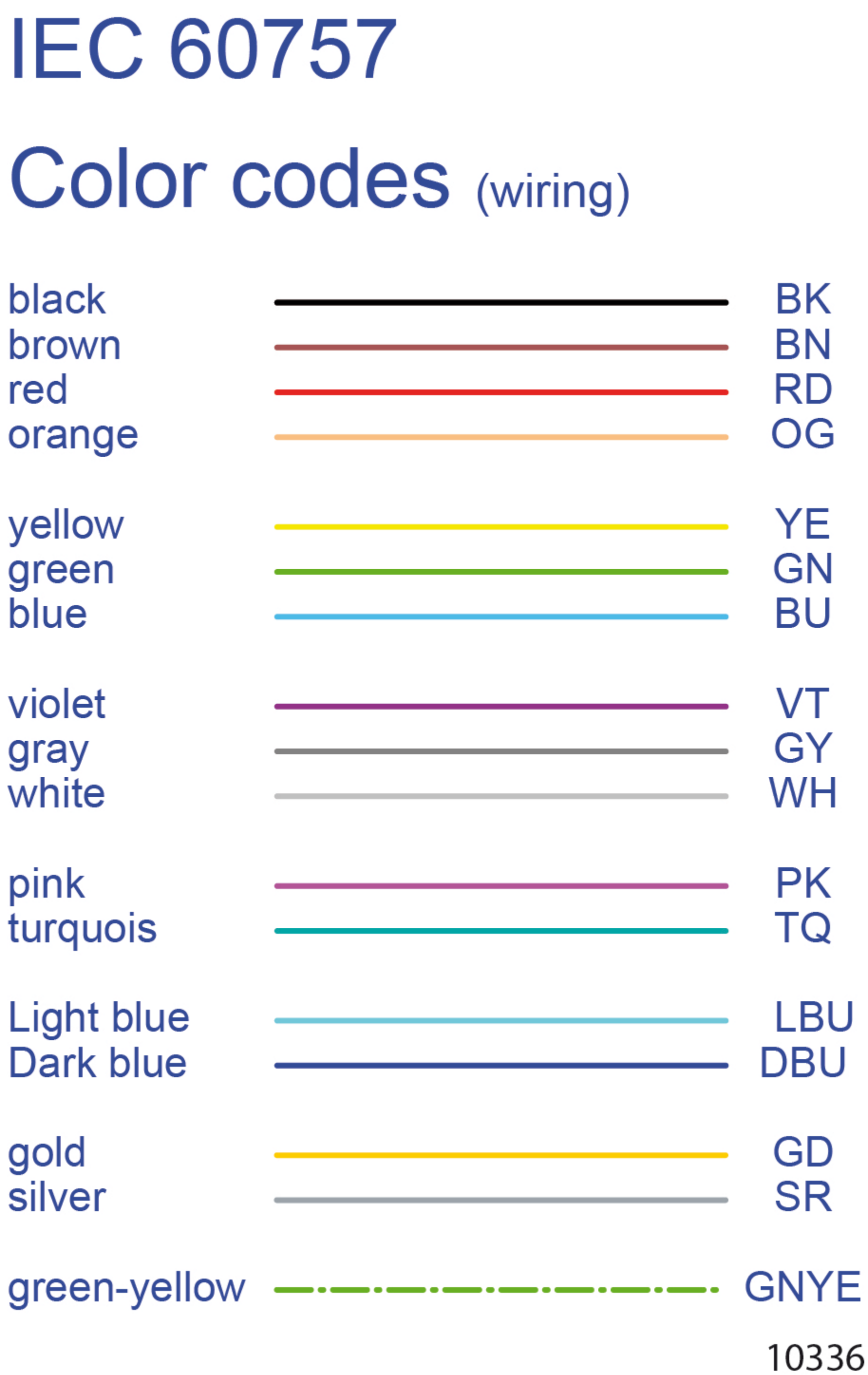


Figure 1.2

CONVERSION TABLE

Units of length:	**Units of power:**
1 mm = 0.03937 in 1 in = 25.4 mm 1 ft = 12 in = 0.3048 m	1 kW = 1.341 hp 1 hp = 0.7457 kW 1 kW = 1.3596 PS 1 PS = 0.7355 kW
Units of area:	**Units of temperature:**
1 cm^2 = 0.155 sq. in (in^2) 1 sq. in (in^2) = 6.4516 cm^2	K = °C – 273,15 °C = (°F – 32) / 1,8 °F = (°C x 1.8) +32
Units of volume:	**Units of velocity:**
1 cm^3 = 0.06102 cu in (in^3) 1 cu in (in^3) = 16.3871 cm^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	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
Units of mass:	**spec. fuel consumption:**
1 kg = 2.2046 lbs. 1 lb. = 0.45359 kg	1 g/kWh = 0.001644 lb/hph 1 lb/hph = 608.277 g/kWh
Density:	**Units of torque:**
1 g/cm^3 = 0.016018 lb/ft^3 1 lb/ft^3 = 62.43 g/cm^3	1 Nm = 0.737 ft lb = 8.848 in lb 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm
Units of force:	**Cable cross-section: Conversion table-Wire Gauge: AWG-mm^2**
1 N = 0.224809 lbf 1 lbf = 4.4482 N **Units of pressure:** 1 Pa = 1 N/m^2 1 bar = 100 000 Pa / 1000 hPa / 100 kPa 1 bar = 14.503 lbf/in^2 (psi) 1 in Hg = 33.8638 hPa	AWG —> mm^2 4 —> 21 6 —> 13 8 —> 8.4 10 —> 5.3 12 —> 3.3 14 —> 2.1 16 —> 1.3 18 —>0.8 20—> 0.52

SAFETY NOTICE

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

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

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

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

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

⚠ WARNING
Identifies an instruction which, if not followed, may cause serious injury or even fatal injury.

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

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

NOTE

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

ENVIRONMENTAL NOTE
Environmental notes give you tips on environmental protection.

TIP This information gives you additional advice and tips.

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

SAFETY INFORMATION

Use for intended purpose

> **⚠ WARNING**
>
> **Non-compliance can result in serious injuries or death!**
> The user has to assume all risks possibly arising from utilizing auxiliary equipment.

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

- This engine is not suitable for aerobatics (inverted flight, etc.). Flight attitudes outside the permissible limits are not allowed
- This engine has exclusively been developed and tested for fixed wing, gyrocopter, pusher and tractor applications. In case of any other usage, the OEM is responsible for testing and the correct function of the engine
- It should be clearly understood that the choice, selection and use of this particular engine on any aircraft is at the sole discretion and responsibility of the aircraft manufacturer, assembler or owner/user
- Due to the varying designs, equipment and types of aircraft, BRP-Rotax grants no warranty on the suitability of its engines use on any particular aircraft. Further, BRP-Rotax grants no warranty on this engines 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!**
> For each use of DAY VFR, NIGHT VFR or IFR in an aircraft the applicable legal requirements and other existing regulations must be adhered to.

- In addition to observing the instructions in our Manual, general safety and accident precautions, 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 shall be applied
- For continued airworthiness see Maintenance Manual Line
- Unauthorized modifications of engine or aircraft will automatically exclude any liability of the engine manufacturer for consequential damage

Engine operation

- The engine must always be operated according to the content of the latest Operators Manual
- To eliminate the risk of injury or damage, ensure any loose equipment or tools are properly secured before starting the engine
- The use of propellers and their fastenings which exceed the specified values of moment of inertia and imbalance is not allowed and releases the engine manufacturer from any liability
- Improper engine installation, use of unsuitable piping for fuel, cooling and lubrication system and use of unsuitable wiring for electric and engine management system releases the engine manufacturer from any liability

INSTRUCTION

Engines require instructions regarding their installation, application, use, operation, maintenance and repair.
Technical documentation and regulations are useful and necessary complementary elements for trainings, but can by no means substitute for theoretical and practical instructions.
These instructions should cover explanation of the technical context, advice for operation, maintenance, installation, 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-Rotax. Modifications are only allowed after consent of the engine manufacturer.

Spare parts

See Illustrated Parts Catalog, latest issue for the respective engine type.

Standard tools / Special tools

ATTENTION

Only use tools and appliances which are suitable for the relevant task according to the latest Manuals.

State of delivery

⚠ WARNING
Engine and gearbox are delivered in “dry“ conditions (without fuel, oil and coolant). Before putting the engine into operation it must be filled with oil and cooling liquid. Use only oil and coolant as specified.

See latest Operators Manual and Service Instruction SI-912 i-001 “Selection of suitable operating fluids“, current issue.

TECHNICAL DOCUMENTATION

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

Documentation

- Installation Manual
- Operators Manual
- Maintenance Manual (Line and Heavy Maintenance)
- Overhaul Manual
- Illustrated Parts Catalog
- Alert Service Bulletin
- Service Bulletin
- Service Instruction / Service Instruction-Parts and Accessories
- Service Letter

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

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

Reference This Manual is only part of the technical documentation and will be supplemented by the respective Operators Manual, Maintenance Manuals and Illustrated Parts Catalog.

ATTENTION
Pay attention to references to other documentation, found in various parts of this Manual.

If not stated otherwise, any reference to a document refers to the latest edition issued by BRP-Rotax.

Illustrations The illustrations in this Manual are merely sketches and show typical arrangements. They may not represent full detail or the exact shape of the parts but should outline the same or

similar function. Therefore deriving dimensions or other details from illustrations is not permitted.
TYPICAL indicates a general view which may not represent exact details.

NOTE

The Illustrations in this Manual are stored in a graphic database system and are provided with a consecutive, irrelevant, number.
This number (e.g. AE 5iS001) is of no significance for the content.

Some measurements are given in the drawings, these are manufacturing dimensions and are subject to corresponding tolerances.

Installation drawings

Installation drawings and a DMU-model for (virtual) installation analysis are available from the ROTAX® Authorized Distributors or their independent Service Centers on special request and relevant non disclosure and copyright regulations.

The illustrations in this Manual show a possible installation variant including non certified parts.

Chapter: 10–10–00
<u>STORAGE AND INSTALLATION</u>

<u>TOPICS IN THIS CHAPTER</u>

GENERAL

ATTENTION
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!

ENGINE STORAGE

The engine is preserved at BRP-Rotax thus guaranteeing proper protection against corrosion damage for at least 12 months after the date of delivery from BRP-Rotax.

This warranty is subject to the following conditions:

- The engine must be stored in the GENUINE-ROTAX®-packing as supplied by BRP-Rotax.
- 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 bag (blue) surrounding the engine must not be damaged or removed, as it protects the engine from corrosion and oxidation

If the engine is stored for a period longer than 12 months (or it is not stored in the GENUINE-ROTAX®-packing) then maintenance tasks must be carried out every 3 months as per the currently valid Maintenance Manual Line.

UNPACKING THE ENGINE

ATTENTION
The attachment screws are only for transport and must not be used in the aircraft.

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

Unpacking the engine

When the engine is delivered, check for damage of the packaging. If the package is damaged, contact a ROTAX® Authorized Distributor or their independent Service Center for ROTAX® aircraft engines.
To unpack a new engine and for checking the state of delivery, proceed as follows:

1. Remove the wooden cover.
2. Remove the bag and protective wrapping around the engine.
3. Check that the serial number and engine type on the type plate are identical to those shown on the delivery note.

If the serial number or the engine type is deviating from the delivery contact a ROTAX® Authorized Distributor- or their independent Service Center for ROTAX® aircraft engines.

4. Inspect the engine for damage or corrosion.
   If the engine is damaged or corroded, contact a ROTAX® Authorized Distributor- or their independent Service Center for ROTAX® aircraft engines.

5. Remove the transport bracket screws from wooden bottom of the box.

6. Remove transport brackets from engine.

Protective coverings

ATTENTION

Protective coverings are only for use during transport and engine installation. They must be removed completely (including sealing materials) 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 line or hose.

The protective coverings can be found at following locations:

Pos.	Installation location	Amount
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	
8	Cover plate hydraulic governor (if configuration 3)	

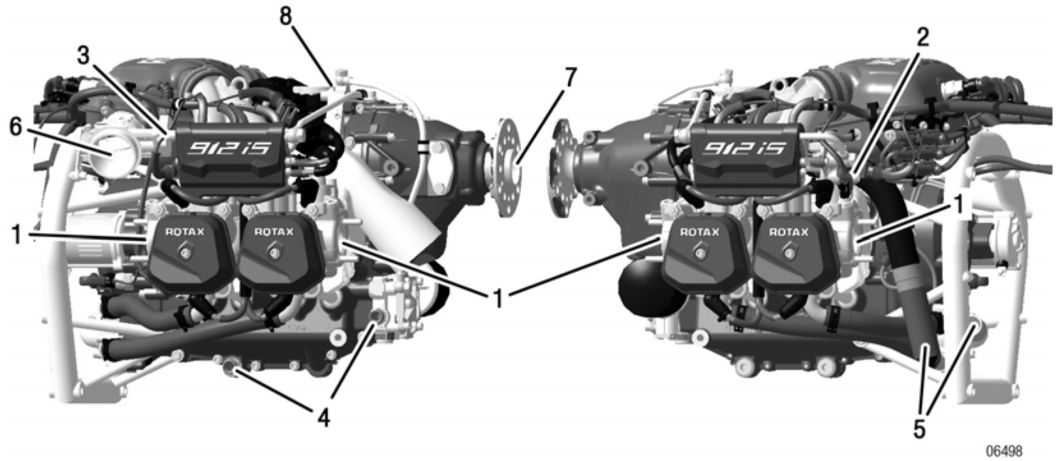


Figure 2.1: Protective covering positions

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*	8	*Cover plate governor (if configuration 3)*

ENGINE HANDLING

ATTENTION
Do not use the fuel lines or the wiring harness for lifting the engine!

Attachment points

The engine may only be lifted on the dedicated attachment points by using the GENUINE-ROTAX®- engine lift set and a spreader bar with 350 mm (13.78 in) distance between lifting points. Make sure that lifting device does not bend the attachment lugs by relevant force distribution.

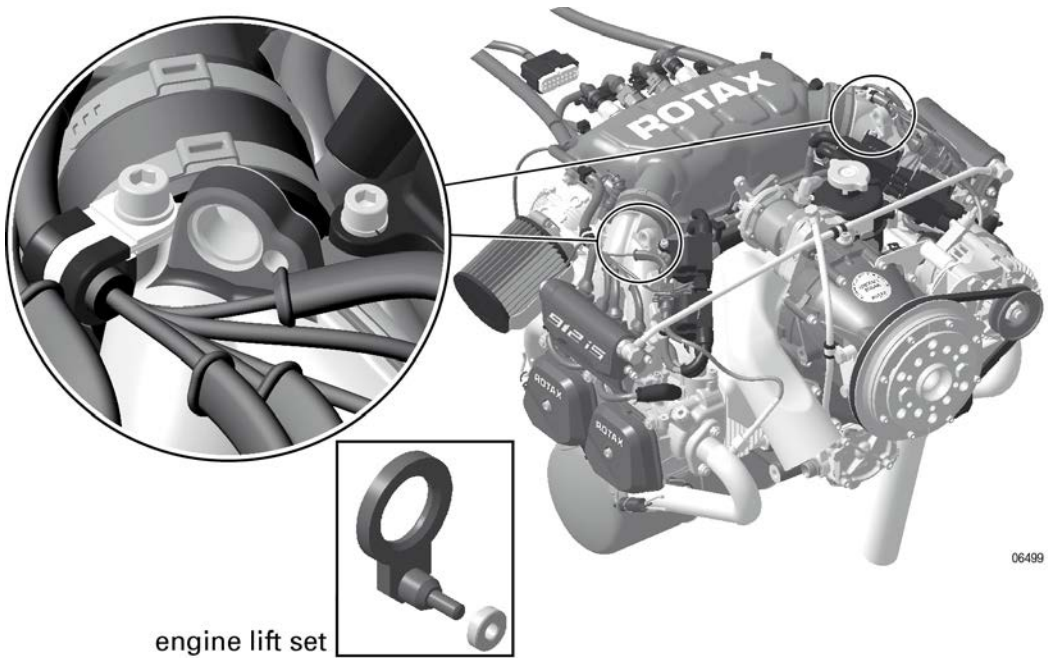


Figure 2.2: Attachment points

ENGINE SUSPENSION AND INSTALLATION POSITION

ATTENTION

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 and 4 on the engine suspension frame).

Engine suspension frame If the engine suspension frame is not used or if modified:

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

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

ATTENTION

The engine suspension frame has been verified to following limit manoeuvring load factors: n = 6 downwards/upwards n = 2 sidewards

ENGINE SUSPENSION

The rubber mounts for neutralizing 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 behavior.

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

Noise emission and vibration

ATTENTION
The engine suspension must be designed to prevent excessive engine movement and to minimize noise emission and vibration on the airframe.

ATTENTION
If the GENUINE-ROTAX®-engine suspension frame is not being used, a vibration test must be carried out.

See Service Letter SL-912–010 “Vibration test”, latest issue.

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 is taken care of accordingly.

Damping elements

ATTENTION
All elements for neutralizing vibrations must be captive.

Standard aircraft industry damping elements (e.g. Lord) are suitable. The illustration shows Lord J 3608-1 or J 3608-2 rubber mounts.

NOTE

Consult the parts manufacturer for the dimensions of the rubber mounts.

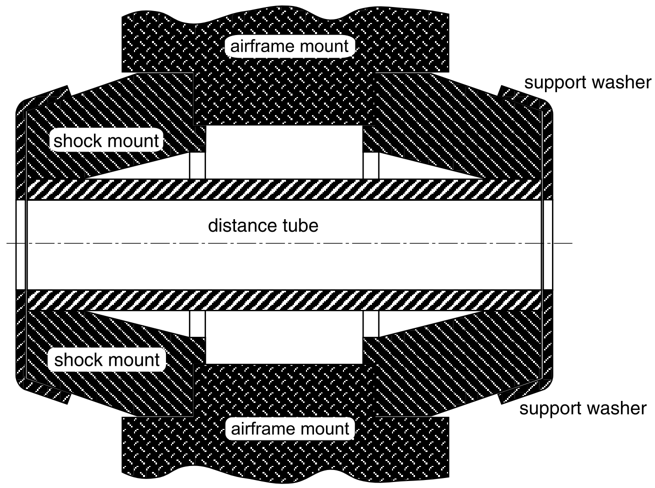


Figure 2.3: Damping element engine suspension

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

MECHANICAL INTERFACES

ATTENTION

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

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

⚠ 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.

ATTENTION
The attachment screws are only for transport and must not be used in the aircraft.

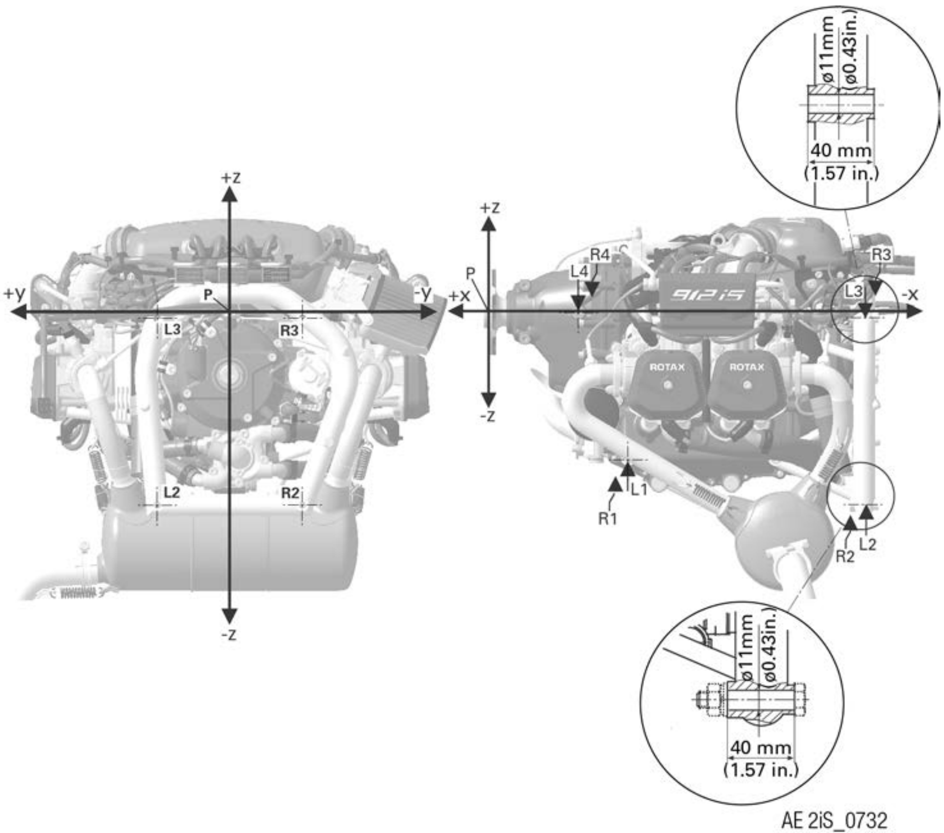


Figure 2.4: Attachment points

Attachment points	L1	R1	L2	R2	L3	R3	L4	R4
x-axis (in)	-7.90		-22.20				-5.05	
y-axis (in)	-2.80		4.13	-4.13	4.13	-4.13	3.43	-3.43
z-axis (in)	-8.31		-10.91		-0.28		0	
Max. permissible force (secure load) in x axis (lbf)	1124.04						427.14	
Max. permissible force (secure load) in y axis (lbf)	1124.04		449.62				427.14	
Max. permissible force (secure load) in z axis (lbf)	1124.04		674.43				427.14	
Max. permissible bending moment (secure load) in x, y, z axis (lbf ft)	56.8		73.75				28.7	
Thread	M10						M10	
Max. usable Thread length (in)	0.98						0.63	

PERMISSIBLE INSTALLATION POSITIONS

ATTENTION

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

NOTE

All distances are given in relation to the reference coordinate system (P).

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°

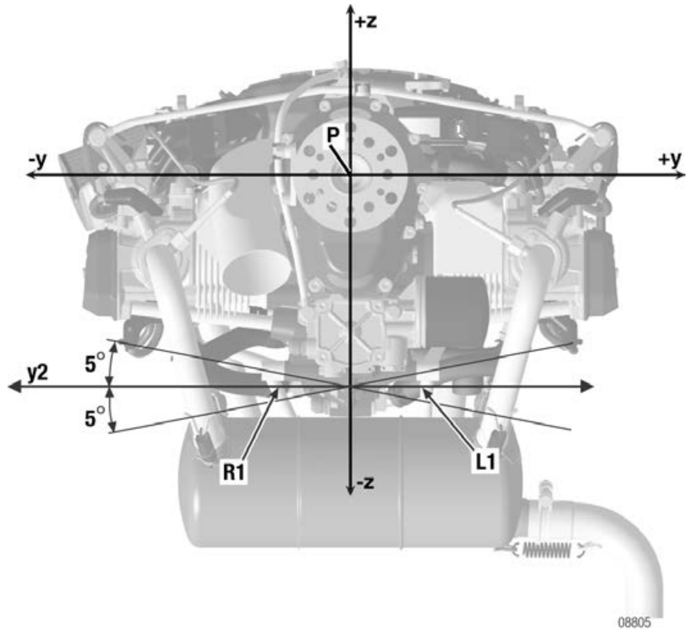


Figure 2.5: Deviation Propeller axis

Vertical axis The y-axis must be perpendicular to the longitudinal axis of the aircraft.
Permissible deviation from perpendicular: ±10°

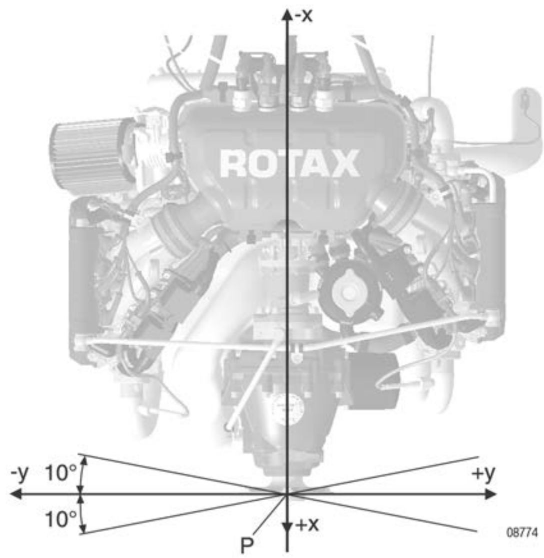


Figure 2.6: Deviation Vertical axis

PREPARATIONS FOR TRIAL RUN OF ENGINE

⚠ **WARNING**

Non-compliance can result in serious injuries or death!
Engine start and operation must be observed as described in the Operators Manual.

CHECKS BEFORE TRIAL RUN

⚠ **WARNING**

Non-compliance can result in serious injuries or death!
Always observe the engine from a safe place while it is running. Check that the cockpit is occupied by a competent operator.

NOTE

This checklist is not exhaustive. Consult all Instructions for Continued Airworthiness.

See latest Operators Manual of the respective engine type.

Review relevant Service Instruction SI-912 i-001 for "Selection of suitable operating fluids" current issue.

- Check engine oil, coolant and fuel level
- Make sure that no tools remain in the engine compartment
- Check for other foreign or loose objects
- Check for tight fit of propeller and pitch setting
- Check that propeller control hits stops and operates on correct range of motion (if equipped)
- Fasten the aircraft to the ground in an appropriate way and use chocks for the wheels. Secure the area surrounding the propeller to exclude hazards to other persons
- Visual inspection of engine and accessories
- Check for leaks
- Turn on fuel pumps and check entire system for leaks
- Check suspension of engine
- Check for a tight fit of oil filter
- Check oil hose connections are correct
- Check for correct oil system purging

- Check if other systems and instruments are installed appropriately
- Check gauges for accuracy
- Check wires routed properly and secured
- Check exhaust system for security and free of blockage
- Preheat engine in cold weather

CONDUCT TEST RUN

See latest Operators Manual of the respective engine type.

⚠ 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.

⚠ WARNING
Non-compliance can result in serious injuries or death! Proper clothing, ear protection etc. should be used during any engine test run.

VERIFICATION OF THE THROTTLE LEVER DETENT FOR MAX. CONTINUOUS POWER

Performance check in accordance with Operators Manual.
If nominal performance won't be reached or is in excess of, examination of the installation and engine will be necessary.

ATTENTION
Don‘t conduct any test flights before fault has been traced and found.

NOTE

Make an entry of the details and test results into the engine log book.

Chapter: 24–00–00
ELECTRICAL POWER

TOPICS IN THIS CHAPTER

GUIDELINES FOR THE CIRCUIT WIRING

General

BRP-Rotax cannot prescribe the exact wiring installation design due to the existence of many different types of aircraft, where our engines are installed. Accordingly, it is the responsibility of the airframe manufacturer to define the specific routing of the external wiring .

NOTE

Good practices for the installation of aircraft related wiring is given within following standards and Advisory Circulars (search on the internet):

- *Aviation Maintenance Technician Handbook FAA-H-8083-30*
- *AC 21-99: Aircraft Wiring and Bonding*
- *AC 43.13: Acceptable Methods, Techniques and Practices - Aircraft Inspection and Repair*

⚠ WARNING
Non-compliance can result in serious injuries or death! The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

ATTENTION
The routing and connections have to be completed by the aircraft manufacturer in accordance to ASTM F2639 and effective certification FAR or EASA.

ATTENTION
The power supply to the various consumers (e.g. battery) must have adequate circuit protection (fuses, fusible links or circuit breakers). Using incorrectly rated fuses may result in destruction of the equipment. Do not route consumer cables (e.g. battery) alongside the secondary ignition cable. There is a risk of electromagnetic interference or damage.

ATTENTION
Do not bend, kink, pinch or otherwise improperly stress the wiring harness. Use proper routing, clamping and strain relief on wiring harnesses.

NOTE

Follow the relevant regulations (licensing conditions)

of the maintenance staff, during manufacturing of the wiring harness and repairs or modifications of the aircraft

The representation of components (such as switches, protection devices etc.) that are not included in the scope of engine delivery is purely symbolic. It does not constitute a specification of the version and shall therefore only be seen functionally.
The actual interpretation/selection of the corresponding regulations and specified characteristics is the task of the aircraft manufacturer.

APPROVAL OF ELECTRIC AND ELECTRONIC COMPONENTS (EQUIPMENT QUALIFICATION ACCORDING TO 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 912iS/912 iS Sport/ 912 iSc Sport are considered as part of the equipment and have been tested and qualified according to the following table:

DO-160G, Section 4 — Temperature and Altitude	Cat. B3V[1]
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, L and M for ECU)
DO-160G, Section 9— Explosion Proofness	[2]
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	[2]
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-160G, Section 21 — Emission RF Energy	Cat. B
DO-160G, Section 22 — Lightning Induced Trans. Suspectibility	Cat. A3G3L3

1. Components were tested at „operating low temperature“ of - 25 °C (- 13 °F) instead of - 45 °C (- 49 °F) and „Altitude“ of 18.000 ft instead of 25.000 ft.
2. Test not performed

DO-160G, Section 23 — Lightning Direct Effects	2
DO-160G, Section 24 — Icing	2
DO-160G, Section 25 — Electrostatic Discharge	Cat. A

BATTERY

ATTENTION

The use of rechargeable batteries with lithium–ion technology should only be used in combination with a suitable battery management system. If such an battery is used, the responsibility is up to the aircraft manufacturer. The approval of the relevant aeronautical authority may be necessary. For installation of lithium-ion batteries refer e.g. to FAA AC No: 20-184

ATTENTION

Observe the specifications of the battery.
The size of the battery needs to be adequate for essential flight equipment and has to meet the airworthiness requirements of its place of operation.

When sizing the battery ensure that during each operating state and also during the transition between two operation states a sufficient supply of the display is guaranteed (e. g. during engine start). Furthermore, it must be ensured that at least 30 minutes after failure of the primary power supply the display is supplied with sufficient energy, if it is necessary for a safe operation of the aircraft.

NOTE

If the aircraft is regularly used at temperatures below - 5 °C (23 °F) (i.e. the engine start is carried out at these engine and ambient temperatures) it is recommended to provide a connection for an external power supply and that adequate engine pre-heating is applied.

Technical data

ATTENTION

If all consumers are active, take care not to discharge the battery deeply.

The engine bus voltage is displayed via the CAN BUS. It can also be displayed using the `B.U.D.S. Aircraft Diagnostic Tool`. Whether the required minimum voltage of 9 V is actually observed (e. g. during engine start) can only be determined with an oscilloscope.

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 `B.U.D.S. Aircraft Diagnostic Tool` or on display)

Nominal voltage	12 V
Internal resistance	maximal 10mΩ at -18 °C (-0.4 °F)
Cold Cranking Ampere (cca)	At least 350 A at -18 °C (-0.4 °F) (SAE J537)
Capacity	At least 16 Ah

The selected battery has to provide a min. voltage of 9 V on the ECU BUS during start-up (also in cold weather conditions). The ECU BUS voltage is displayed via the CAN BUS. The ECU BUS voltage can also be displayed using the B.U.D.S. Aircraft diagnostic tool. Whether the required minimum voltage of 9 V is actually provided (e.g. during engine start) can only be determined with an oscilloscope.

NOTE

The choice to use a lower capacity battery is up to the aircraft manufacturer. It should be noted that additional electrical loads, which are in some cases required by law, affect the battery performance during the starting process,(e.g. ACL (Anti Collision Light), Navigation Light, Avionics).

ATTENTION

The connection from the battery to the EMS system must be kept separate from the one to the starter relay in order to avoid unnecessary voltage drop.

GROUNDING CABLES (EMS GROUND POINT/AIRCRAFT GROUND POINT)

During installation, a distinction is made between 2 circuits:

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

At the engine start (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.

The electrical system of EMS works isolated from the rest of the aircraft.
The engine block must be connected to the aircraft using a properly sized line (minimum the same cable cross section as starter supply), to allow for sufficient starter current and to avoid static electricity between the engine and the aircraft.
Components that must not be connected to the aircraft ground or that can be decoupled from the firewall or in the cockpit:

- ECU
  See Chapter 76-00-00 section ECU.
- Regulator A of Fuse box
  See Chapter 24-00-00 Requirements for correct operation of the integrated rectifier regulator.
- Starter relay
  See Chapter 80–00–00 Starter relay assy. technical data.

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

Continuity must not be present.

NOTE

EMS ground must be connected to the regulator plate A (heat sink of the Fuse box) only.
Aircraft ground must be connected to the regulator plate B (heat sink of the Fuse box) only.
Regulator B represents the negative pole of the internal generator for the supply of the aircraft. Connection of regulator B to the airframe ground or the negative pole of the battery is required.

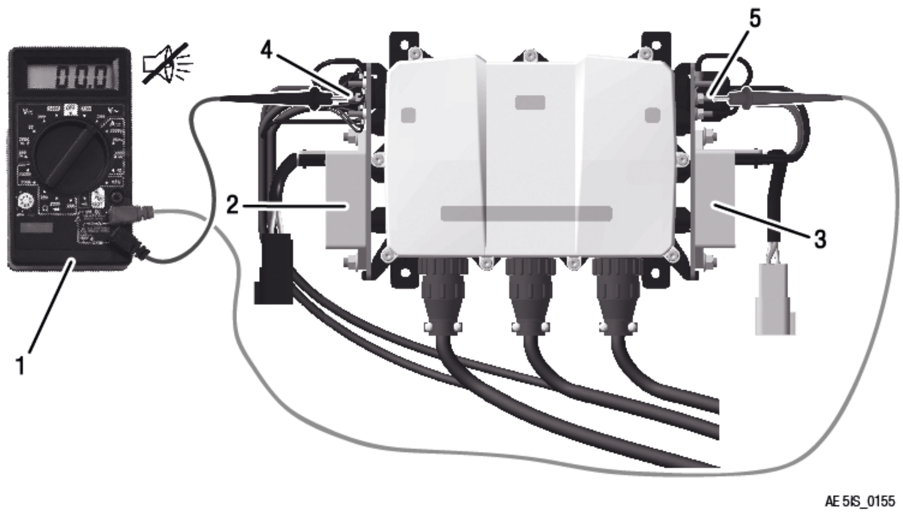


Figure 3.1: Continuity check, typical

1	*Multimeter*	*2*	*Rectifier regulator A (black wire connector)*
3	*Rectifier regulator B (grey wire connector)*	*4*	*Ground connections regulator A*
5	*Ground connections regulator B*		

CONTROLLER BOARDS ON THE FUSE BOX

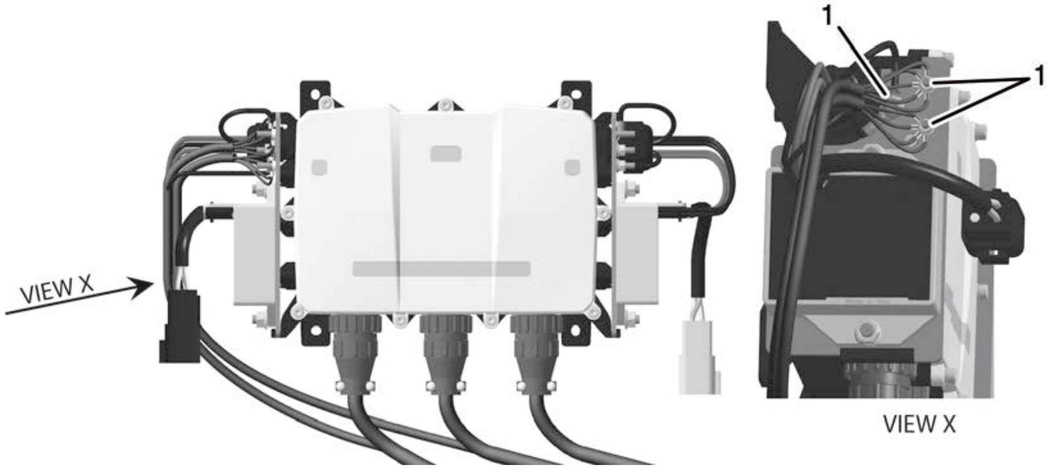


Figure 3.2: Fuse box, typical

1 *EMS ground attachment points (studs)*

The EMS grounding cables of the wiring harness (labelled: "Regulator A“ on cables with ring terminals) must be connected to the 3 attachment points of the EMS ground (Regulator A). Each cable bundle of ground wires from the wiring harness has to be connected to one of the unused ground studs.
EMS ground has 3 interconnected ground connections (studs) which may be used interchangeably.
Airframe ground (Regulator B), also has 3 interconnected ground connections (studs) which may be used interchangeably, one of which must be connected to the airframe ground.

NOTE

Airframe ground is independent of EMS ground and must NOT be interconnected.

ATTENTION
Observe the tightening torque. The tightening torque of the nuts to secure the EMS grounding cables and the airframe ground of the respective attachment points must be 1.2 Nm (10.7 in.lb).

See SI-912 i -019, Information on Fuse box assy. modifications for ROTAX® Engine Type 912 i (Series).

FUSE BOX CONNECTIONS

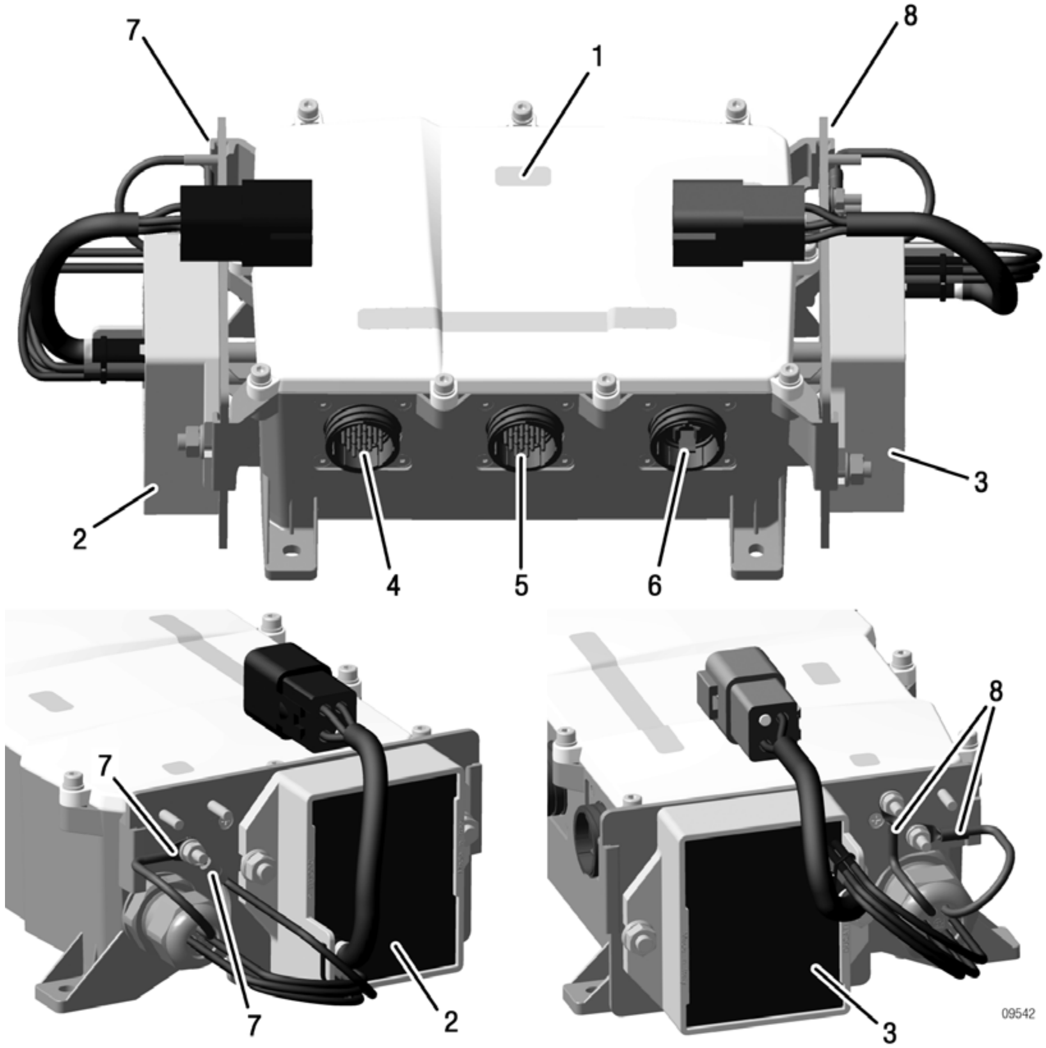


Figure 3.3: Fuse box connections, typical

1	*Fuse box assy.*	2	*Rectifier regulator A (black plug)*
3	*Rectifier regulator B (grey plug)*	4	*Plug connection X1 (LANE A)*
5	*Plug connection X2 (LANE B)*	6	*Plug connection X3 (power)*
7	*EMS ground (Generator A)*	8	*Aircraft ground (Generator B)*

INTERNAL GENERATOR

The internal generator has two isolated coils integrated (individual generators). During the starting operation, the EMS system is powered by the battery. With sufficient speed generator B takes over this function. After the EMS system check, generator A takes over the supply of the EMS system (engine), if the switching threshold is exceeded. Generator B is then used to supply the aircraft instruments and for charging the battery.
While the engine is running, the generator B can be used for the aircraft instrumentation.

- Generator A 14.2 V/16 A (220 W nominal capacity at 20 °C/68 °F)
- Generator B 14.2 V/30 A (420 W nominal capacity at 20 °C/68 °F)

ATTENTION

If generator A fails, generator B takes over its functions. The airframe electrical components and the instruments will be supplied by the battery. The battery will no longer be charged!

ATTENTION

If generator B fails, the battery will no longer be charged. The engine still runs on generator A and the instruments will be supplied by the battery. The function of the instruments depends on the state of charge of the battery.

The charging of the battery from generator B is not monitored by the EMS. An ammeter has to be provided by the aircraft manufacturer according to the latest requirements.

Connections

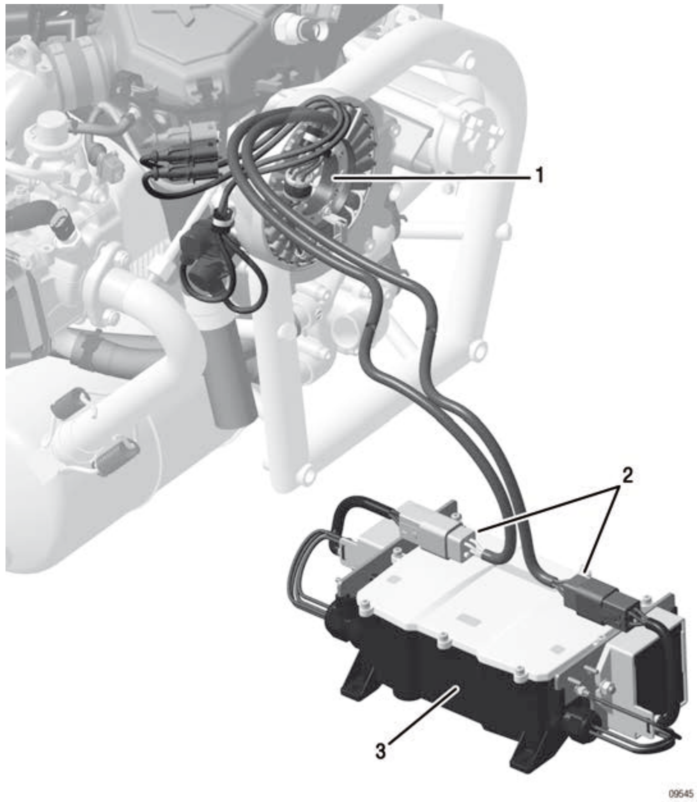


Figure 3.4: Connections internal Generator, typical

1 Stator

2 DEUTSCH-Connector

3 Fuse box with rectifier regulators

Power supply wires from the internal generator (exciting from the left side (cylinders 2/4) of the ignition housing) to the regulators on Fuse box.
DEUTSCH-Connector:

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

SYSTEM LIMITATION

Valid Installation Positions

The Fuse box must not be installed in the cockpit. Installation is only allowed in the engine compartment.

Component	Min.	Max.
Component temperature[3]	-	80 °C (176 °F) (measured in area (2)).

NOTE

The performance specifications are given for optimal cooled components.

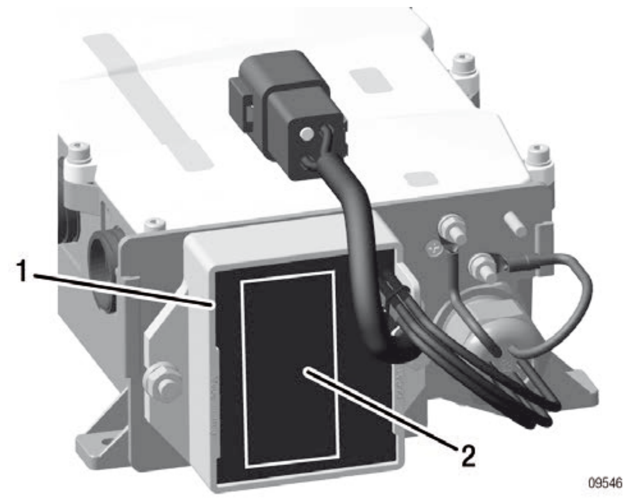


Figure 3.5: Regulator -Measurement area for component temperature, typical

1	*Rectifier regulator*	*2*	*Measuring area for component temperature*

Interface Description

The Fuse box is representing the interface between the airframe and the engine.

3. Measurement area for component temperature

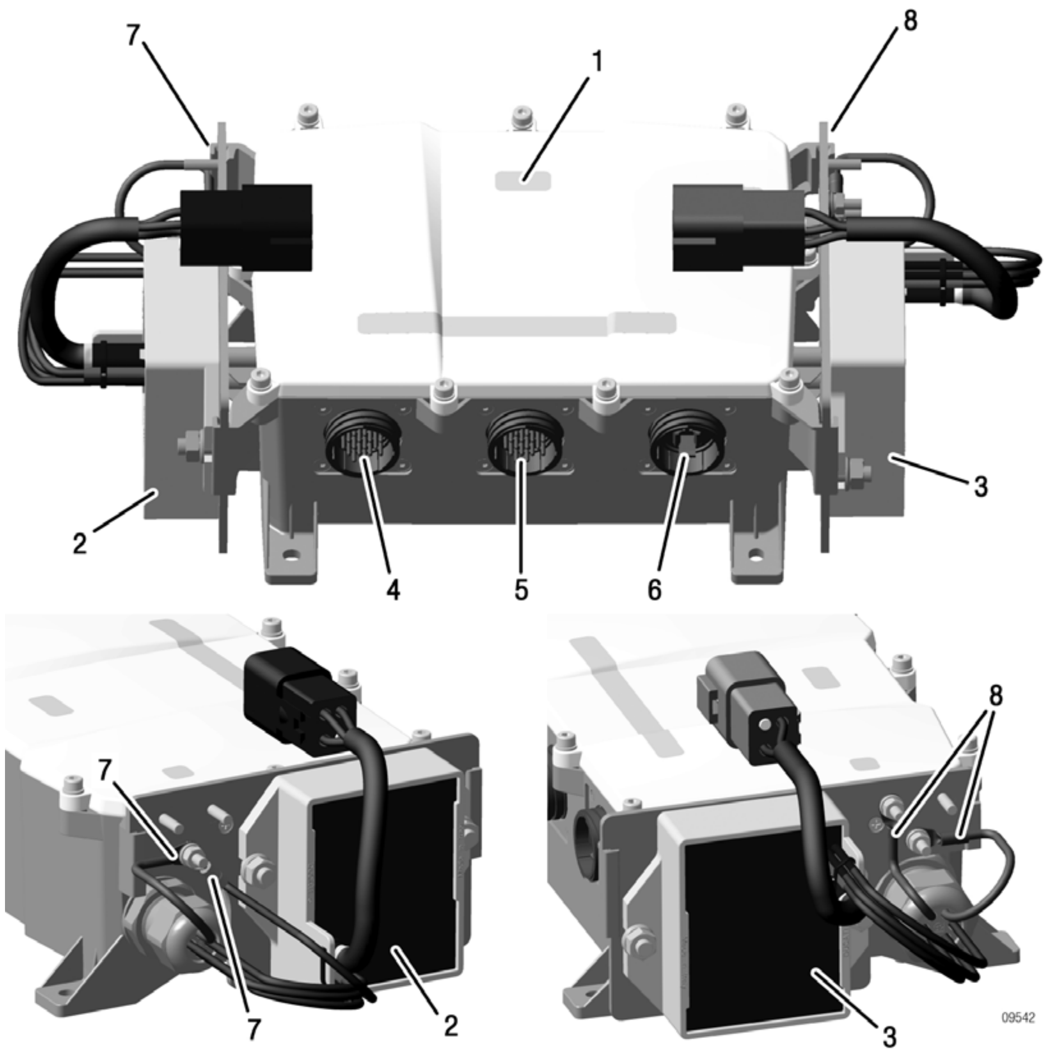


Figure 3.6: Fuse box connections, typical

1	*Fuse box assy.*	2	*Rectifier regulator A (black plug)*
3	*Rectifier regulator B (grey plug)*	4	*Plug connection X1 (LANE A)*
5	*Plug connection X2 (LANE B)*	6	*Plug connection X3 (Power)*
7	*EMS ground (Generator A)*	8	*Aircraft ground (Generator B)*

Electrical Interfaces

The seals supplied with the Fuse box must be inserted into the X1,X2 and X3 Connector (Fuse box side) to enable a good connection between plug and socket.

Fuse box –X1, X2 Connector

The X1 and X2 ensure the power distribution to the EMS System. Both plugs must be connected with mating sockets on the (engine-) wiring harness. The connectors are not interchangeable and are marked on the wiring harness side.

Fuse box –X3 Connector

The X3 Connector is the interface to the (aircraft-) wiring harness. See also Chapter 76–00–00 section Fitting the Amp connector.

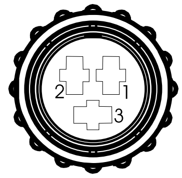


Figure 3.7: X3-Connector:(Airframe) Wiring Harness side

1 *PIN 1 backup battery switch*

2 *PIN 2 start power switch*

3 *PIN 3 start power switch and bus*

Terminal 1 enables to supply the EMS with an external power source (e.g. in case the internal power supply fails supplying the EMS). Terminal 2 enables powering the EMS during engine start (until the engine speed is high enough that the internal generator is able to supply the EMS). Terminal 3 can be used for supplying the Airframe with electrical energy after generator A has taken over powering the EMS.

Terminal	Interface Parameter	Min.	Max.	Nominal
1	Input Voltage:	9 V[4]	14.5 V	12 V
	Input Load:		230 W/DC cont. 290 W/DC peak	
2	Nominal Input: Voltage:	9 V[4]	14.5 V	12 V
	Input Load:		230 W/DC cont. 290 W/DC peak	
3	Output Voltage:	13.9 V[5]	14.5 V[5]	12 V
	Nominal Capacity:		420 W/DC (at 20°) (68 °F)	

Connector

AMP connector (Included in the engines scope of supply)

Performance diagram

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

4. This limit must also be considered when the starter motor is actuated
5. Attention: In failure conditions the output voltage can exceed the specified limits.

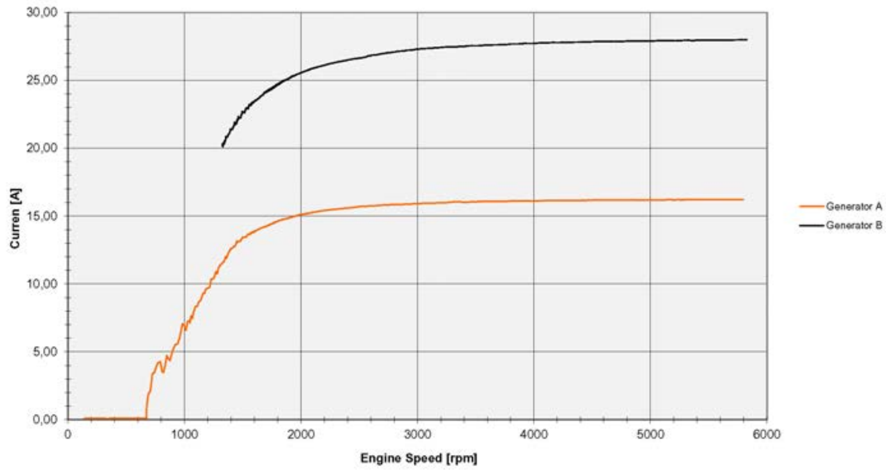


Figure 3.8: Performance diagram showing engine speed against amps

EXTERNAL ALTERNATOR (OPTIONAL EXTRA)

NOTE

The voltage regulator is integrated in the alternator.

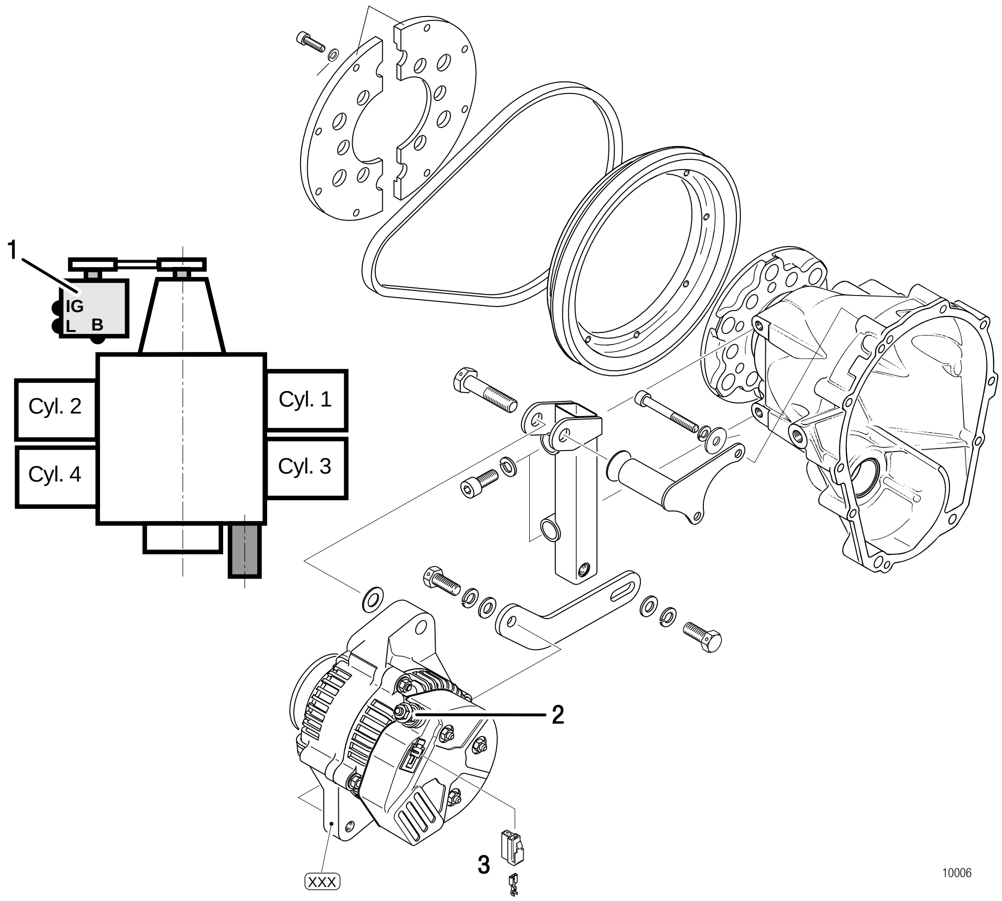


Figure 3.9: external alternator

1 External alternator | *2 Positive terminal*

3 Control wiring

Technical data

Output	Max. 550 W/DC at 6000 r.p.m. (complies ~ 4800 r.p.m. crankshaft speed)
Output voltage	14.2 V – 14.8 V
Ambient temperature	Min. -30 °C (-22 °F) Max. +90 °C (194 °F)
Weight	See Chapter 72–00–00 section Weight

Connections

Power supply wires	Power supply wires to external alternator (1) have to be installed depending on the mounting position and according to the regulations of the aircraft manufacturer.
Positive terminal	M6 screw connection suitable for cable terminal according to DIN 46225 (tightening torque 4 Nm (35 in.lb)).
Grounding	Via engine block.
Control wiring	Via supplied standard plug (Sumitomo 6111-2568) and 6.3 x 0.8 Faston connectors (female).

REQUIREMENTS FOR CORRECT OPERATION OF THE INTEGRATED RECTIFIER REGULATOR

Fuse The rectifier regulator must be protected by a slow blowing 50 A fuse or circuit breaker. Fuse or circuit breaker rating must be determined by load, wire size and length.

Load distribution Due to slightly different output voltages of the regulators (alternator and regulator A/B of Fuse box) the power is drawn by the generator with the higher output voltage at low load.

Amperage

ATTENTION

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

Ambient temperature:	20 °C (68 °F)
Voltage:	permanent 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.

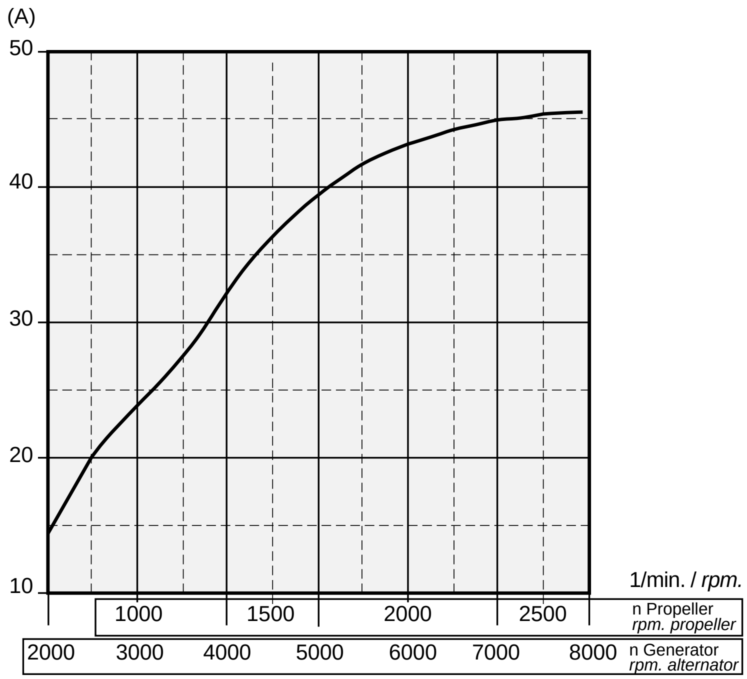


Figure 3.10: Current over engine speed graph

INTERNAL POWER CONSUMERS

⚠ WARNING

Non-compliance can result in serious injuries or death!
The battery and all loads in the aircraft must be dimensioned so, that even if one of the generators fails, a safe flight is ensured. Possible malfunctions of the supply system have to be taken into consideration by the aircraft manufacturer.

See the performance diagrams of the internal and external alternators as a function of engine speed.

Current consumption

Components	Current consumption
Fuel pump (main pump)	maximum 10 A
Fuel pump (additional pump)	maximum 10 A
ECU	~ 1.2 A
Warning lamp A	maximum 120 mA
Warning lamp B	maximum 120 mA
Fuse box	~ 400 mA

NOTE

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

WIRING HARNESS

The function of the engine wiring harness is the connection between:

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

ATTENTION
The wiring harness must not be shortened or modified.

Sensors/ actuators

The sensors and actuators are fitted at factory and connected to the engine wiring harness. Depending on the engine version the exhaust gas temperature sensors are included or already fitted to the GENUINE-ROTAX® exhaust systems.

Connector

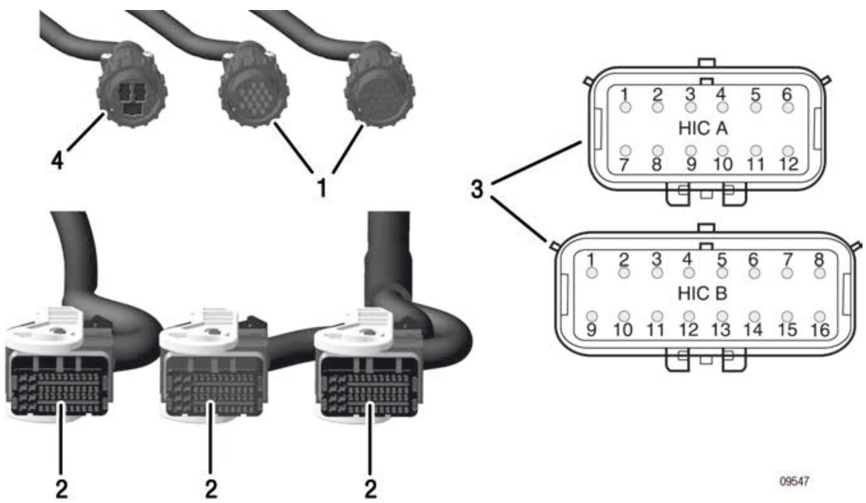


Figure 3.11: Connector

1	*Fuse box X1 (LANE A), X2 (LANE B)*	2	*ECU connector A1, A2, B*
3	*Harness Interface Connector A, B*	4	*Fuse box X3*

ECU/Fuse box connector

Install and lock the connectors of the ECU and/or Fuse box with supplied rubber gasket.

NOTE

Connectors with properly installed gasket will be difficult to push/pull. If connector feels loose, check if gasket is missing.

HIC

The HIC (Harness Interface Connectors) connects the control and monitoring instruments and maintenance ports to the engine.

FITTING THE FASTON CONNECTOR TO THE HARNESS INTERFACE CONNECTOR (HIC)

General note

The Faston connector represents the counterpart to the HIC interface on engine side. The specification is within the competence of the aircraft manufacturer, who must ensure that the applicable building regulations are complied with and the technical configurations are supported on aircraft side.

NOTE

Faston connectors are supplied loose. The Faston connectors and connector receptacles for the airframe are included in the scope of delivery.

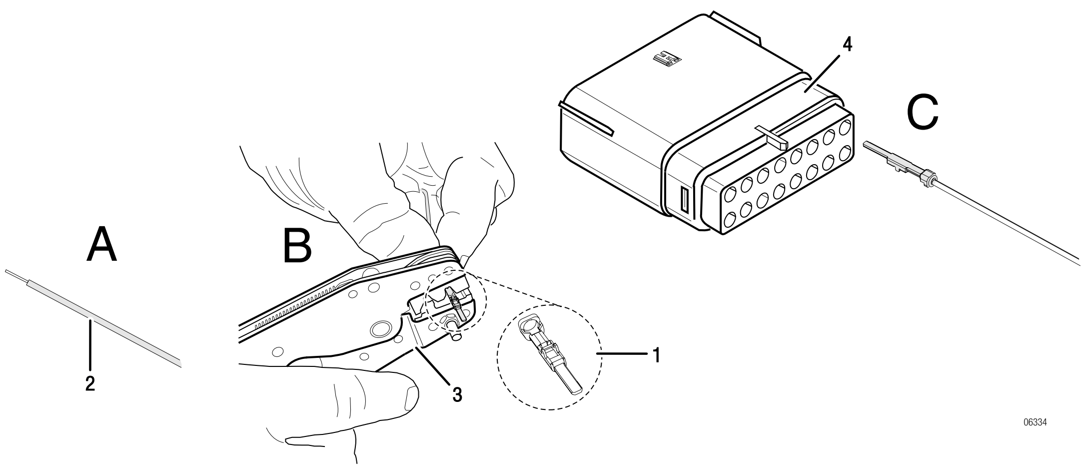


Figure 3.12: Fitting the Faston connector

1 Faston connector
2 Wiring (airframe)
3 Crimping tool
4 Harness Interface Connector

Special tools

The following special tools are necessary for fitting the Faston connector.

Part number	Description
n.a.	MOLEX Crimping tool 64016-0035/63811-4400
n.a.	MOLEX Disassembly tool 63813-1500

Procedure

Step	Procedure
1	Strip cable as required (**A**).
2	Use suitable crimping crap to fit the Faston connector (**B**).
3	Pull out white integral terminal position assurance (TPA) with needle nose pliers until “click” is heard (approx. 5 mm).

Step	Procedure
4	Push the Faston connector in the corresponding slot of the Harness Interface Connector receptacle until it is locked in place (**C**).
5	Push TPA back into locked position.
6	Check for tight fit (wire pull test).

NOTE

The TPA pin holder must not be pressed or pushed with excessive force.

Pin assignment

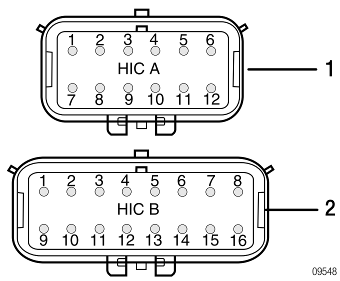


Figure 3.13: Harness Interface Connector (HIC)

NOTE

Unused pin holes must be plugged (in scope of supply).

1 HIC A-pin 1 to 12 *2 HIC B-pin 1 to 16*

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_A	CONN_STARTER_REL_SW
5	CAN_LOW_1_A	PLUG
6	CAN_HIGH_1_A	CAN_GND_1_B
7	LANE_SEL_SW_A_2	CAN_LOW_1_B
8	WARN_LAMP_A	CAN_HIGH_1_B
9	GND_FUEL_PUMP_1	LANE_SEL_SW_B_2
10	CAN_GND_2_A[6]	WARN_LAMP_B

6. Maintenance Port LANE A

PIN No.	HIC A	HIC B
11	CAN_LOW_2_A[7]	GND_FUEL_PUMP_2
12	CAN_HIGH_2_A [7]	SUPP_START_SWITCH
13	—	PLUG
14	—	CAN_GND_2_B[8]
15	—	CAN_LOW_2_B[8]
16	—	CAN_HIGH_2_B[8]

SWITCH AND WARNING LAMP REQUIREMENTS

Switches

The representation of components (such as switches, protection devices etc.) that are not included in the scope of engine delivery is purely symbolic. It does not constitute a specification of the version and shall therefore only be seen functionally.
The actual interpretation / selection of the corresponding regulations is the task of the aircraft manufacturer.

LANE SELECT SWITCH A	Requirement	Connector/slot
Switch type	Toggle-SPST	HIC A
Nominal voltage	28 VDC	
Nominal current	7,5 A	
Number of 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
Switch type	Toggle-SPST	HIC B
Nominal voltage	28 VDC	
Nominal current	7,5 A	
Number of poles	1-pole	
Designation on wiring harness	LANE_SEL_SW_B_1	1
	LANE_SEL_SW_B_2	9

Lane Select Switch A and B must be designed to allow Lane A or B to be enabled or disabled independently from each other.

7. Maintenance Port LANE A
8. Maintenance Port LANE B

FUEL PUMP SWITCH 1	Requirement	Connector/slot
Switch type	Toggle-SPST	HIC A
Nominal voltage	28 VDC	
Nominal current	10 A	
Number of poles	1-pole	
Designation on wiring harness	SIG_FUEL_PUMP_1	3
	GND_FUEL_PUMP_1	9

FUEL PUMP SWITCH 2	Requirement	Connector/slot
Switch type	Toggle-SPST	HIC B
Nominal voltage	28 VDC	
Nominal current	10 A	
Number of poles	1-pole	
Designation on wiring harness	-SIG_FUEL_PUMP_2	3
	+SUB_FUEL_PUMP_2	11

ATTENTION

LANE Select Switch A and LANE Select Switch B also Fuel Pump Switch A and Fuel Pump Switch B in this connection type must be a toggle switch.

BACKUP BATTERY SWITCH	Requirement	Connector/slot
Switch type	Toggle-DPST (but with mechanical inter-lock to prevent switch on during standard operation).	Fuse box Battery (+)
Nominal voltage	28 VDC	
Nominal current	20 A	
Number of poles	2-pole	
Designation on wiring harness	Not connected to the wiring harness.	
FUSE BOX	Must be installed by the air-craft manufacturer.	

START POWER SWITCH	Requirement	Connector/slot
Switch type	Toggle-DPST, momentary function as described in OM chapter “Engine start”	
Nominal voltage	28 VDC	
Nominal current	20 A	
Number of poles	2-pole	
Designation on wiring harness	Not connected to the wiring harness.	

WARNING LAMP A	Requirement	Connector/slot
Lamp colour	In accordance with the regulations	HIC A
Nominal voltage	12 V	
Nominal current	Maximum 120 mA	
Designation on wiring harness	SUPP_WARN_LAMP_A	2
	WARN_LAMP_A	8

WARNING LAMP B	Requirement	Connector/slot
Lamp colour	In accordance with the regulations	HIC B
Nominal voltage	12 V	
Nominal current	Maximum 120 mA	
Designation on wiring harness	SUPP_WARN_LAMP_B	2
	WARN_LAMP_B	10

Optional

EXTERNAL ALTERNATOR INDICATOR LAMP	Requirement	Connector/slot
Lamp colour	In accordance with the regulations	
Nominal voltage	12 V	
Nominal current	Maximum 300 mA	
Designation on wiring harness	Not connected to the wiring harness.	

ATTENTION

If using LED they will always glow, even with no alarm or warning shown! Remedy: The use of 2 resistors. See also section Wiring diagrams.

EXTERNAL ALTERNATOR SWITCH	Requirement	Connector/slot
Switch type	Toggle-SPST	
Nominal voltage	28 VDC	
Nominal current	5 A	
Number of poles	1-pole	
Designation on wiring harness	Not connected to the wiring harness.	

START SWITCH[9]	Requirement	Connector/slot
Switch type	Toggle-SPST (non-lockable)	HIC B
Nominal voltage	28 VDC	
Nominal current	5 A	
Number of poles	1-pole	
Designation on wiring harness	CONN_STARTER_REL_SW	4
	SUPP_START_SWITCH	12

WIRING POWERSIDE (OPTIONAL)

TIP The following informations allows a simplification of the starting process.

Instead of using the `Start Power Switch` and the `Start Button` at the same time the engine can be started by turning a key switch. In addition, the key switch takes over the control of a master relay.

NOTE

It is not allowed to install the `Start Power Switch` *and the* `Start Button` *with a single switch. This will cause faults as they should not be activated at the same time.*

The re-flightsystems pilot display takes over the control of the start power relay. If the display is turned ON, for example in case of a complete restart of the aircraft, the start power relay closes. If the key switch is actuated (engine start) and put into the third position, the

9. optionally a key switch can be used.

engine starts. Due to the spring return position of the key switch, it falls back to the second switching position (ON). As soon as the engine has reached a defined and displayed speed (1500 r.p.m.) to the pilot display, the relay opens. The start power relay still stays open for security reasons until restart of the display.

Performance of the key switch and operation of the relays.

Position of the key switch	**0**	**1**	**2**
Pins		Master Relay Airframe Ground	HIC B Pin 4 HiC B Pin 12
Aircraft/Engine Status	off	on	Engine Start
Master Relay	open	closed	closed
Start Power Relay	open	closed	closed (will open as soon as speed > 1500 r.p.m.. can only be opened once; The correct sequence is controlled by the pilot display)
Locking	yes	yes	Spring return (to Pos. 1)

NOTE

The responsibility for

- *proper selection and installation of such displays is up to the aircraft manufacturer.*
- *the specification and interconnection of the relay is up to the display manufacturer.*

The interconnection with a display of the manufacturer “Stock Flight System” (www.rs-flightsystems.com,) was shown. This functionality is not supported by all displays on the market.
The installation and specification of the Start Power Display depends on the pilot display output.

Specification additional components additional to Switch and warning lamp requirements

MASTER RELAY	Requirement	Connector/slot
Switch type	Relay	
Nominal voltage	28 VDC	
Nominal current	Tbd from aircraft manufacturer	
Min. control voltage	Minimum 6 V Maximum 18 V	
Number of poles	SPST NO (normally open)	
Designation on wiring harness	Not connected to the wiring harness.	

START POWER RELAY	Requirement	Connector/slot
Switch type	Relay	
Nominal voltage	28 VDC	
Nominal current	20 A	
Min. control voltage	Tbd from aircraft manufacturer	
Number of poles	2 Poles NO (normally open)	
Designation on wiring harness	Not connected to the wiring harness.	

KEY SWITCH	Requirement	Connector/slot
Switch type	Off/ON	
Nominal voltage	28 VDC	
Nominal current	5 A	
Number of poles	2-pin	
Designation on wiring harness	Not connected to the wiring harness.	

INSTALLATION OVERVIEW

- External alternator
- EMS Wiring diagram
- Wiring Powerside
- Wiring Powerside (optional)
- Wiring HIC Switch and warning lamps

Cable cross-section The cable cross-section in the EMS diagram (aircraft interface) are minimum data and should be increased in case of voltage drop and upstream fuses according to the situation in the aircraft.

Deviations The minimum cable cross-section for the line from the battery to the starter relay and from there to the electric starter and for the ground line (start system) depends on the cable length “**l**“(= Sum of the supply line and ground line of the electric starter) and has to be calculated according to the following table.

l [m]	**A_{min} [mm^2]** Battery -> Starter Relay	**A_{min} [mm^2]** Starter Relay -> Electric starter	**AWG_{min}** Cable Cross
<4	20.408	25	4
4<l<4,5	22.959	35	3
4,5<l<5	25.51	35	3
5<l<5,5	28.061	35	2
5,5<l<6	30.612	35	2
6<l<6,5	33.163	35	2
6,5<l<7	35.714	50	1
7<l<7,5	38.265	50	1
7,5<l<8	40.816	50	1
8<l<8,5	43.367	70	0
8,5<l<9	45.918	70	0
9<l<9,5	48.469	70	0
9,5<l<10	51.02	70	0

The internal resistance of the battery and the resistance of the electrical system (wires, contact points, relay contacts) largely determine the performance of the starting system. Therefore, the total loop resistance$_{Smax}$may not exceed 0.015 Ω.

$$R_{Smax} = \Sigma R = R_{iBatt} + R_{KStarterrelay} + R_{L} + R_{other}$$

R_{iBatt}	*Internal resistance battery*	$R_{KStarter\text{-}Relay}$	*Contact resistance starter relay*
R_{L}	*Line resistance*	R_{other}	*Any other resistors (z. B. Master Relais,*

Scope of delivery

The representation of components (such as switches, protection devices etc.) that are not included in the scope of engine delivery is purely symbolic. It does not constitute a specification of the version and shall therefore only be seen functionally.
The actual interpretation / selection of the corresponding regulations is the task of the aircraft manufacturer.

ATTENTION

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

Components

Items/components which are not included in the standard engine scope of delivery must be certified.

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

- Internal Generator
- Electric starter
- Warning lamps
- Switch
- ECU
- Fuse box (rectifier regulator)
- Wiring harness
- Fuel pump module
- Starter Relay

Optional Components

- External Alternator
- Consumer (Battery,...)

Installation wiring diagram

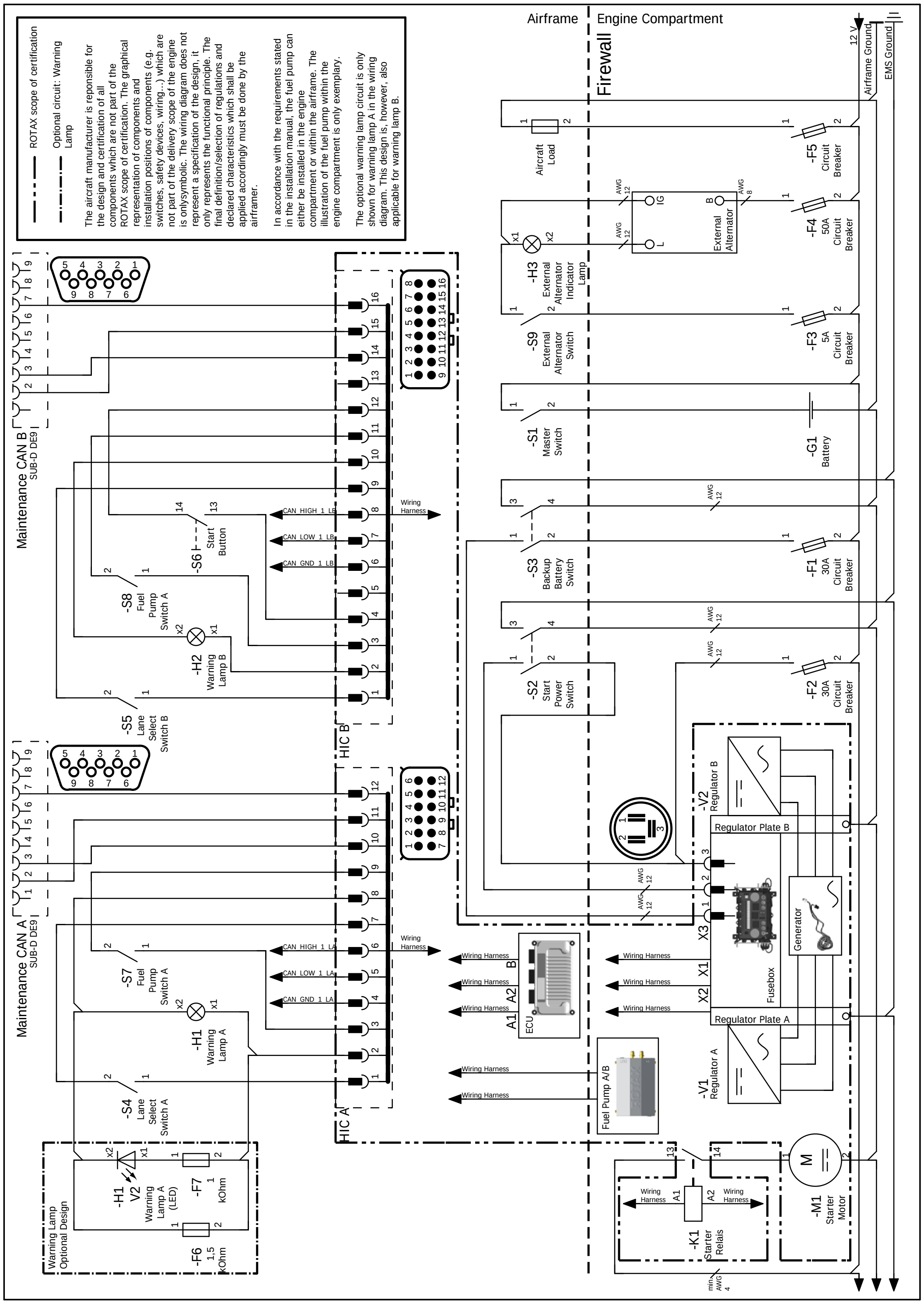


Figure 3.14

External alternator (optionally)

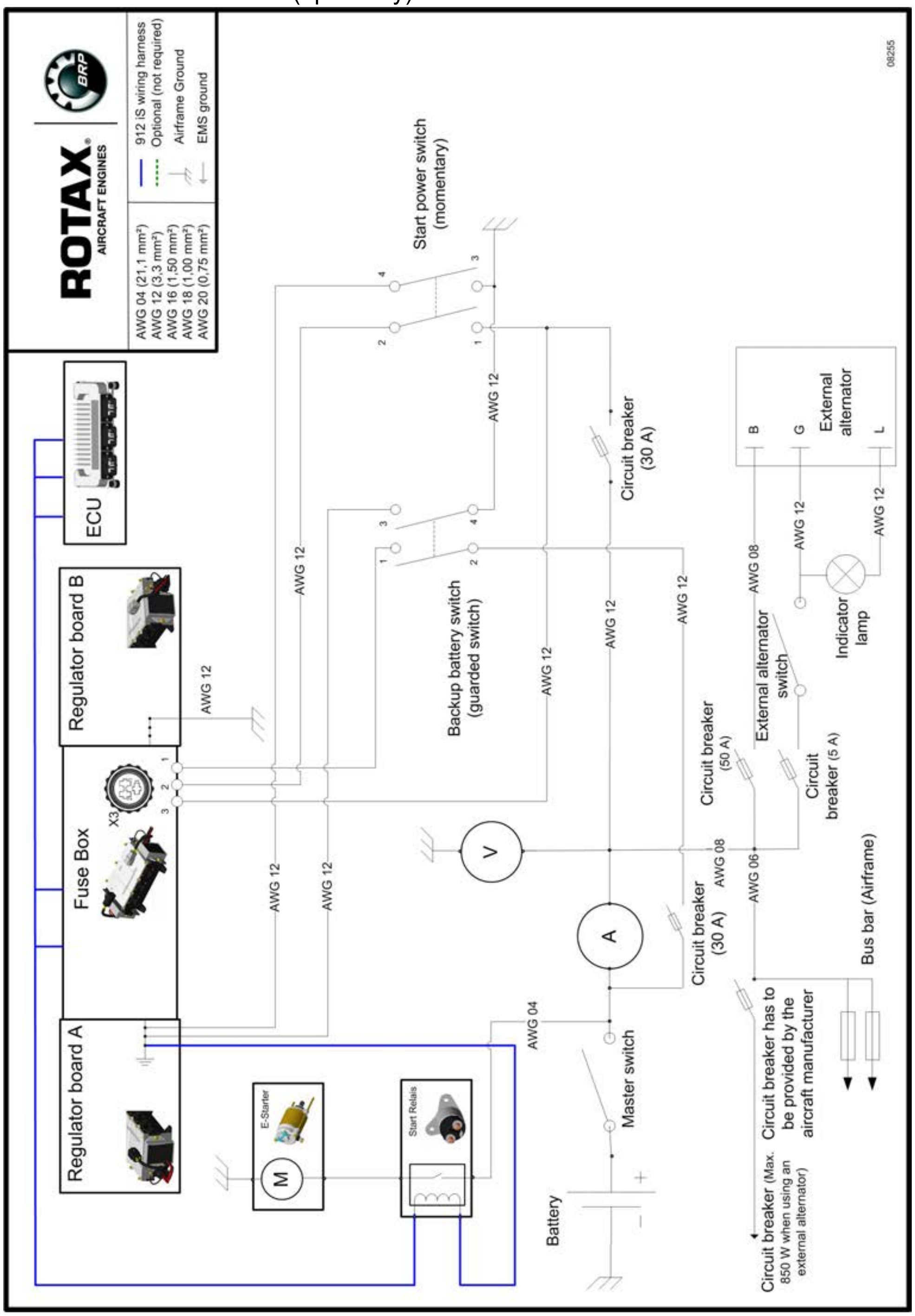


Figure 3.15: Pin assignment external alternator

EMS Wiring diagram

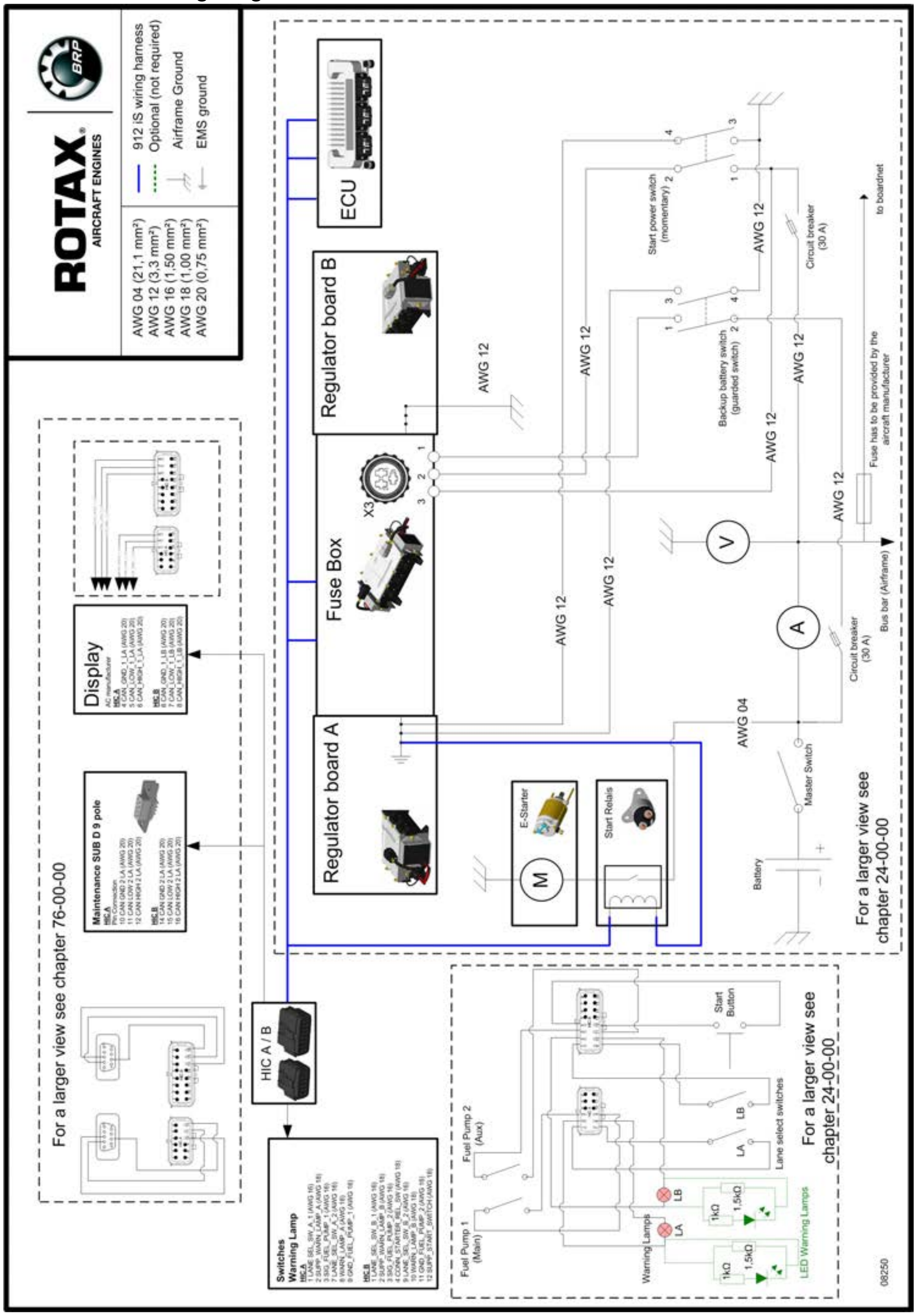


Figure 3.16: EMS Wiring diagram

Wiring Powerside

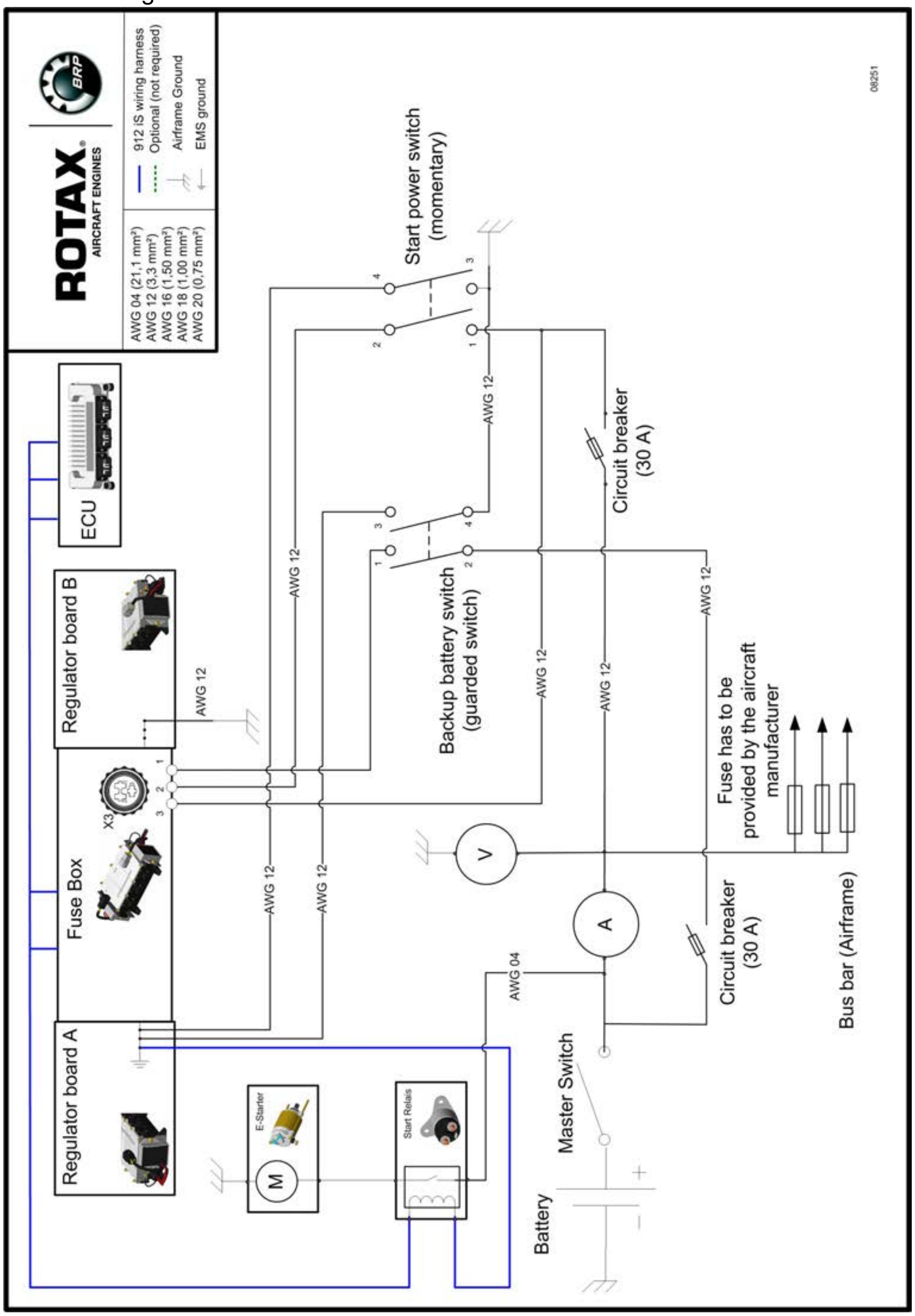


Figure 3.17: Wiring Powerside

Wiring Powerside (optional)

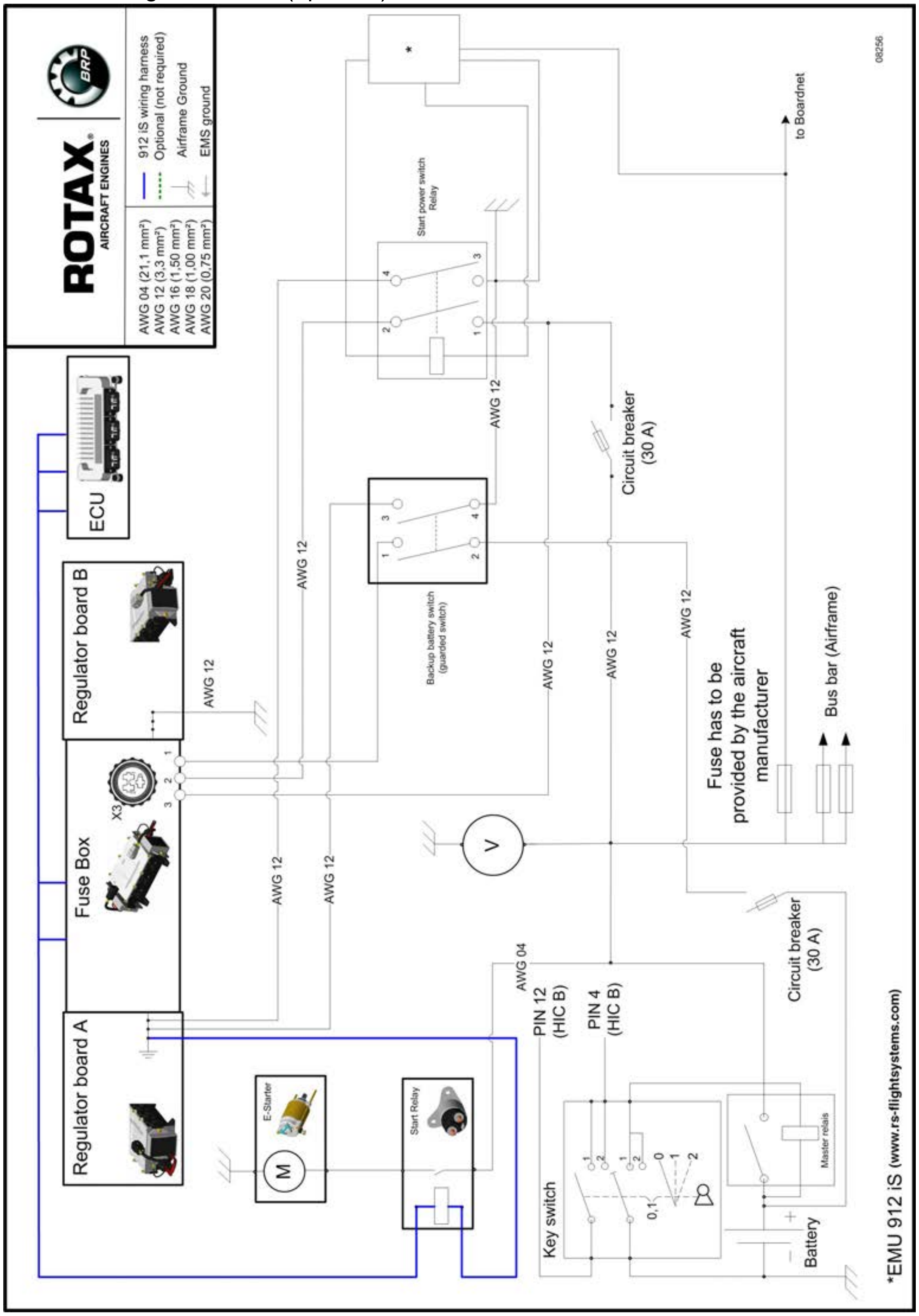


Figure 3.18: Wiring Powerside (optional)

Wiring HIC Switch and warning lamps

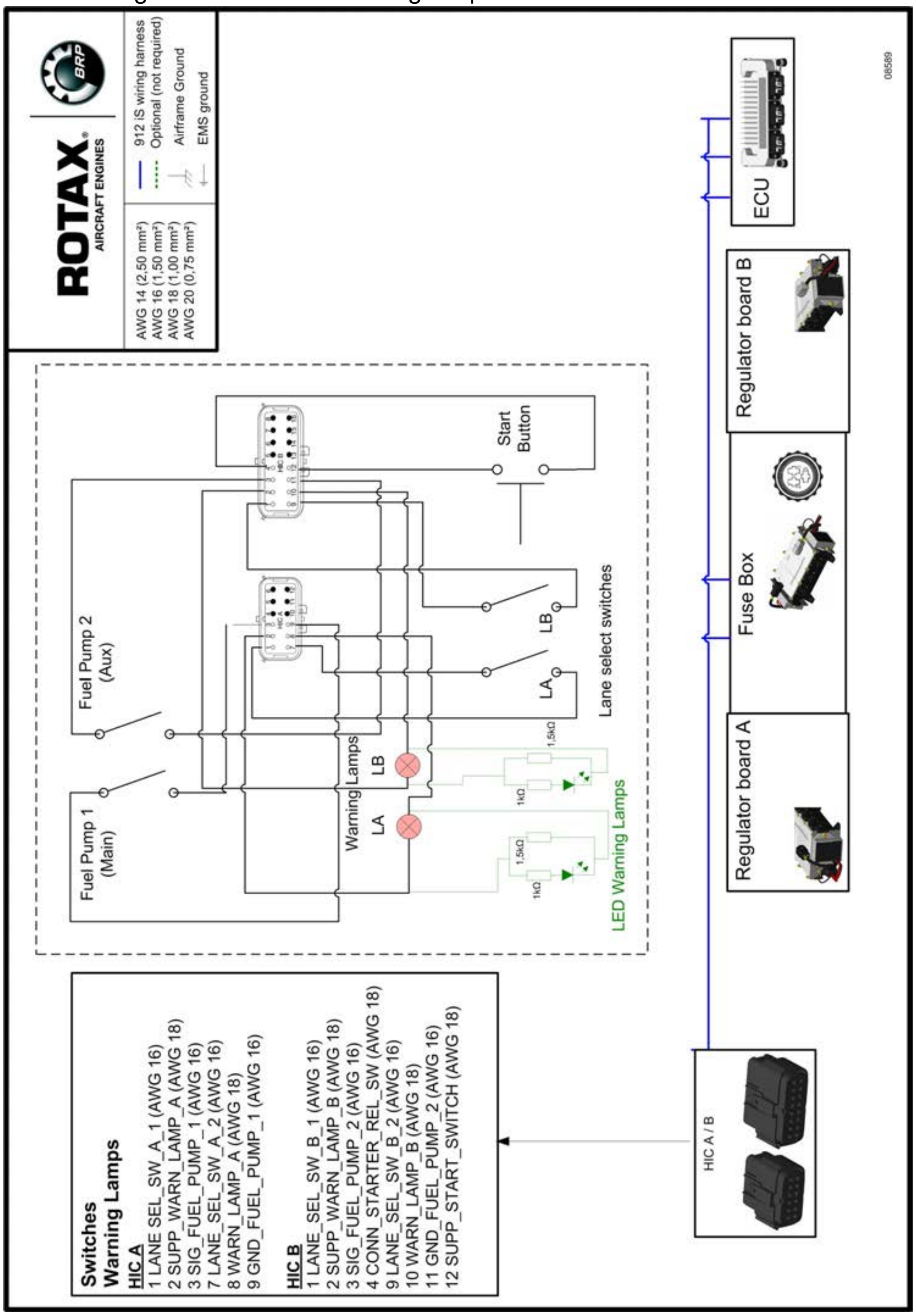


Figure 3.19: Wiring HIC Switch and warning lamps

INTENTIONALLY LEFT
BLANK

Chapter: 61–00–00
PROPELLER DRIVE

TOPICS IN THIS CHAPTER

INTERFACE DESCRIPTION

Interface Overview

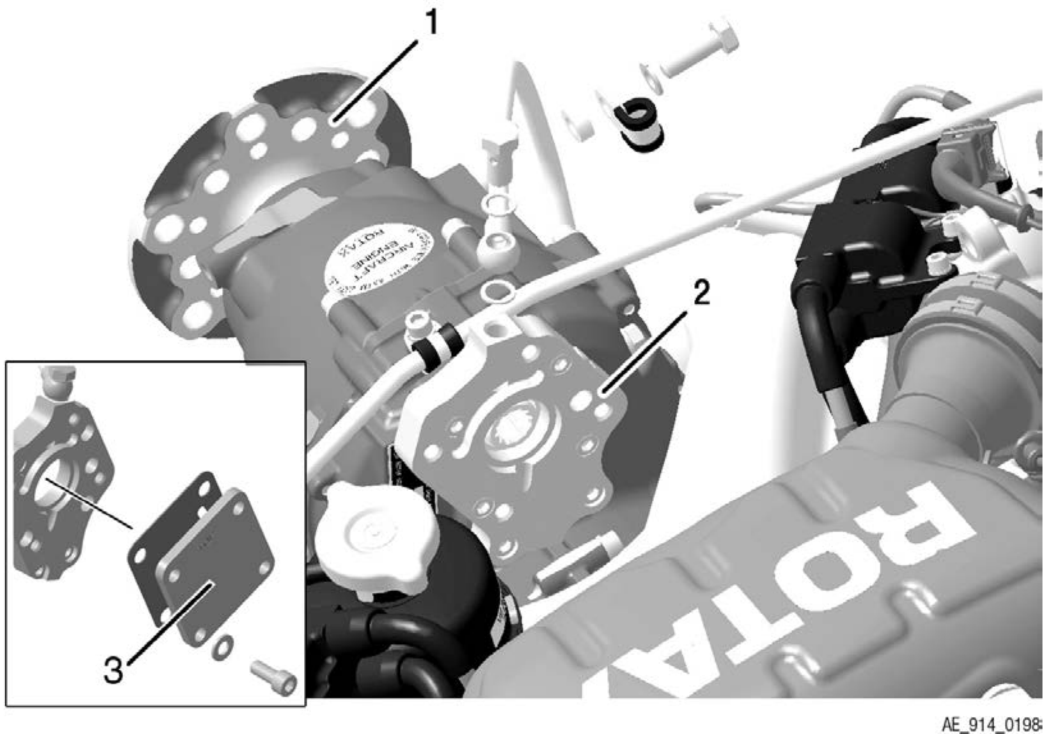


Figure 4.1: Interface

1	*Propeller shaft (mechanical. Interface*	2	*Governor flange (hydraulic. Interface)*
3	*Cover plate*		

NOTE

The cover plate and its screw used for delivery needs to be removed before engine operation. The cover may not be used in operational condition.

PROPELLER DRIVE

Propeller shaft flange

The propeller in tractor or pusher arrangement must be fitted on the propeller flange in accordance with applicable regulations. As required utilize one of three possible pitch circle diameters (P.C.D.) on the flange.
Certification of the propeller sizing and arrangement to the latest requirement such as FAR or EASA has to be conducted by the aircraft manufacturer.

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

ATTENTION
Modification of the propeller shaft is not permitted.

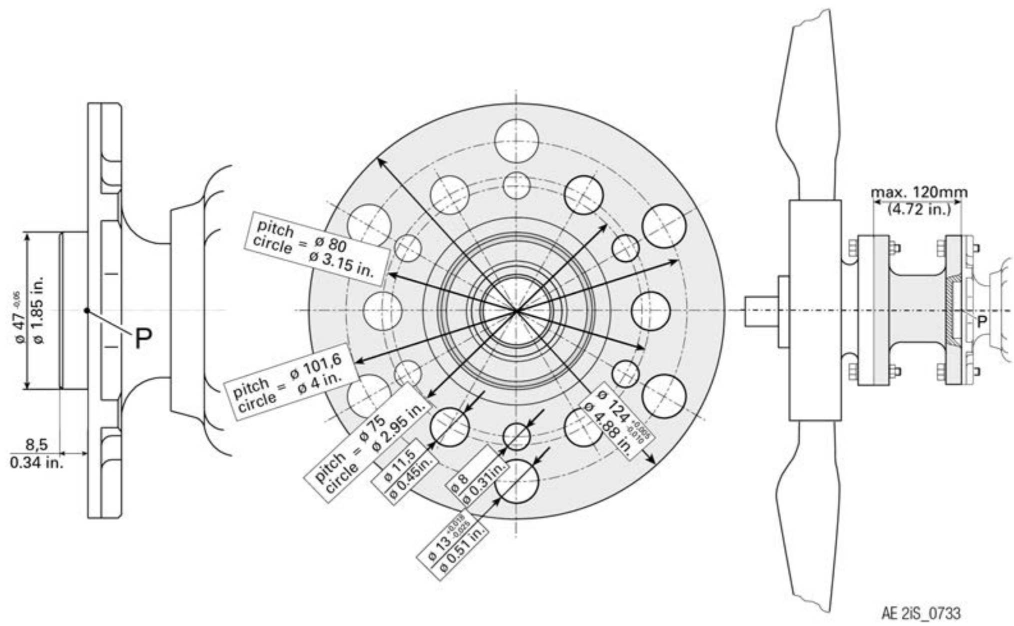


Figure 4.2: Propeller shaft flange

Pitch circle diameter 75 mm +/- 0.3 mm (2.95 in. +/- 0.012 in.)	6x through holes 8 mm (0.31 in.)
Pitch circle diameter 80 mm +/- 0.3 mm (3.15 in. +/- 0.012 in.)	6x through holes 11.5 mm (0.45 in.)
Pitch circle diameter 101.6 mm +/- 0.3 mm (4 in. +/- 0.012 in.)	6x through holes 13 mm (0.51 in.)
Hub diameter	47 mm (1.85 in.)
Gear transmission	i= 2.4286 (51 Teeth/21 T)

left, counter clockwise, looking towards face of flange

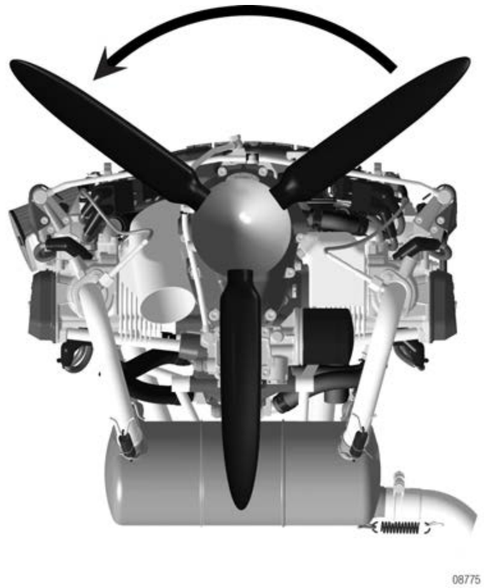


Figure 4.3: Direction of rotation

SYSTEM LIMITATIONS

Operating limits

Refer to latest issue of the Operators Manual ROTAX® 912 i Series.

Moment of inertia

System Limit	Min.	Max.
Moment of inertia on propeller	1500 kg cm^2 (3.559 lb ft^2)	6000 kg cm^2 (14.238 lb ft^2)

Out of balance

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

Propeller shaft

System Limit	Min.	Max.
Extension of the propeller shaft	–	maximal 120 mm (4.72 in.)

Torque

ROTAX® 912 i at i=2,4286: 340 Nm (on propeller)

HYDRAULIC GOVERNOR FOR CONSTANT SPEED PROPELLER

See SB-912 i–001, Installation/use of governors for ROTAX® Engine type 912 i, latest issue.

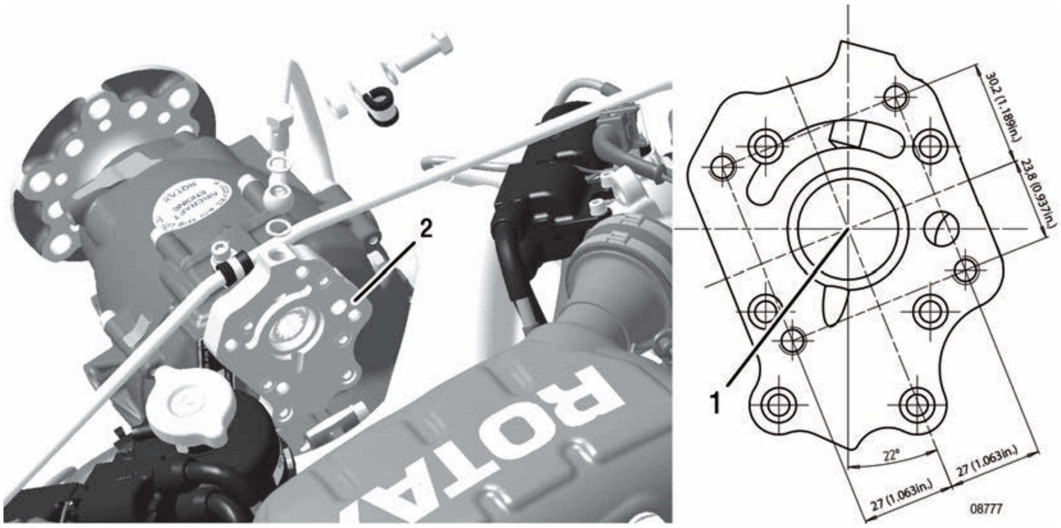


Figure 4.4: Crankcase flange

1	*Connection for propeller governor*
2	*Governor flange*

Drive

Drive via propeller gearbox.
Position of the propeller connection on the governor flange:

x-axis [mm/in]	**y-axis** [mm/in]	**z-axis** [mm/in]
-206.3 (8.12)	0	51.5 (2.03)

Connection

ATTENTION
Obey the manufacturers instructions!

Technical Data 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 size	M8
Thread length	max. 14 mm (0.55 in)
Toothing	Internal spline 20/40 SMS 1834 NA 14x1,27x30x12
Power input	max. 600 W
Operating pressure	max. 30 bar (435 psi)

Chapter: 72–00–00
<u>ENGINE</u>

TOPICS IN THIS CHAPTER

OVERVIEW

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

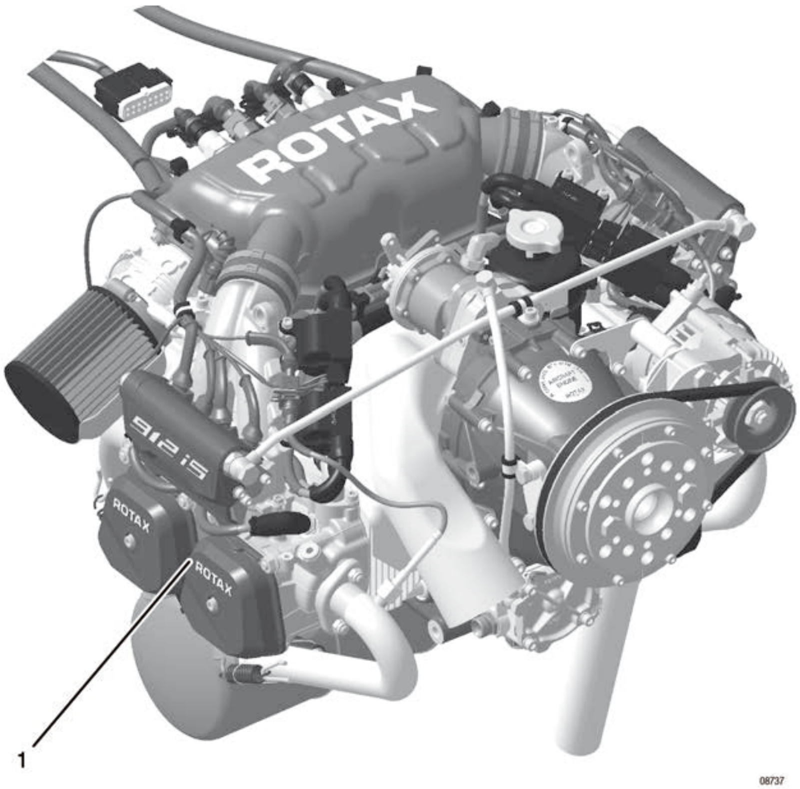


Figure 5.1: Engine

1 *Engine Type 912 i Series*

INTERFACE OVERVIEW

NOTE

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

A	points of attachment (for engine transport) - centre of gravity		
P	zero reference point for all dimensions		
x, y, z	axes for system of coordinates		
PTO	power take off side	**MS**	magneto side
Cyl. 1	Cylinder 1	**Cyl. 3**	Cylinder 3
Cyl. 2	Cylinder 2	**Cyl. 4**	Cylinder 4

Side view

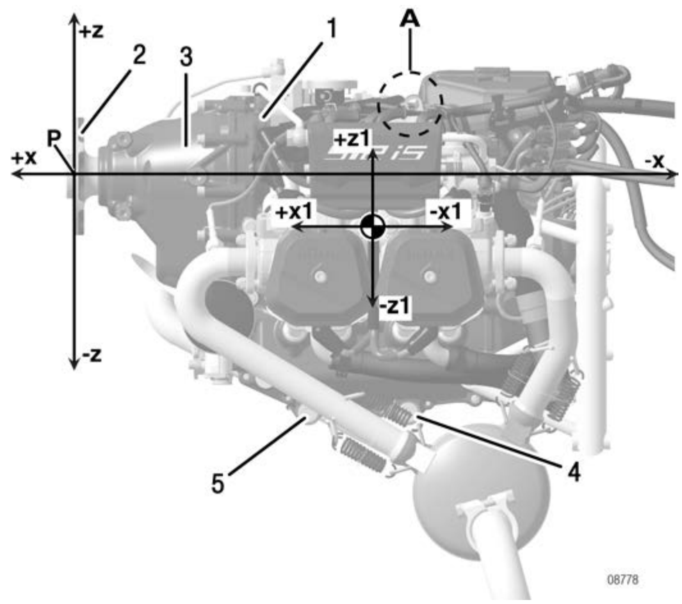


Figure 5.2: Side view Engine

1 *Engine serial number plate*
2 *Propeller flange*
3 *Propeller gearbox*
4 *Connection for return line (tractor)*
5 *Connection for return line (pusher)*

Front view

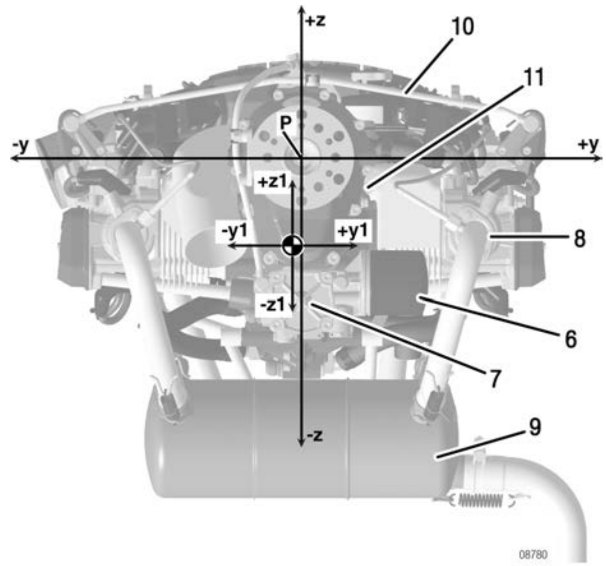


Figure 5.3: Front view Engine

6	*Oil filter*	*7*	*Oil pump*
8	*Exhaust flange*	*9*	*Muffler assy.*
10	*Fuel line assy.*	*11*	*Crankshaft locking screw position*

Top view

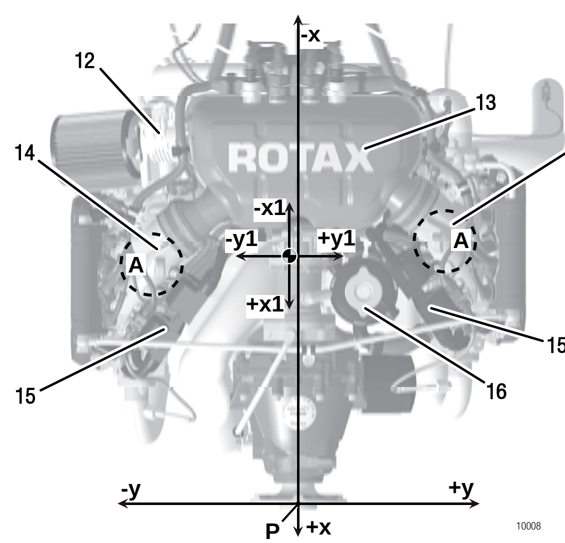


Figure 5.4: Top view Engine

12	*Throttle valve support assy.*	*13*	*Airbox*
14	*Suspension points for lifting devices*	*15*	*Dual ignition coils*

16	*Expansion tank assy.*	*17*	*Ignition housing*
18	*Electric starter*		

Rear view

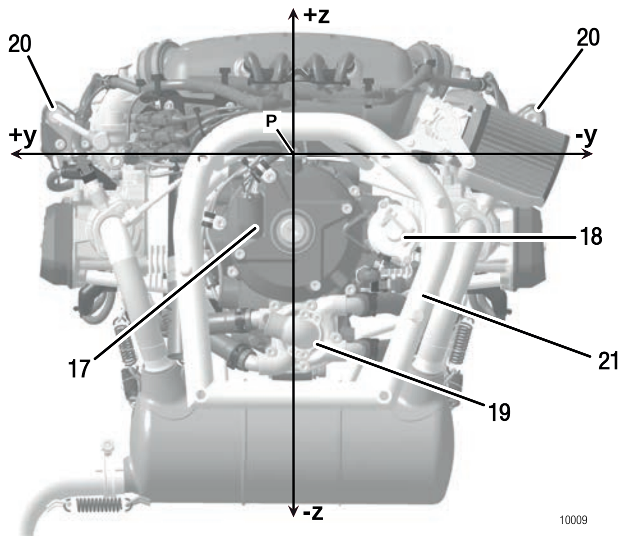


Figure 5.5: Rear view Engine

19	*Water pump housing*	*20*	*Fuel rail (right, left)*
21	*Engine suspension frame (ring mount)*		

TECHNICAL DATA

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.

WEIGHT

The engine weight is defined by the following conditions:

- incl. oil tank
- incl. electrical system: wiring harness, ECU, Fuse box, starter relay

Weight

Engine component	Weight	Spare parts	Optional[10]
Base engine with gearbox:	63.6 kg (140.21 lb)		
Engine suspension frame	2.0 kg (4.41 lb)	X	X
Exhaust system	4.7 kg (10.36 lb)	X	X
Fuel pumps assy.	1.6 kg (3.53 lb)	X	
Cooling air baffle	0.36 kg (0.79 lb)	X	X
External alternator	3.0 kg (6.61 lb)	X	
Oil 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	
Oil tank	1.50 kg (3.31 lb)	X	
ECU	1.13 kg (2.49 lb)	X	
Fuse box	2.02 kg (4.45 lb)	X	
Ambient sensor	0.06 kg (0.132 lb)	X	
Wiring harness	2.50 kg (5.51 lb)	X	
Electric starter	0.43 kg (1 lb)	X	

10. Can be installed to ORIGINAL-ROTAX®-engine at the factory (also available as a spare part)

Starter relay	0.145 kg (0.32 lb)	X	
Coolant radiator	1.5 kg (3.3 lb)	X	

INSTALLATION DIMENSIONS STANDARD ENGINE VERSION

NOTE

All distances are given in relation to the reference coordinate system (P).

	Pos. (+)	**Neg. (-)**	**Total**
Max. dimension along x axis [mm/in.]	8.5 (0.33 in.)	-656,6	665.1 (26.19 in.)
Max. dimension along y axis [mm/in.]	288 (11.34 in.)	-288 (-11.34 in.)	576 (22.68 in.)
Max. dimension along z axis [mm/in.]	247 (9.73 in.)	-311 (-12.24 in.)	531 (20.91 in.)

CENTRE OF GRAVITY OF ENGINE AND STANDARD ACCESSORIES

NOTE

All distances are given in relation to the reference coordinate system (P).

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

MOMENTS OF INERTIA

	Configuration 2	**Configuration 3**
Axis x1-x1 (kg cm²)	20 470	21 210
Axis y1-y1 (kg cm²)	24 560	25 450
Axis z1-z1 (kg cm²)	26 520	27 480

OPERATING LIMITS

Refer to latest issue of the Operators Manual ROTAX® 912 i Series.

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

SYSTEM LIMITATIONS

Operating limits

Refer to latest issue of the Operators Manual ROTAX® 912 i Series.

Installation position

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

System Limit	Min.	Max.
Static roll angle ß		40°

The oil level should be in the upper half (between the “50%” and the “Max.” mark) and should never fall below the “Min.” mark. For the oil level measuring procedure refer to the latest version of the respective Operators Manual.

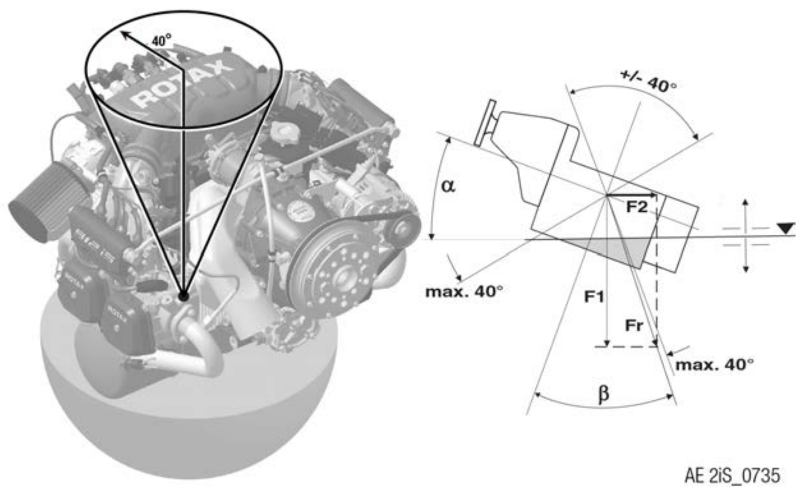


Figure 5.6: Bank angle

Angle/force	Description
α	Bank or rotation
F1	Gravity
β	Bank angle
F2	Acceleration
Fr	Result of F1 and F2

CRANKSHAFT DRIVE

Drive for external parts

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

Parts

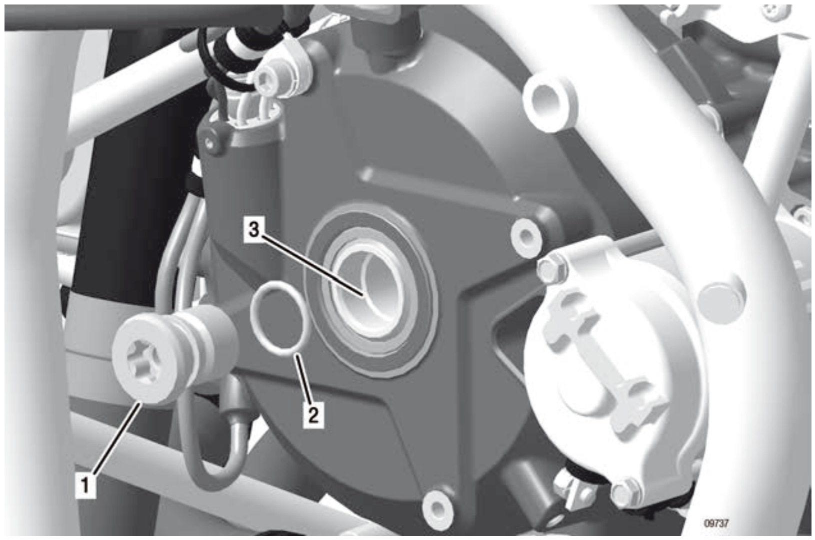


Figure 5.7: Parts Crankshaft

1 *Plug screw M22x1,5*

2 *O-Ring 18x2.5*

3 *Support bearing*

Dimensions

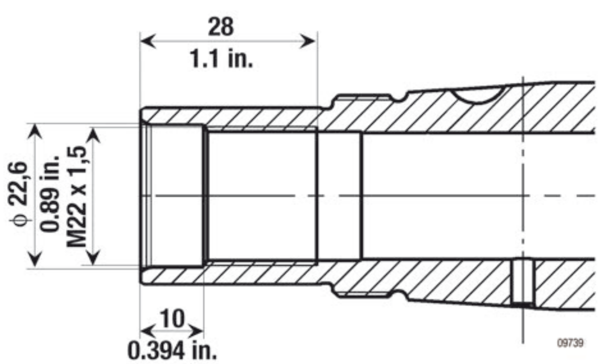


Figure 5.8: Crankshaft Dimensions

Position

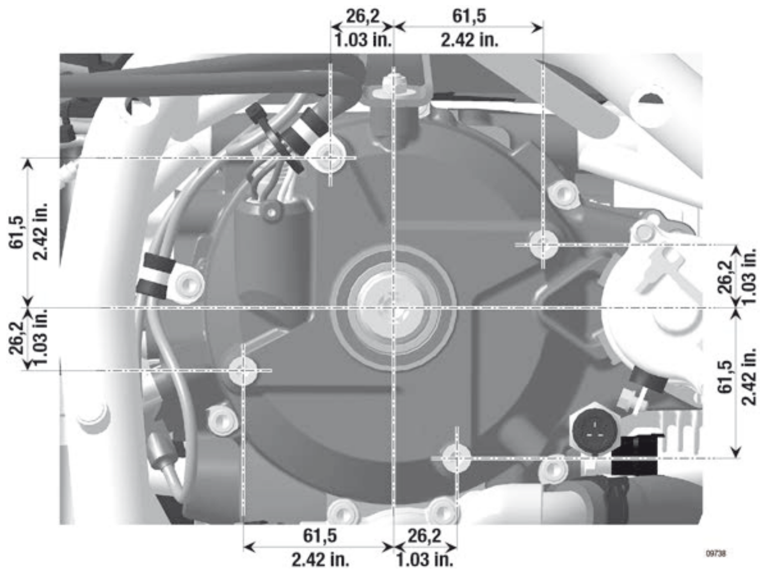


Figure 5.9: Crankshaft Position

INTENTIONALLY LEFT
BLANK

Chapter: 73–00–00
ENGINE – FUEL AND CONTROL

TOPICS IN THIS CHAPTER

INTERFACE DESCRIPTION

ATTENTION

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!

ATTENTION

Parallel hydraulic operation of the fuel pumps is not permitted. The fuel pressure regulator can not cope with the flow rate in this case and generator A can not deploy the high consumption of current (Error entry in the ECU).

NOTE

It should be noted that the engine has an Eco and/or a Power- Mode. The Power-Mode is always active in Single-Lane operation and can be decisive for the range calculation. The fuel consumption charts are available in the Operators Manual.

The fuel delivery is provided by two electric pumps connected in series with bypass valves and engine will operate with either one or both pumps running. The operating state of the pumps is manually selected. There are 2 injectors per cylinder (8 in. total). During engine run both injectors per cylinder are in operation. If a failure is detected in any one injector the injection period of the other one on that cylinder is adjusted for compensation.
The ECU operates all fuel injectors. A single blocked injector would be compensated automatically. If a problem with a fuel injector occurs, the fault is reported to the ECU and the pilot will be informed about a fault by the instrument panel.
The representation of components that are not included in the scope of engine delivery is purely symbolic. It does not constitute a specification of the version and shall therefore only be seen functionally. The actual interpretation /selection of the corresponding regulations and characteristics is the task of the aircraft manufacturer.

INTERFACE OVERVIEW

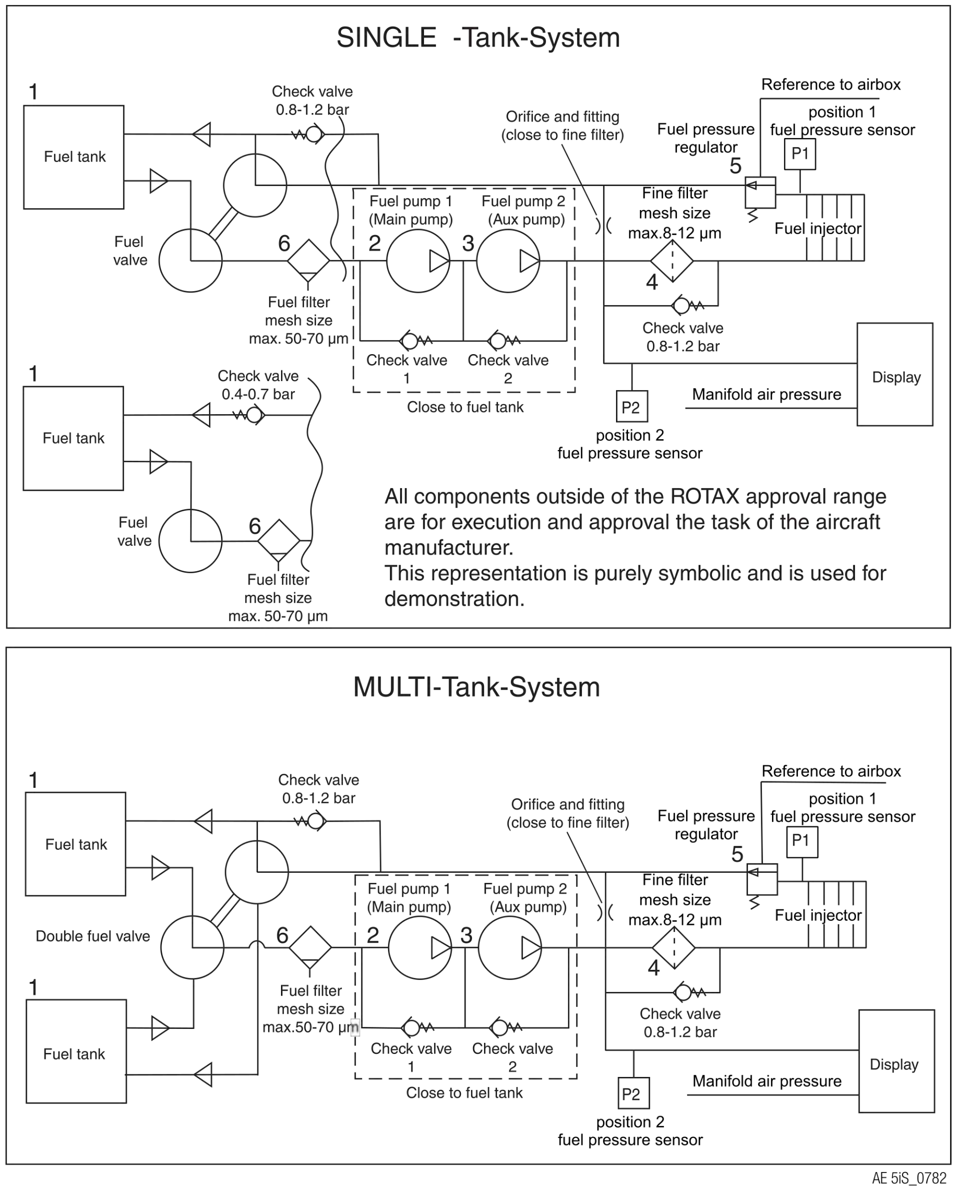


Figure 6.1: Interface overview

1 *Fuel tank*	2 *Fuel pump 1*
3 *Fuel pump 2*	4 *Fine filter*
5 *Fuel pressure regulator*	6 *Coarse filter/water trap*

REQUIREMENTS OF THE FUEL SYSTEM

Operating limits

See Operating Manual 912 i Series Chapter 2 section Operating limits.

ATTENTION

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

In case of deviations in fuel pressure:

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

FUEL TEMPERATURE

The fuel system must be designed considering vapor lock depending on the ambient conditions (e.g. pressure and temperature) and the used fuel types (vapor pressure class). Vapor lock may result in engine stoppage.
Depending on the building regulations on aircraft level e.g. the “Hot Fuel Test” has to be passed.
Should problems occur during the test period, the affected components, e.g. the supply line to the fuel pumps, must be cooled.

FUEL PRESSURE

The fuel pressure is adjusted by a mechanical pressure regulator. The pressure regulator is installed in the fuel line after Cylinder 4. The reference pressure of the fuel system is the airbox pressure.
The operating limit of the fuel pressure must be maintained at the inlet of the fuel pressure regulator.

A fuel pressure sensor is required to monitor the operating limits of the engine and its measured values have to be visible for the pilot.
It is in the scope of the aircraft manufacturer to select a suitable measurement position of the fuel pressure sensor.

Pressure measurement at “first installation“

The fuel system must be checked at "first installation"[11] of the 912 iS engine. A single measurement of the fuel pressure in reference to the intake manifold pressure at inlet of pressure regulator is required by the engine manufacturer. Operating limits regarding to fuel pressure must be observed under all operating condition (e.g. engine load, temperature, altitude, filter contamination, etc.). For this measurement a calibrated measuring tool must be used. An appropriate verification must be available by the aircraft manufacturer

TIP If the measurement position of the fuel pressure sensor is at the inlet of the pressure regulator (see position 1 fuel pressure sensor in interface overview figure 6.1), the limits in the Operator Manual 912 i Series (see chapter 2.1 section “operating limits”) have to be complied with.

If the measurement position of the fuel pressure sensor is at an alternative position (e.g. before the fine filter, so the filter load can be checked, see position 2 fuel pressure sensor in interface overview figure 6.1), the pressure limits have to be adapted to account for:

- potential pressure losses due to length of fuel lines, kinks, valves,...
- filter load (new vs. used)
- fluid column (in relation to flight situation)
- fuel flow variations (partial vs. full load)

This adaption has to ensure the correlation with the measurement at first installation at the inlet of pressure regulator (position 1).

FUEL LINES

General

NOTE

BRP-Rotax connectors on the fuel pump module / engine fuel rail are made of NiRo-material (stainless steel).
So we can not give a specific tightening torque information due to the chosen fittings and must refer to the relevant hose and connector specifications by the supplier.

Safety

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

11. for aircraft in prototype/technical-release process.

ATTENTION
For prevention of vapor locks: All the fuel lines on the suction side of the fuel pump have to be insulated against heat in the engine compartment and routed at distance from hot engine components, without kinks and protected appropriately. At very critical conditions (e.g. problems with vapor formation) the fuel lines could be routed in a hose with cold air flow.

Inlet line

- Connection thread on the right-hand injection line (Cylinder 1/3): M14x1.5 or AN-6 (9/16-18 UNF)
- Inlet line inner diameter: minimum 7.5 mm (0.3 in.) (AN-6 or 3/8“)

Fuel return line

ATTENTION
With the engine switched off (with both fuel pumps switched on), the pressure on the output of the fuel pressure regulator must not exceed 0.5 bar (7.25 psi) (relative to ambient pressure)

- Connection thread on fuel pressure regulator: 9/16-18 UNF
- Return line minimum inner diameter: 7.5 mm (0.3 in.) (AN-6 or 3/8“)

ATTENTION
If no bypass line is installed, the pressure release in the fuel lines is very slow. This must be noted accordingly in the manuals of the aircraft manufacturer (fuel lines are possibly under full operating pressure even after engine stop).

Bypass line

TIP To allow venting of the fuel system after a potential inclusion of air, install a restricted bypass line between the inlet (pressure side of the fuel pump module) and the return line. In this bypass line a restricted orifice must be installed so that there is an ideal balance between short venting time and minimum fuel flow rate.
The positioning and dimensioning of the orifice is up to the aircraft manufacturer.

TIP For better heat dissipation select fuel lines made of metal whenever practicable (except for flex hoses to/from engine).

NOTE

The switching between several fuel tanks at power loss due to fuel shortage must be given within a defined period of time and without falling below the minimum performance limit and must be ensured by the aircraft manufacturer.

Refer to the latest requirements such as FAR or EASA.

Screw clamp

ATTENTION
Prevent leakage! Utilize the full slip-on length for all connections. Secure hoses with suitable clamps or crimp connection.

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 50 - 67 micron (0.0019 in. up to 0.0026 in.) must be provided in the supply line between the tank and the fuel pumps. This filter must be of sufficient capacity to prevent complete blockage between maintenance intervals.

WATER SEPARATOR / GASCOLATOR

The installation of a water separator/gascolator must be carried out by the aircraft or fuselage manufacturer and verified according to the latest regulations, such as FAR or EASA.

FINE FILTER

The fine filter must be installed so that it is easily accessible for maintenance work and can be inspected as per the maintenance overview.
The fine filter with following specifications must be installed between the fuel pumps (modul) and the injection rail (Cylinder 1/3):

- Filter mesh size: 8 - 12 micron (0.0003 in. up to 0.0005 in.)
- Fuel flow rate: min. 90 l/h
- Differential pressure: max. 0.02 bar (0.29 psi)

GENUINE-ROTAX®-FUEL PUMP ASSY.

ATTENTION

Fuel pumps are permitted in connection with the GENUINE-ROTAX®-steel housing only. When not using this assy., the aircraft manufacturer has to perform all tests according to the latest construction regulations.

NOTE

The GENUINE-ROTAX® fuel pump unit has been tested and approved according to CS-E-130. Thus , the fuel pump unit can be installed to the firewall without additional fire protection.

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 lock. The pump must be free of vibrations and installed low, if possible below the level of the fuel tank outlet.

NOTE

If the length of the power supply line is insufficient, it can be extended. A ROTAX® connector set is available.

ATTENTION

The wiring is manufactured for the GENUINE-ROTAX®-fuel pump assy. only.
Do not connect additional load (additional fuel pumps, lamps, LED, etc.) to the power supply of the fuel pumps.

CURRENT INPUT

Operating condition of the fuel pumps: ON

Voltage [V]	12	14	16
Current [A]	9.1	10.1	11.2

TECHNICAL DATA

	The technical data of the fuel pumps provided by ROTAX® is shown below.
Housing	Stainless steel
Nominal voltage	12 V
Capacity	approx. 120 l/h (31.7 US 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 US gal/h) c) pressure safe up to 20 bar (290 psi)

Dimensions: Connection 9/16-18 UNF

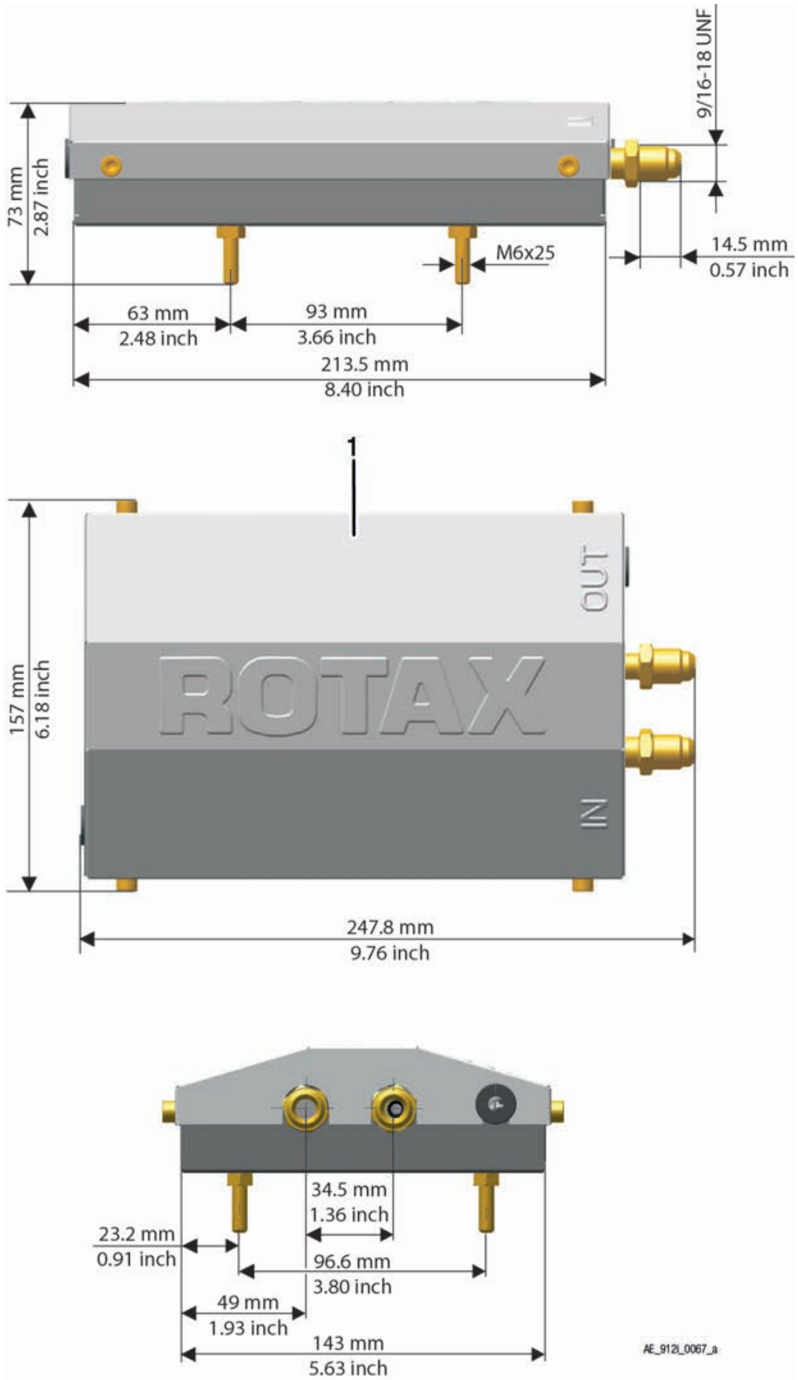


Figure 6.2: Dimensions: Fuel pump Connection 9/16–18 UNF

1 *Fuel pump assy.*

Dimensions: Connection M14x1,5 metric

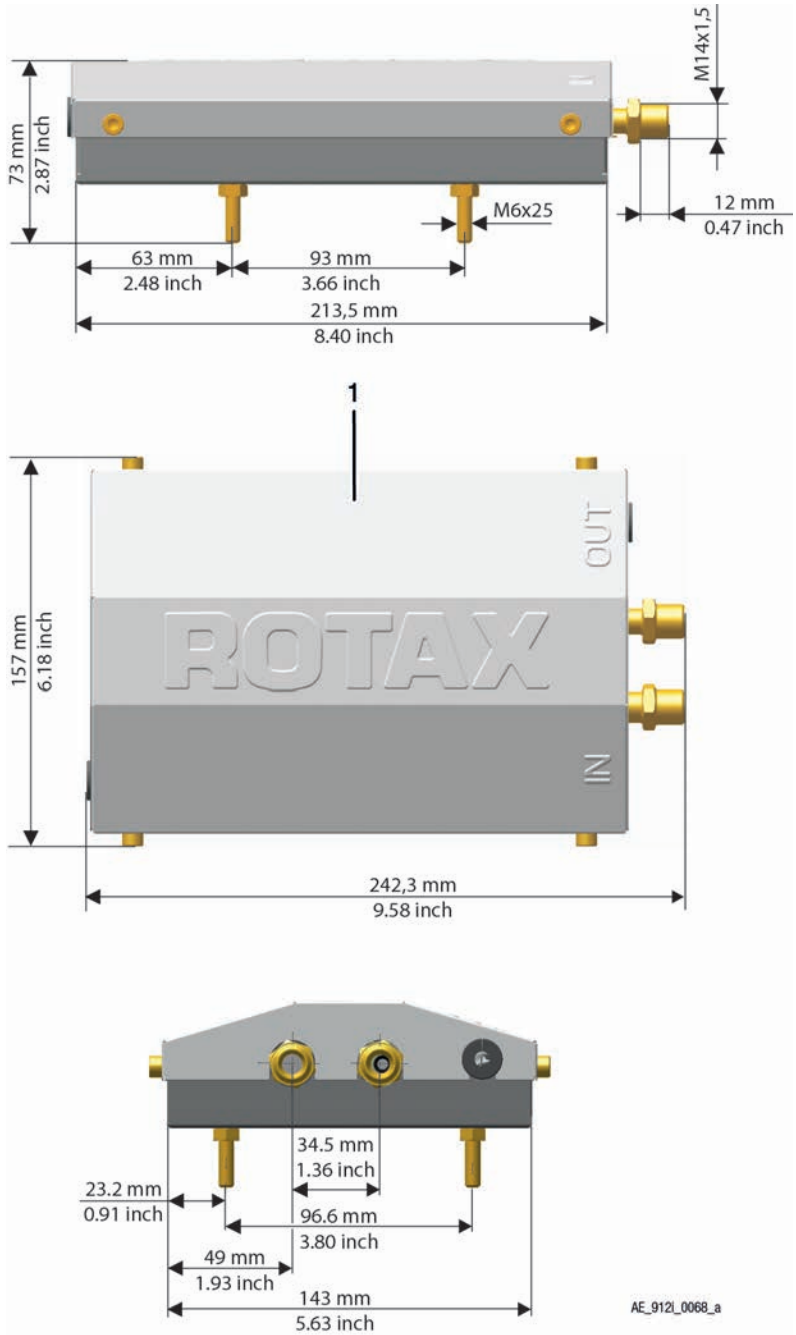


Figure 6.3: Dimensions: Fuel pump Connection M14x1,5 metric

1 *Fuel pump assy.*

GENERAL REQUIREMENTS PLACED ON THE FUEL PUMPS

ATTENTION

With the engine switched off (with both fuel pumps switched on), the pressure on the output of the fuel pressure regulator must not exceed 0.5 bar (7.25 psi) (relative to ambient pressure)

Min. delivery rate 56 l/h

Min. fuel pump pressure 4.5 bar (65.26 psi) absolute (at sea level)

Power supply line If the length of the power supply line is insufficient, it can be extended. A ROTAX® connector set is available.

ATTENTION

The responsibility for correct implementation and use of the power supply wires between harness connector and fuel pump is up to the aircraft manufacturer or the authorized Service Center, which performs the work.

For use as a power supply line for supplying the fuel pumps off the standard wiring harness, a line insulated with PTFE, ETFE or higher has to be used. The construction regulations for each aircraft class are mandatory and have to be applied and complied with.

Wire size The cross-section of the power supply wire must be at least 1.5 mm²/ 16 AWG (0.0023 in²) of stranded, coated copper. The length of the power supply wire between the harness connector and fuel pump must be selected so that the voltage drop along the additional wire does not exceed < 500 mV.
In accordance with the construction regulations, the aircraft manufacturer or the approved Service Center can also develop their own cable design.

ATTENTION

The aircraft manufacturer or the approved Service Center must ensure that the fuel pump is supplied with sufficient electrical energy to maintain the required minimum values for the engine and the fuel pressure and volume flow in each operating state and in every flight attitude.

Wire construction The wire construction must be a shielded twisted pair cable (STP, 40x twisted per meter) to meet the requirements of the EMC Directive (electromagnetic compatibility).

Supply problems

TIP In case of supply problems of the fuel pump, the fuel tank should be emptied and filled with AVGAS. If the problem does not occur at the next test (with AVGAS), then this is a sign of formation of vapor bubbles when using MOGAS (or auto fuel).

Favorable impact on the installation

TIP

- Single tank
  (large volume of fuel in the tank, just a few fuel lines)
- Catchtanks in the wing tanks
  This provides the fuel supply in every flight situation/position

Headertank

- Tank should be made of light metal
- Tank volume at least 5 l (1.32 US gal)
- A sump should be integrated into the headertank
- Provide connection for a "Low Fuel" sensor
- The venting line from header tank to wing tank should generally be on an incline to avoid trapping bubbles
  The venting line must have an inner diameter of at least 12 mm (0.50 in)
- Fuel feed lines from the wing tanks to the header tank should be on a steady decline

Unfavorable impact on the installation

TIP

- Fuel lines smaller than 7.5 mm (0.30 in) (AN-6 or 3/8“) of inner diameter
- Multi-tank systems without Catch-, Headertank
- Coarse or fine filter not in use
- Fuel cock position on the pressure side of the fuel system (after the fuel pump module)

Pressure fluctuations

TIP Fuel pressure regulators have very precise tolerances and are generally reliable. Pressure fluctuations are not typically caused by the pressure regulator, so they have to be searched in other areas (filter clogged, pulsation of lines, kinks in the hoses, etc.) of the fuel system, before troubleshooting the pressure regulator.

Vapor bubbles

TIP

- Vapor bubbles in the return line must be efficiently vented out of the fuel system to atmosphere
  Adequate fuel tank venting system design is imperative.
  Large vent lines with (most) direct routing avoiding low points are desired.
- A header tank design that efficiently jets vapour bubbles back to the fuel tanks and atmosphere without possibility of re-entry into the suction line, is critical.

Low points

TIP Non drainable low points in feed, return and vent lines must be avoided. Any low points must allow for drainage of water and other contaminants.

⚠ WARNING

At the low points, accumulations of water can freeze and cut off the flow.

CONNECTIONS FOR THROTTLE BOWDEN CABLE ACTUATION AND PERMISSIBLE LOAD

ATTENTION
The specified permissible loads must never be exceeded!

TECHNICAL DATA

Connection for throttle valve

Set screw	M6x12
Tightening torque	4 Nm (36 in.lb) (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)

REQUIREMENTS ON CABLE ACTUATION

⚠ 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.

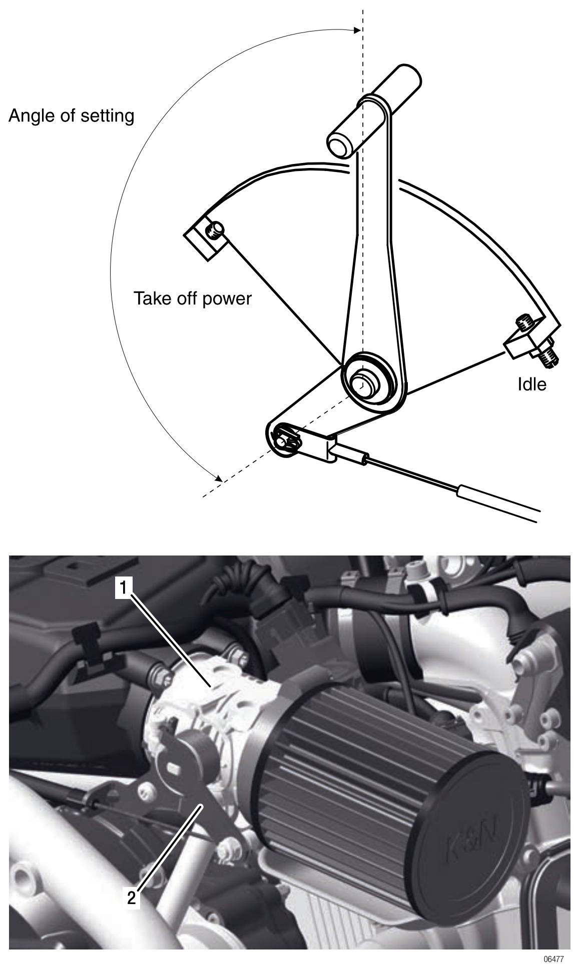


Figure 6.4: Cable actuation

1 Throttle valve | *2 Throttle lever*

Throttle lever / Bowden cable adjustment

Adjust Bowden cable such that throttle valve can be fully opened and closed.

Step	Procedure
1	Pull to “full throttle”, then adjust Bowden cable so that it has 1 mm (0.04 in.) clearance (no tensioning), thereby ensured that throttle valve is completely open. **NOTE** *Spring pulls the throttle valve to full throttle position.*

Step	Procedure
2	Pull to "idle". Adjust the spring loaded screw until the required idling speed is reached. The screw with the black cap is the setting for the lowest idle speed and adjusted by the factory. This setting must not be changed..
3	Mark adjustments with locking varnish.

NOTE

It is not recommended to install a throttle limiter. With the installation of a throttle limiter, the engine can not reach its nominal power.

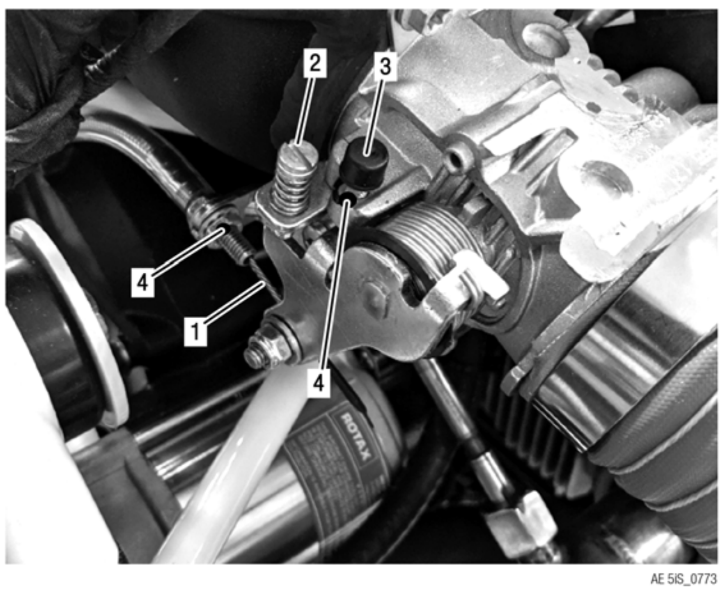


Figure 6.5: Figure shows idle position

1	*Bowden cable*	2	*Spring-loaded screw (idle speed adjustment)*
3	*Screw with black cap (setting for lowest idle speed)*	4	*Locking varnish*

Throttle lever stop

The idle speed must not be adjusted by a throttle stop in the cockpit. The throttle lever must contact the idle speed stop screw on the engine (idle speed, see latest Operators Manual).

⚠ 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.

Chapter: 74–00–00
IGNITION SYSTEM

TOPICS IN THIS CHAPTER

INTERFACE OVERVIEW

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.

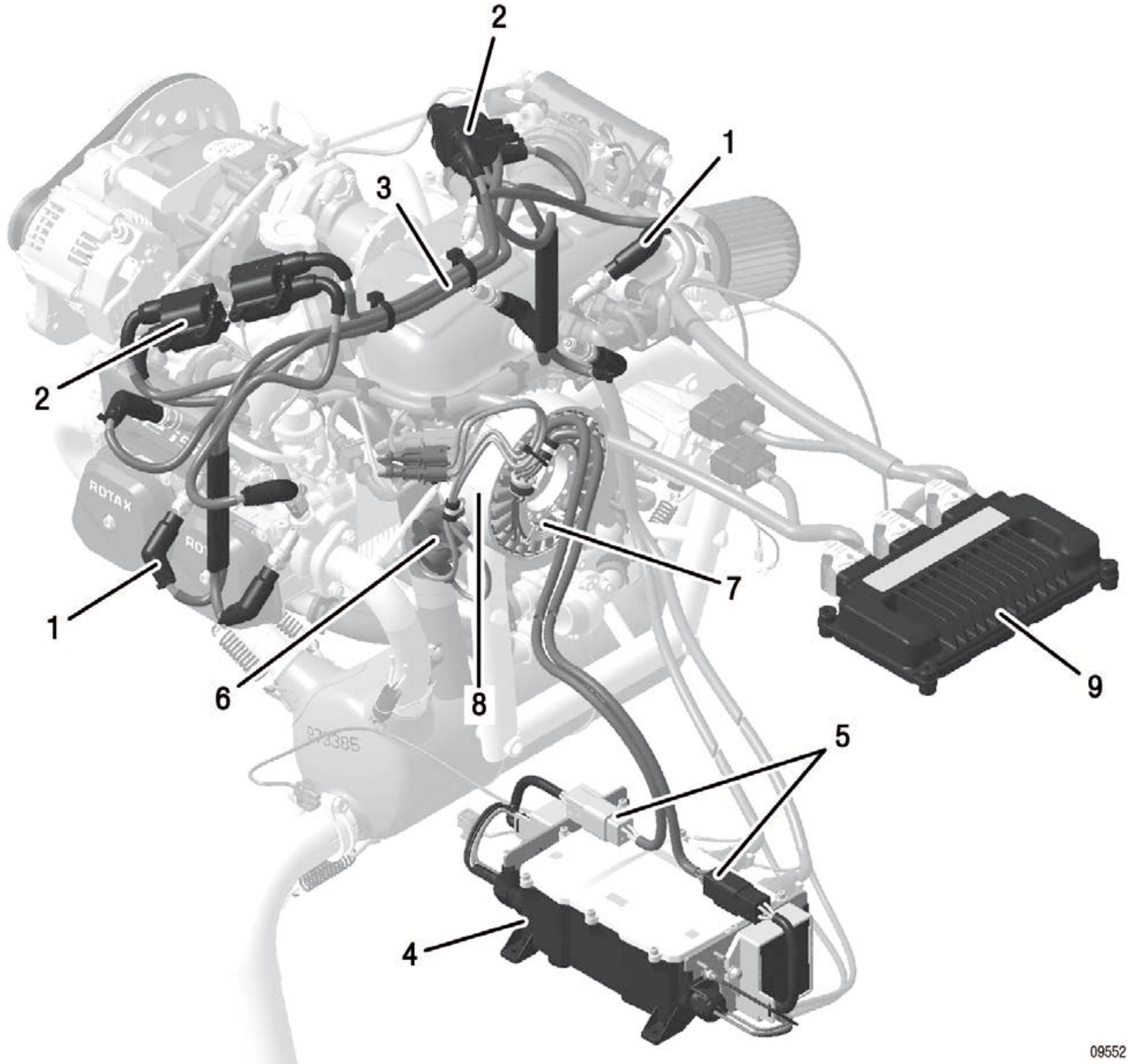


Figure 7.1: Ignition system, typical

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*		

CONNECTION TO RECTIFIER REGULATOR

⚠ 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.

ATTENTION
Connecting the components incorrectly will mean that there will not be enough energy for the on-board power supply or to charge the battery. The two connectors are colored differently to prevent them being connected incorrectly. The two connectors are colored differently to prevent them being connected incorrectly.

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

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 2400 rpm longer than 3 sec, then the ECU automatically switch over to generator A) and to charge the aircraft battery.

Chapter: 75–00–00
COOLING SYSTEM

TOPICS IN THIS CHAPTER

INTERFACE OVERVIEW

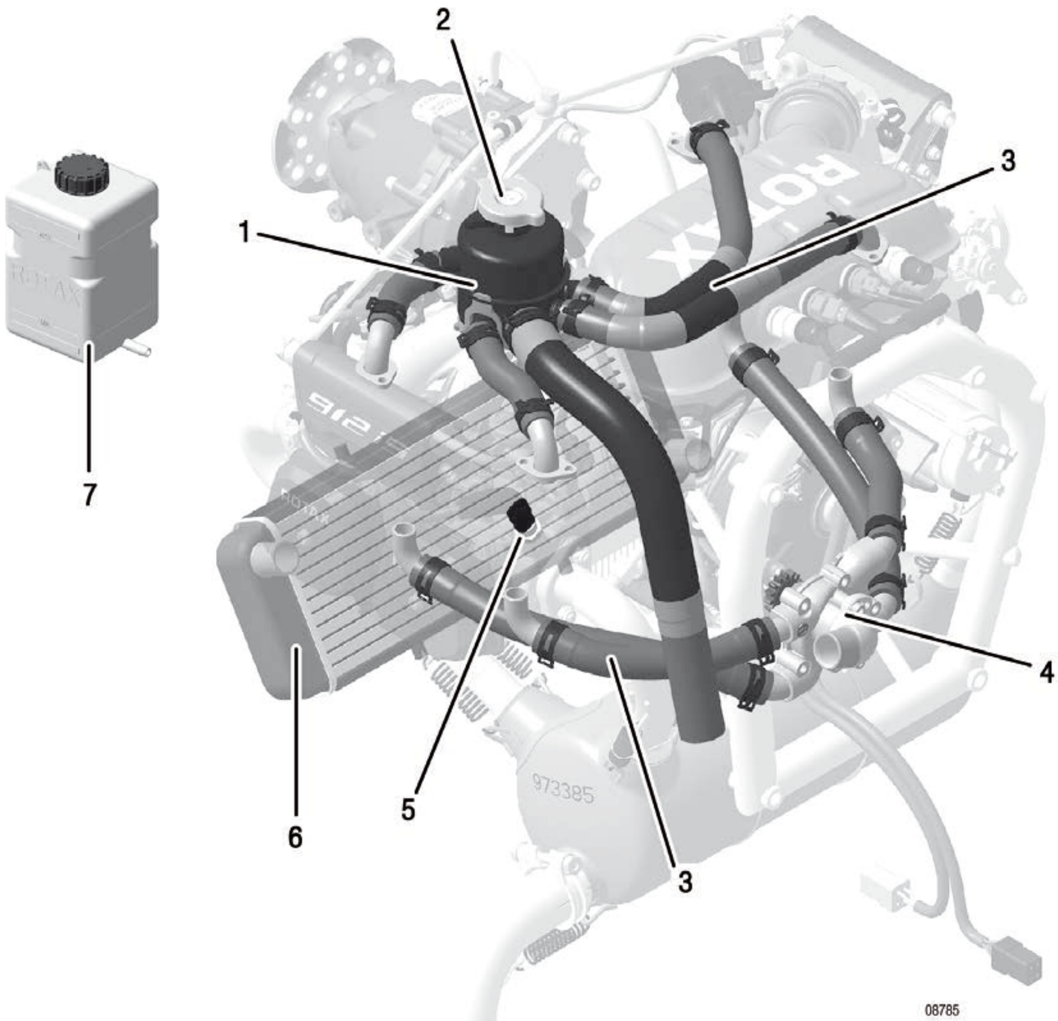


Figure 8.1: Cooling system — Interfaces

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

INSTALLATION OVERVIEW

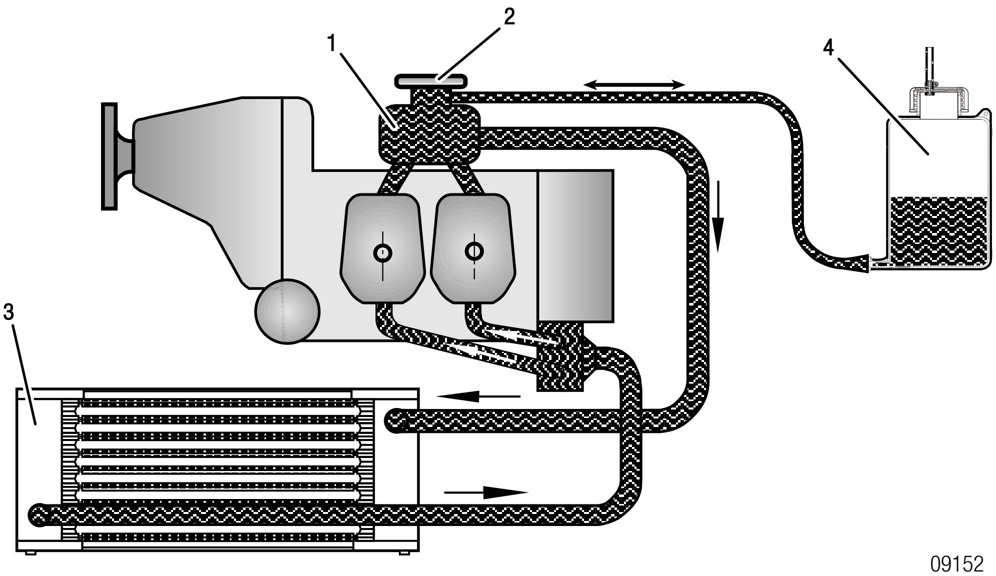


Figure 8.2: Cooling system

1	*Expansion tank*	*2*	*Pressure cap*
3	*Radiator*	*4*	*Overflow bottle*

SYSTEM LIMITATIONS

Operating limits

Refer to latest issue of the Operators Manual ROTAX® 912 i Series.

⚠ 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.

Cooling

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. Since the standard location of the radiator 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 (with pressure relief valve and return valve). As the coolant heats up and expands, the pressure relief valve opens and the coolant flows via hose at atmospheric pressure to the transparent overflow bottle. 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. Readings are taken on measuring point of the hottest cylinder head, depending on engine installation.

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.

OPERATING LIMITS

⚠ 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.

“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:

- Coolant types
- Mixture ratio (percentage of water)
- System pressure (opening pressure of radiator cap)

NOTE

Permanent monitoring of coolant temperature is necessary.

Coolant temperature

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

COOLANT TYPES

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

Permissible coolant types:

- Conventional coolant based on ethylene glycol

ATTENTION
Obey the latest edition of Service Instruction SI-912 i-001, for the selection of the correct operating media.

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

ATTENTION
Obey the manufacturers instructions!

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

Marking

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

VALIDATION OF INSTALLATION

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

Measurement of coolant temperature

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

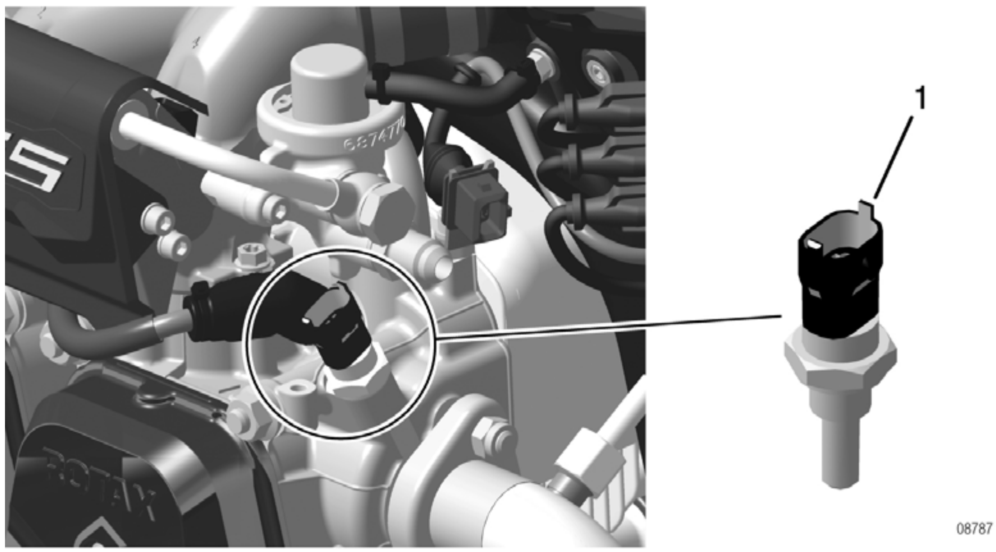


Figure 8.3: Coolant temperature sensor

1 *Coolant temperature sensor*

Coolant outlet temperature

⚠ **WARNING**

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

ATTENTION

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

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

Cylinder wall temperature

Max. permitted cylinder wall temperature on hottest cylinder is 200 °C (392 °F). See the following figure.

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.

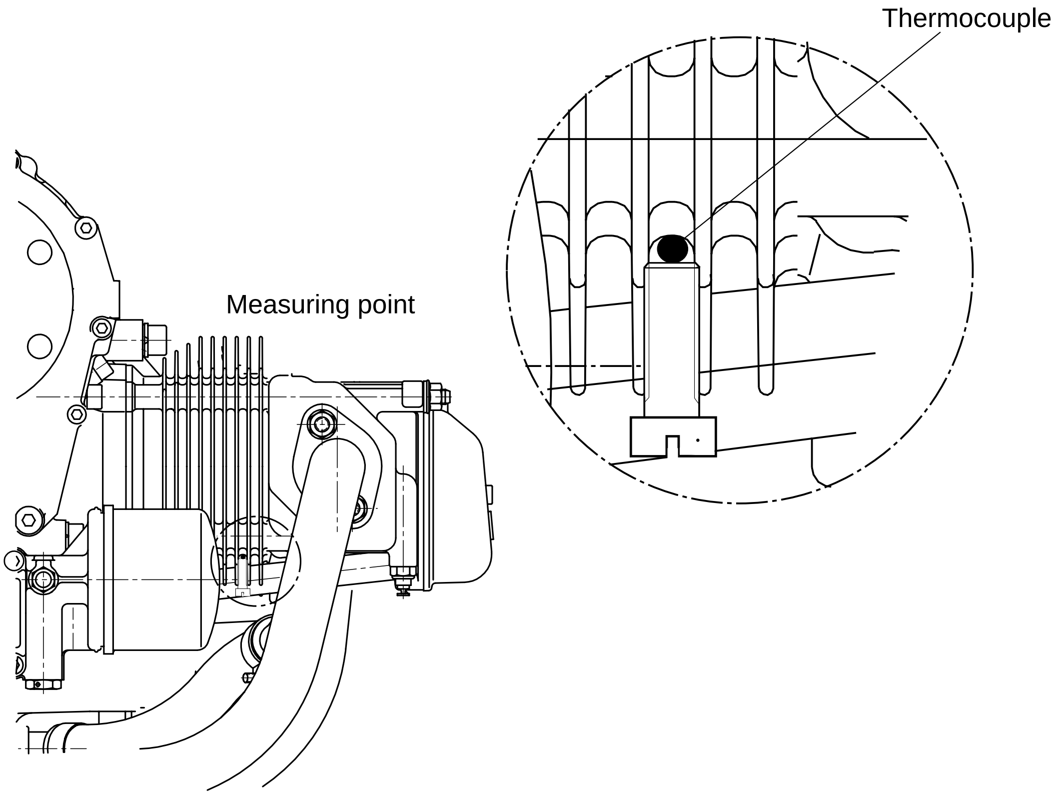


Figure 8.4: Measuring point

Pressure test

To ensure the System has no leakage, remove the pressure cap from the expansion tank. Then attach the pressure tester and pump the system until the pressure manometer shows 1.2 bar (18 psi). After min. 1 minute, there should be still 1.2 bar (18 psi) pressure in the system.

- Check the efficiency of the coolant radiator and its proper sealing between cowling and radiator.
- Check the proper flow between expansion tank and overflow bottle.
- Ensure that no ram air is induced onto the overflow bottle vent line.
- Check efficiency of air duct (if installed) and proper air flow through the duct and around cylinders.
- Consider cold (winter) and hot (summer) conditions in ground and flight testing.
- Check proper dampening of the water radiator and stressless installation and proper sealing.

COOLANT HOSES

ATTENTION

Hoses exposed to direct heat radiation from the exhaust system, must be suitably protected with heat-resistant protection covers, for example.

Aluminium tubes with an inner diameter of 25 mm (0.98 in) can be used instead of longer hoses. These must have a bulge in order to prevent coolant hoses working loose.

NOTE

Note, the addition of an aluminium tube will double the number of hose clamps required!

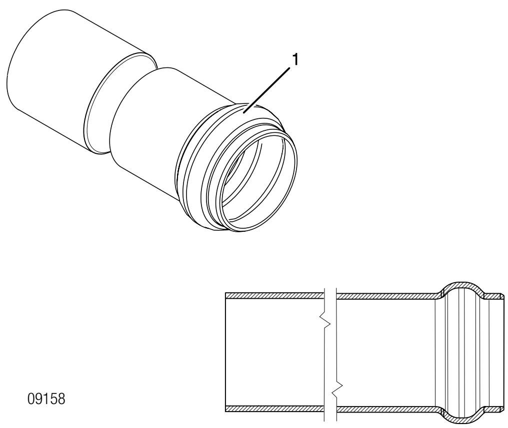


Figure 8.5: Aluminium tube

1 Bulge

Temperature resistance	min. 125 °C (257 °F)
Pressure durability	min. 5 bar (72 psi)
Inner diameter	25 mm (1″)
Bending radius	min. 175 mm (6.89 in.) (except moulded hoses)
Material	100 % resistant to glycol, antifreeze, ozone

Hose from expansion tank

⚠ 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 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.

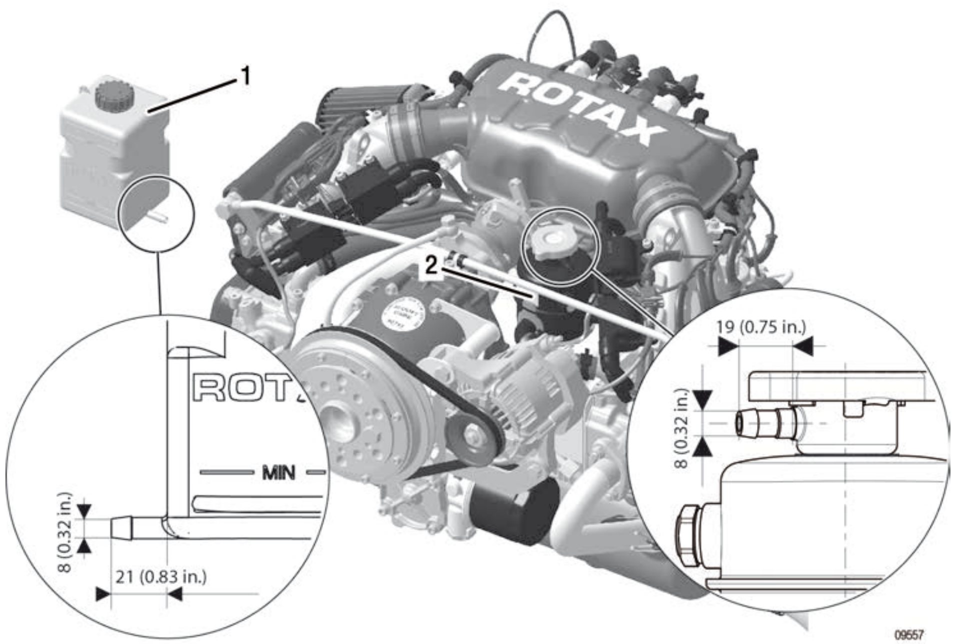


Figure 8.6: Hose connections

1 Overflow bottle

2 Expansion tank assy.

CONNECTING SIZE AND POSITION OF CONNECTIONS

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

water inlet elbow	Outside diameter	27 mm (1 1/16″)
	Slip-on length	max. 19 mm (3/4″)

Connecting dimension

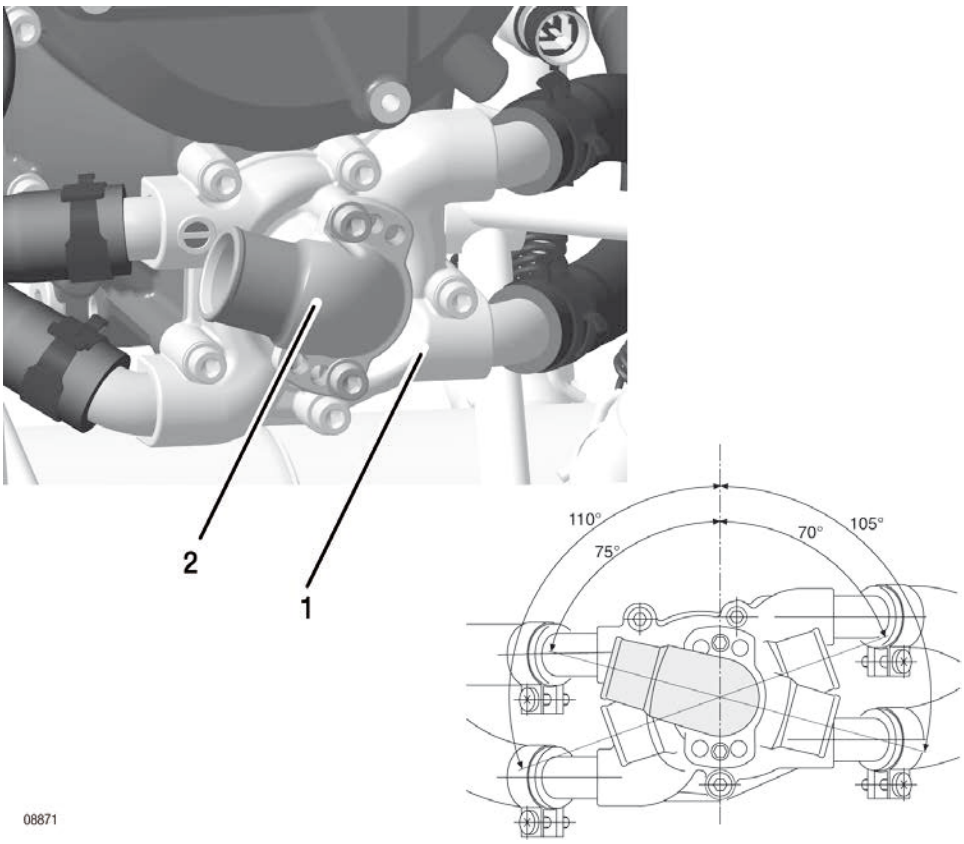


Figure 8.7: Connecting dimension

1 Water pump housing

2 Water inlet elbow

Water inlet elbow

> **ATTENTION**
>
> **Prevent leakage!**
> Utilize the full slip-on length for all connections. Secure hoses with suitable clamps or crimp connection.

Choose between six possible installation positions of water inlet elbow appropriate to specific installation (see Fig. Connecting dimension).
Use two M6x20 Allen screws and lock washers to attach the water inlet elbow. Tighten screws to 10 Nm (90 in lb).

REQUIREMENTS, PERMISSIBLE LOCATION AND INSTALLATION POSITION

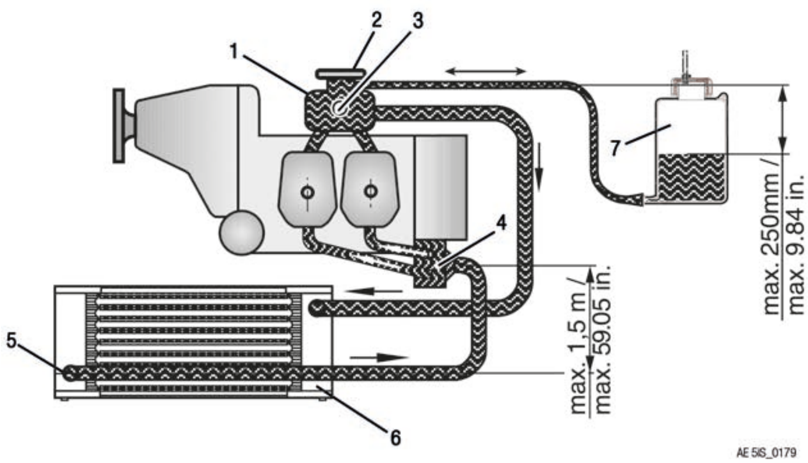


Figure 8.8: Permissible location

1	*Expansion tank*	2	*Pressure cap*
3	*Fluid level glass*	4	*Water pump*
5	*Radiator outlet*	6	*Radiator*
7	*Overflow bottle*		

Radiator

⚠ WARNING

Non-compliance can result in serious injuries or death!
The components must be designed and installed such that the permissible operating temperatures are maintained and the max. values are not exceeded. This must also apply to “Hot day conditions“! If need be, take appropriate measures.

ATTENTION

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

Expansion tank location

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

NOTE

The expansion tank is fitted on top of the engine in standard configuration.

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.

ATTENTION

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

See “Modification of the overflow bottle“, latest issue.

- 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 US gal)
- With vent diameter at least 2.5 mm (0.1 in)
- Label about indicating function and content

Capacity overflow bottle

⚠ 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 overflow bottle

ATTENTION

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

GENERAL NOTES ON THE COOLING SYSTEM

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

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

ATTENTION

Risk of chafing, wear , loss of coolant.
Ensure that no contact with hoses or hose clamps of the engine is given (risk of chafing, wear, loss of coolant) at the installation of external components (governor, vacuum pump).

Radiator

ATTENTION

The size and type of radiator should be adequate to transfer thermal energy of approx. 30 kW (28.45 BTU/s) at take-off power.

In an installation as depicted with the radiator in a higher position than the standard supplied expansion tank, a water accumulator has to be fitted instead of the expansion tank. Additionally a suitable expansion tank has to be installed at the highest point of the cooling circuit.

NOTE

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

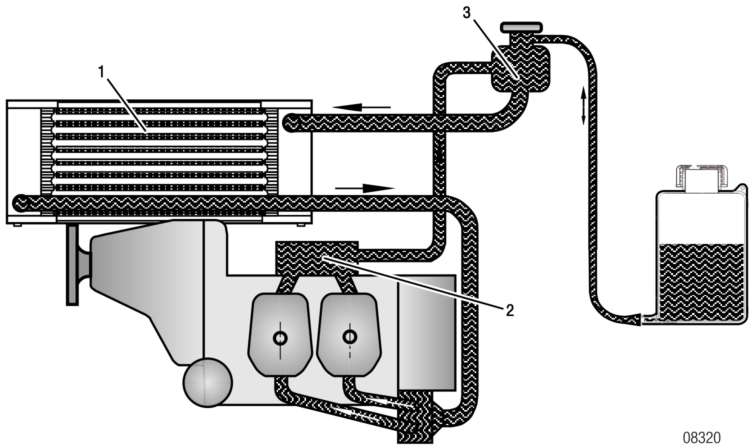


Figure 8.9: Radiator

1 *Radiator* 2 *Water accumulator*

3 *Expansion tank*

Flow rate The flow rate in the coolant circuit is approx. 60 l/min (15.85 US gal/min.) at 5800 rpm. At full throttle, an approximate value of around 0.75 m^3/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).

ATTENTION

If a GENUINE-ROTAX®-radiator is not being installed, ensure sufficient cooling capacity.
The radiator must be installed without distortion or stress and be free of vibrations.

COOLANT CAPACITY

4 cylinder heads	560 cm^3 (0.020 cu.ft)
Coolant pump	100 cm^3 (0.004 cu.ft)
Expansion tank	250 cm^3 (0.009 cu.ft)
Overflow bottle	approx. 0.5 l (0.13 US gal)
2 m coolant hose (InnerØ 18 mm)	500 cm^3 (0.018 cu.ft)
Total coolant quantity for engine	approx. 1.5 l (0.4 US gal)

MECHANICAL INTERFACES

Coolant radiator

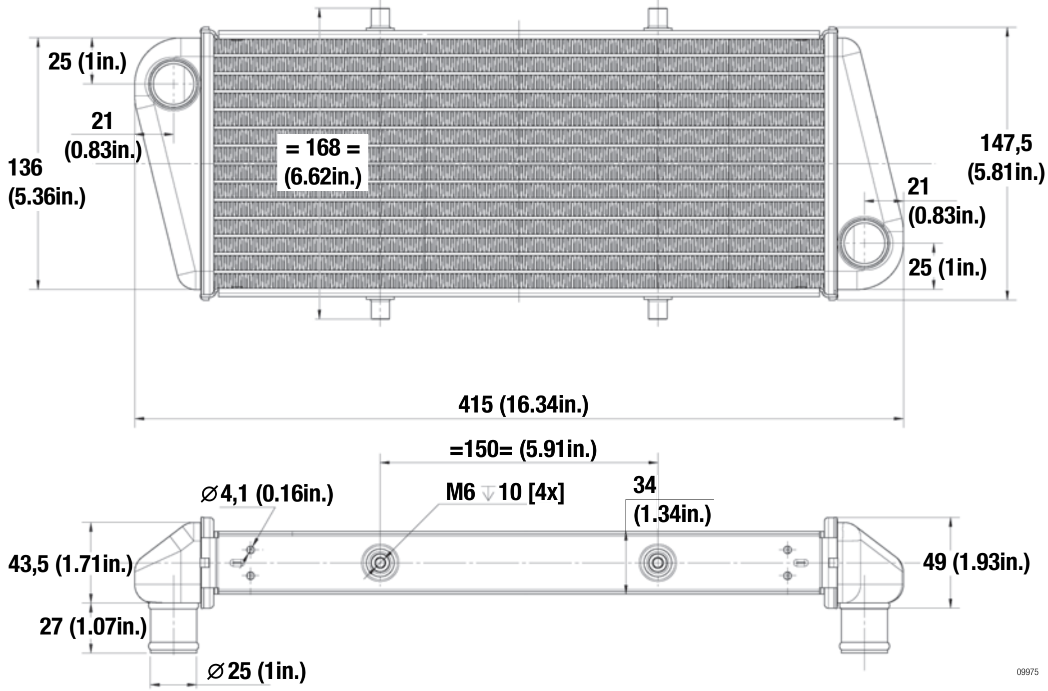


Figure 8.10: Coolant radiator: Connection and dimensions

To attach the coolant radiator within the airframe design four suitable fixation points are available and M6 screws must be used.

ATTENTION
Make sure proper dampening of the 4 fixation points and assure stressfree installation on these 4 fixation points.

OVERFLOW BOTTLE FROM ROTAX® (OPTIONAL AVAILABLE)

Retrofitting

If the optional ROTAX® overflow bottle is used, the hose from the expansion tank to the overflow bottle system must be provided by manufacturer (OEM).
To vent coolant steam from the overflow bottle in case of overheating, the plastic cap can be retrofitted with a hose nipple and hose.
The hose from the expansion tank must be routed so that coolant cannot come in contact with the hot exhaust system.
The vent hose must be routed in a continuous decline or furnished with a drain bore at its lowest point to drain any condensation.
The vent hose 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.

Attaching hose nipple

1. Unscrew the cap from the overflow bottle.
2. Bore out the existing vent 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.
4. Insert hose nipple with the thread first into the vent hole.
5. Fix M6 hex. nut onto the hose nipple.
   Tightening torque 5 Nm (3.69 lbft).
6. Screw the cap onto the overflow bottle.

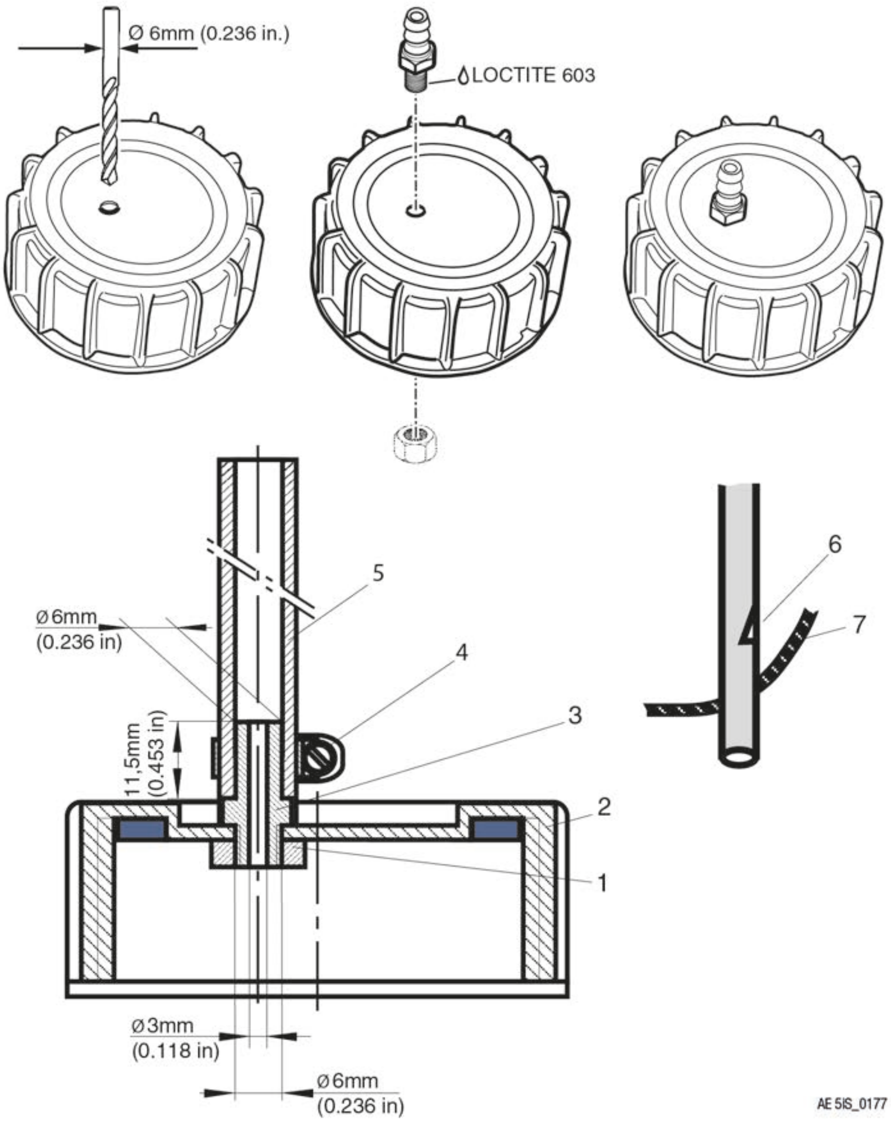


Figure 8.11: Attaching hose nipple

1	*M6 hex. nut*	2	*Cap*
3	*Hose nipple*	4	*Hose clamp*
5	*Vent hose*	6	*Bypass opening*
7	*Cowling*		

AIR COOLING INTERFACES

Position	x-axis	y-axis	z-axis
P1	- 300 mm (- 11.81 in.)	- 30 mm (- 1.18 in.)	- 14 mm (- 0.55 in.)

NOTE

If friction–fit attachment is not sufficient, additional attachment is possible using two M8 threaded lugs on the top of the engine block.

Cooling air duct

NOTE

In some special cases (entirly closed cowl) a separate cold air supply to the induction air filter should be provided.

Following recommendations should assist the aircraft or fuselage manufacturer in selecting suitable cooling air ducts:

Specification	Description
Cooling capacity	The cooling air duct must be designed so, that it transfers thermal energy of approx. 6 kW (5.7 BTU/s) at take-off performance.
Cross section of air duct	Cross section of the air duct min. 100 cm² (15.50 in²).
Material	Glass fibre reinforced plastic or heat and fire resistant material.
Attachment options	Friction–fit on engine block and mounting above the cylinder and the crankcase.

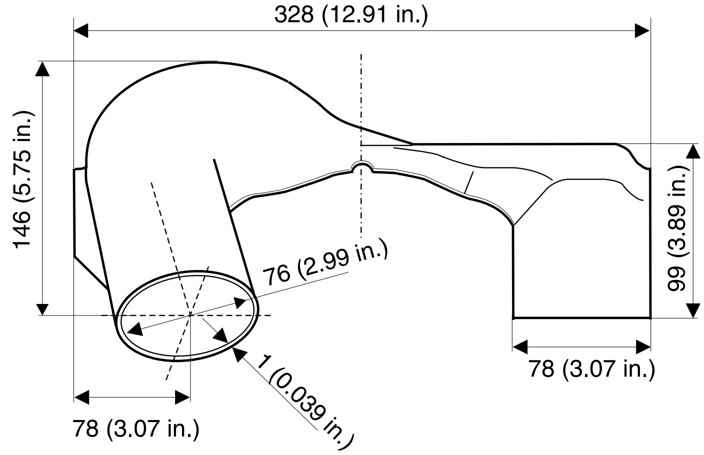


Figure 8.12: Cooling air duct for tractor

Chapter: 76–00–00
ENGINE CONTROLS

TOPICS IN THIS CHAPTER

EMS

Components

- ECU (Control unit assy.)
- ECU actuators
- ECU sensors
- EMS current supply
- Fuse box
- Switches
- Wiring

ECU

The core of the EMS is the engine control unit (ECU), which consists of two modules. These modules will be denoted by LANE A and LANE B, each one capable of taking over control, regulation and monitoring of the engine. In error-free engine operation, both LANES are turned ON. During engine control by LANE A, LANE B ensures that the engine operation can be maintained even after a failure or reduced functionality of LANE A. Depending on the activity and the failure status of the two LANES, the ECU automatically selects a LANE to take over control of the engine.

Sensors/ Actuators

A huge quantity of sensors (e. g. sensors for measuring the pressure in the airbox) and actuators (e. g. ignition coils) of the engine is designed with redundancy. In this case, each of the sensors or actuators is connected to a LANE, so that the two LANES have the same measurement values and send the same output signals. Non-redundant sensors (e. g. oil pressure sensors) are connected to one LANE only and serve for the expanded monitoring of the engine functionality. Due to an ECU internal communication, these sensor values will be exchanged between the two LANES (assuming that both LANES are active and free of errors).

Interface

Each LANE has a maintenance and a display interface (CAN-bus). While the maintenance interface is required to work with the software B.U.D.S. Aircraft to perform various diagnostic and maintenance activities, the display CAN interface enables the connection of a display for visualization of engine parameters.

Fuse box

In addition to the ECU, the Fuse box is another major component of the EMS. The Fuse box with its two rectifier regulators (from generator A and generator B) is responsible for a constant power supply to all EMS components including fuel pump module and the aircraft.

Provide

After engine start and before the engine has reached a defined speed for a specified time (see latest Operators Manual), the EMS is powered by generator B. After this threshold is activated, the generator B can be used to supply the aircraft and to recharge the aircraft battery. In this system state generator A supplies the EMS. In case of an error in the area of the power supply, the EMS is re-switching to generator B for continuation of the engine operation. In this case, the aircraft is no longer supplied with electrical power and the battery will not be recharged. This system state can only be reset with a full restart (power cycle) of the ECU.

NOTE

The generator (generator A or generator B) always supplies the complete EMS (both LANES A and B). The assumption that generator A supplies LANE A and generator B supplies LANE B is false.

Overview

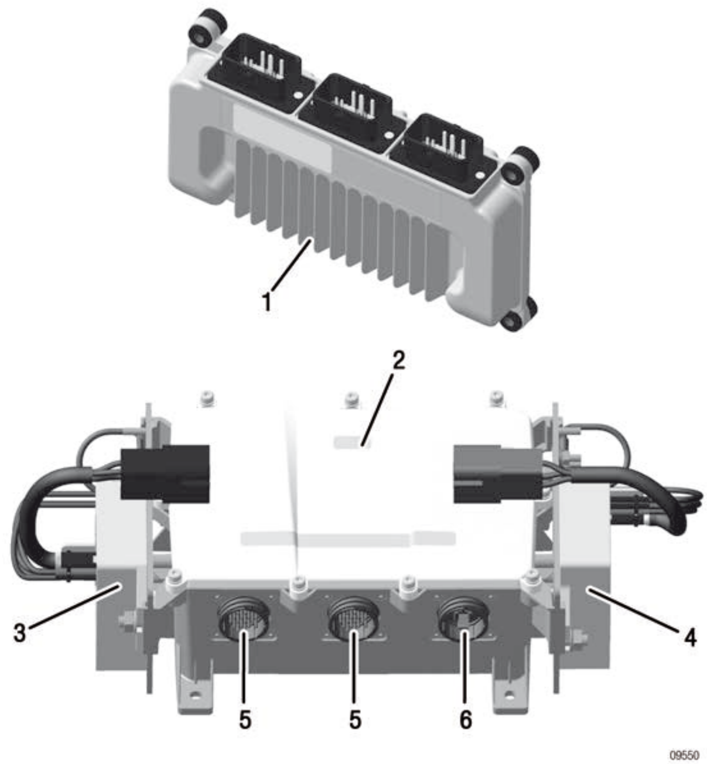


Figure 9.1: Engine control

1	*Control unit assy. (ECU)*	2	*Fuse box assy.*
3	*Rectifier regulator A (black connector)*	4	*Rectifier regulator B (grey connector)*
5	*LANE A (X1)/ LANE B (X2) plug connection*	6	*Plug connection (X3)*

ECU

There are two independent engine management units housed in a single waterproof box.

Technical data

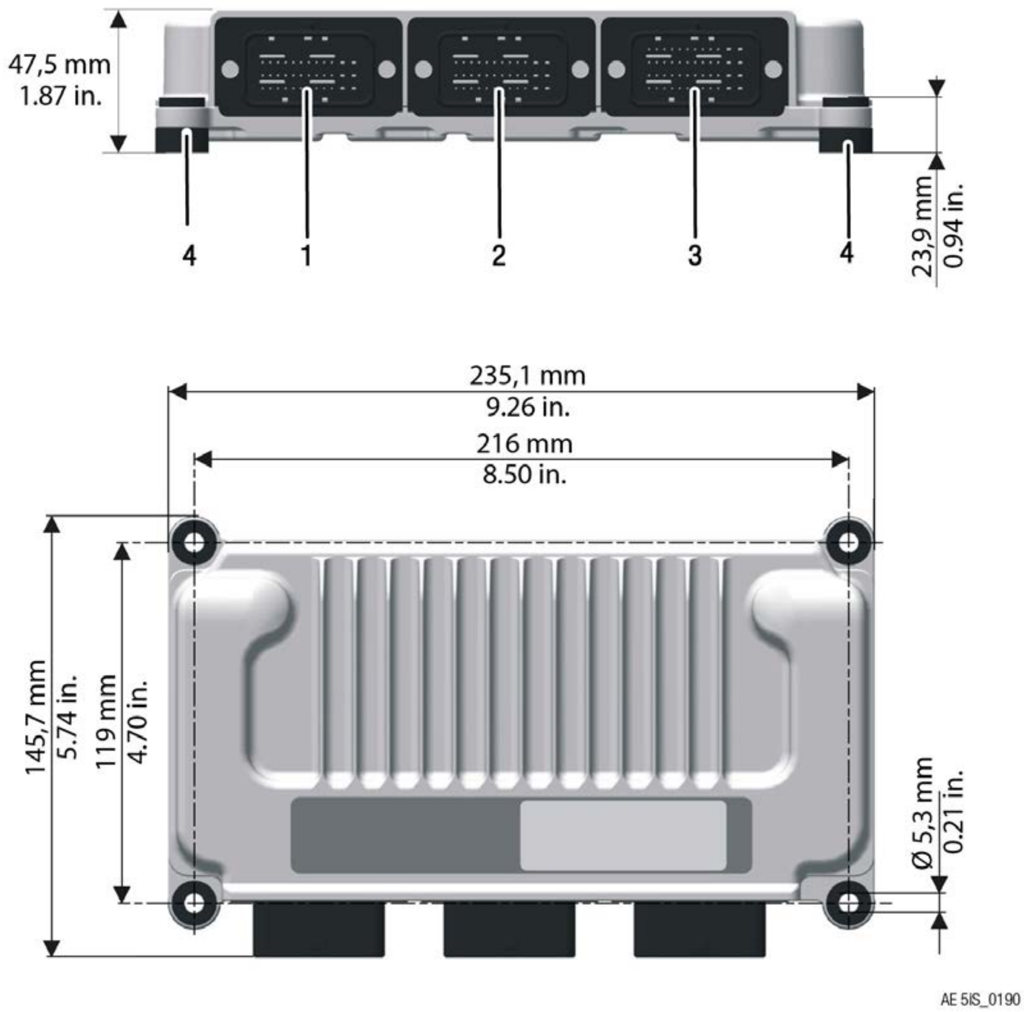


Figure 9.2: Connections and dimensions ECU

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

Connector The connectors are indexed, i.e. connector A1 can only be connected to A1.

ATTENTION
Excessive force or incorrect positioning can result in bent pins and the ECU would then need to be replaced.

Connections

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

ATTENTION
Risk of short circuit. 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.

Installation position

The ECU may be installed either in the engine compartment or in the cockpit or an area protected from fire and water/humidity.

ATTENTION
Prevent ingress of liquid (moisture). The ECU must be mounted so, that the plug connectors are facing downwards to the wiring harness.

- Isolated - No connection to the airframe or engine
- Cables or engine ground must not touch the ECU
- Max. bending radius from the wiring harness 50 mm (1.97 in.)
- Strain relief from wiring harness: ~ 100 mm (3.94 in.) behind the ECU connector

Installation notes

- Unplug the ECU connector from the wiring harness only if absolutely necessary
- In case of damage on the connector plug from the ECU: Replace wiring harness
- Corrosion of the plug contacts: Replace wiring harness and ECU
- Damaged connector plug locking pins: Replace ECU
- Do not rebind the plug contacts of the ECU: Replace ECU if necessary
- Connector plugs (ECU) are suitable for up to 20 plug-in operations according to the manufacturers information.

NOTE

The number of plugging operations must be entered into the logbook.

Temperature

Permissible component temperature: +80 °C (176 °F)

FUSE BOX ASSY.

Technical data

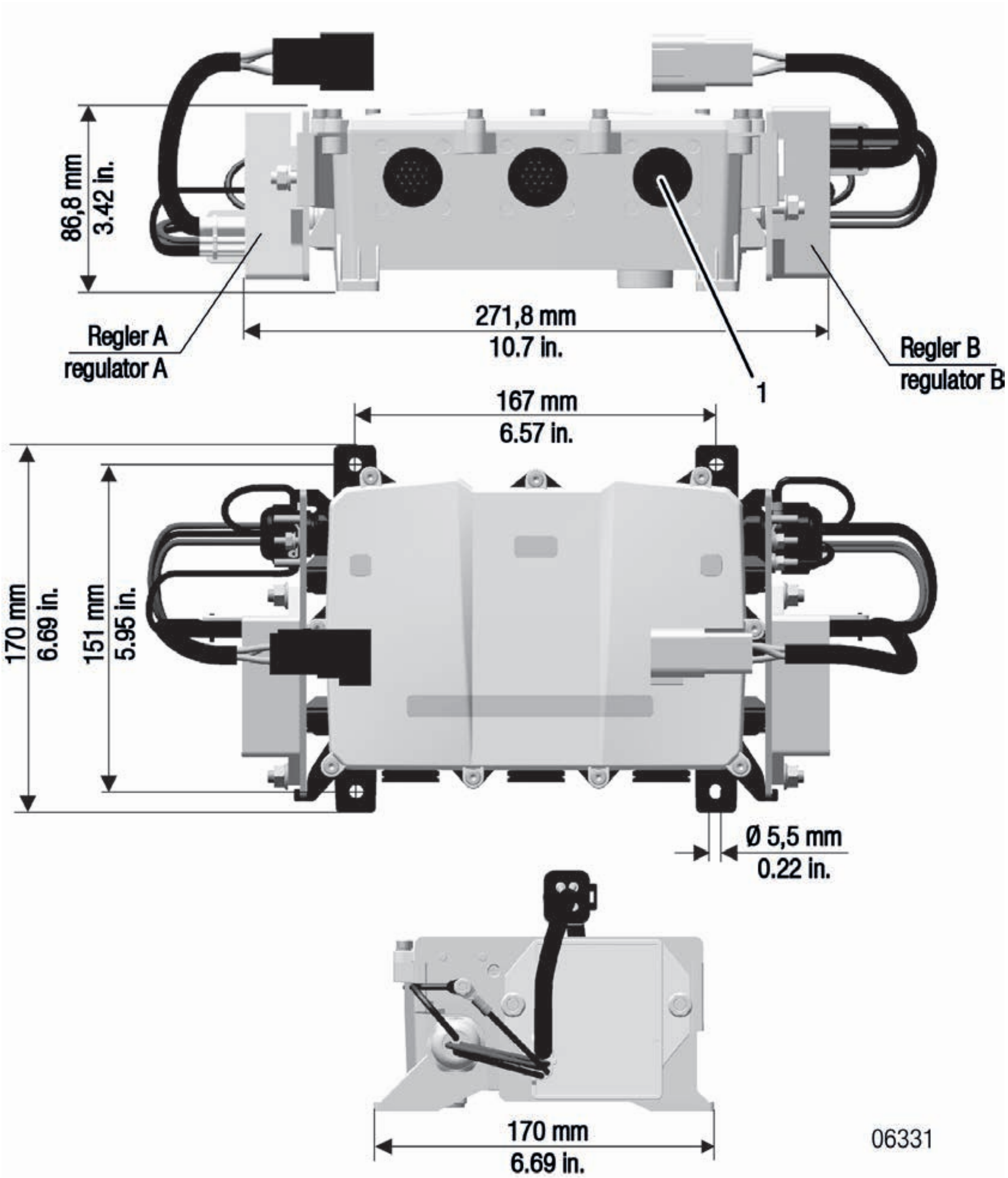


Figure 9.3: Connections and dimensions Fuse box

1 *Plug connection POWER (X3)*

Connections

Seals supplied with the fuse box assy., must be inserted into the grooves provided for each connector plug.
Insert the wiring harness plug in the correct position on the Fuse box assy.

NOTE

A set of spare fuses can be found in the Fuse box.

Installation position

The Fuse box must be placed that the maximum permissible component temperature +80 °C (176 °F) must not exceed.

⚠ WARNING
Risk of fire! The Fuse box must not be installed in the cockpit. Installation in the engine compartment ONLY!

FITTING THE AMP CONNECTOR

NOTE

The AMP connector is included in the scope of delivery.

1. Feed wires through the connector receptacle, squeeze plate and seal (make sure wires are aligned with seal and numbered holes in connector).
2. Strip insulation from wire.
3. Install socket contact using suitable crimping pliers.
4. Push the socket contact into the appropriate position in the AMP connector until it engages.
5. Check for tight fit.
6. Install connector receptacle and tighten.
7. Install wire strain relief clamp with two screws.

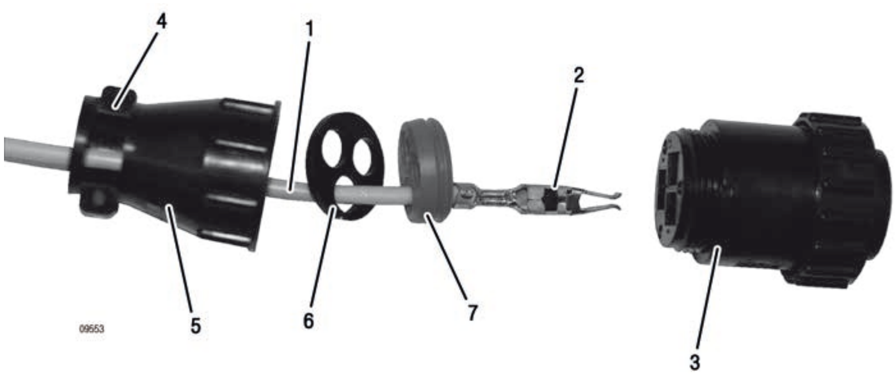


Figure 9.4: Fitting the AMP connector

1	*Line*	*2*	*Socket contact*
3	*Connector*	*4*	*Strain relief clamp*
5	*Connector receptacle*	*6*	*Squeeze plate*
7	*Cable seal*		

AAPTS SENSOR

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 must measure the correct air inlet temperature and the air pressure right before the air filter. The AAPTS must be mounted isolated from vibrations (e.g. caused by the engine).

ATTENTION
Observe correct positioning of AAPTS sensor. The AAPTS sensor must not be mounted in the air intake system between the air filter and throttle body.

MAINTENANCE/DIAGNOSTIC SOFTWARE (MAINTENANCE TOOL)

For engines of the ROTAX® 912 i Series, the maintenance and diagnostic software `B.U.D.S. Aircraft` is available. This provides not only the reading of ECU logs, it also provides a variety of functionality to support troubleshooting of the engine. To start this software and connect the engine with a computer a `B.U.D.S. Aircraft kit` is required.. This is a USB to CAN converter that provides different software functionality depending on its version.

PIN ASSIGNMENT OF MAINTENANCE AND DIAGNOSTIC INTERFACE

Pin assignment See Pin assignment of display interfaces.

Sub-D DE9 Pin assignment (9-pin) of maintenance and diagnostic interface.

PIN	Description	PIN No.	
		Sub-D DE9	HIC
LANE A	CAN_LOW_2_A	2	11 (HIC A)
	CAN_GND_2_A	3	10 (HIC A)
	CAN_HIGH_2_A	7	12 (HIC A)
LANE B	CAN_LOW_2_B	2	15 (HIC B)
	CAN_GND_2_B	3	14 (HIC B)
	CAN_HIGH_2_B	7	16 (HIC B)

NOTE

The positions of the individual pins on the 9-pin Sub-D DE9 connector are numbered.

NOTE

It is not recommended to connect maintenance and diagnostic interfaces LANE A and LANE B together.

Impedance If the ECU is connected with the Maintenance and Diagnostic Sub-D DE9 DE9 (9-pin) connector, the impedance between CAN_HIGH_2_A (CAN_HIGH_2_B) and CAN_LOW_2_A (CAN_LOW_2_B) will be ~60 Ohm.

DISPLAY

> ⚠ **WARNING**
>
> **Non-compliance can result in serious injuries or death!**
> Two independent Display CAN interfaces are provided for displaying or recording engine data. When displaying engine data, it must be ensured that data of both CAN interfaces is used, providing truly redundant data indication or data indication of suitable reliability, consistent with the safety objective of the final application. The proof of consistency with the safety objective of the final application is the responsibility of the installer.

Only use display devices that have a CAN Aerospace interface. Contact an authorized Distributor or Service Center for ROTAX® aircraft engines to get a detailed description of the display CAN interface (Pilot Display Interface Specification Document).

Only the defined operating limits by ROTAX® (see latest Operators Manual 912 i Series) are valid for engine operation. The responsibility for adapting these operating limits to the display accordingly is up to the display manufacturer.

PIN ASSIGNMENT OF DISPLAY INTERFACES

Display pin assignment

See Wiring HIC-Maintenance and Display.

Display interfaces

Connection	Description	PIN Nr.	
		on display	HIC
LANE A Sub-D DE9 Display interface	CAN_LOW_1_A	Refer to the connection specifications of the display manufacturer.	5 (HIC A)
	CAN_GND_1_A		4 (HIC A)
	CAN_HIGH_1_A		6 (HIC A)
LANE B Sub –D DE9 Display interface	CAN_LOW_1_B		7 (HIC B)
	CAN_GND_1_B		6 (HIC B)
	CAN_HIGH_1_B		8 (HIC B)

ATTENTION
In order to ensure a high electromagnetic compatibility in data transmission, twisted cables (3 pins: CAN_H, CAN_L, CAN_GND) must be used for the CAN-connections.

NOTE

If both CAN-interfaces are connected and plugged into an indicating instrument with only one input, an error on one of the interfaces or a short circuit on the data line can cause a total loss of data supply to the indicating instrument. Subsequently the pilot is no longer provided with important information such as temperature, oil pressure, boost pressure and speed.

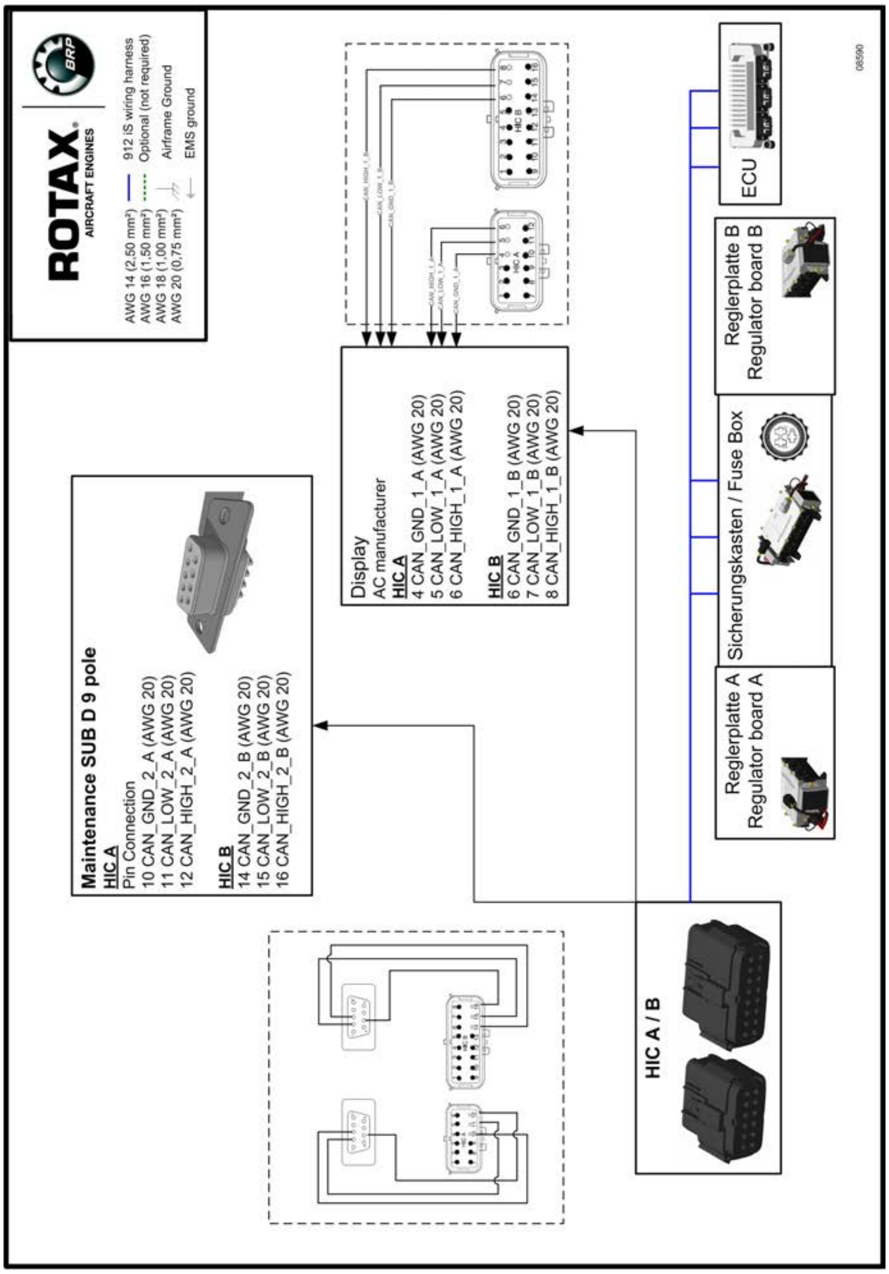


Figure 9.5: Wiring HIC-Maintenance and Display

Chapter: 78–00–00
EXHAUST SYSTEM

TOPICS IN THIS CHAPTER

INTERFACE OVERVIEW

ATTENTION

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.

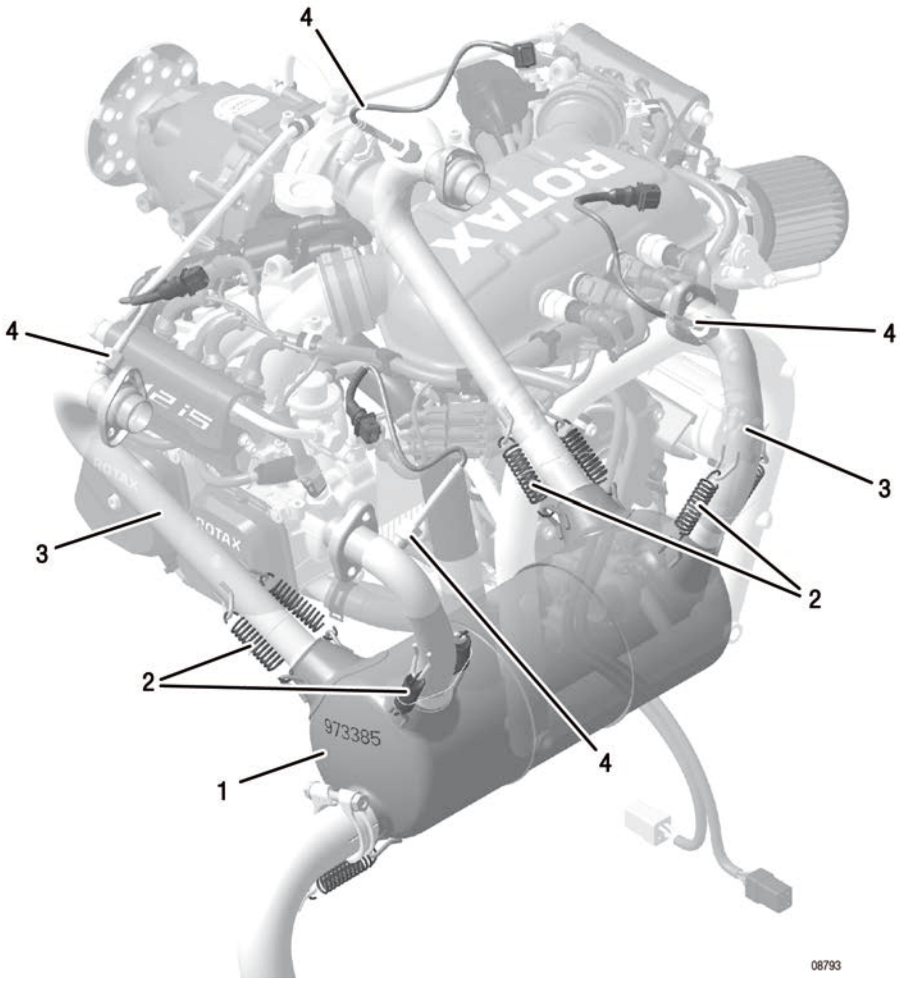


Figure 10.1: Exhaust system, typical

1	*Muffler*	2	*Tension springs*
3	*Exhaust pipes*	4	*EGT temperature sensors*

GENERAL NOTES ON THE EXHAUST SYSTEM

An exhaust system especially designed for universal application has been developed by BRP-Rotax.

⚠ WARNING
Non-compliance can result in serious injuries or death! The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

ATTENTION
Damage of the exhaust system possible. Vibrations due to improper installation and maintenance is the most common reason for damage of the exhaust system.

SELECT A SUITABLE EXHAUST SYSTEM

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.

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

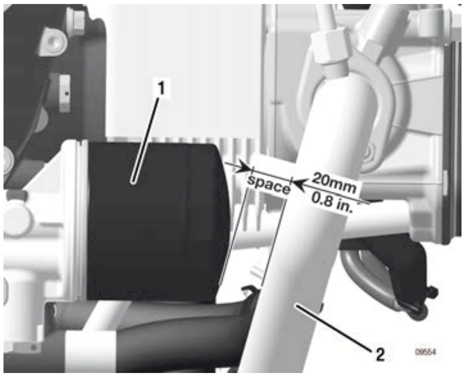


Figure 10.2: Oil filter

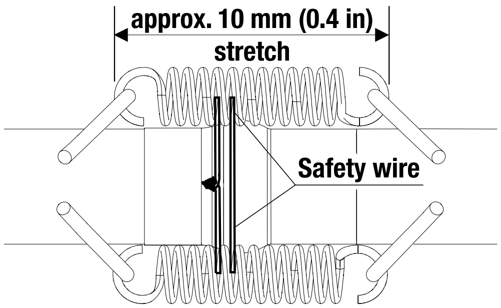
1 Oil filter *2 Exhaust manifold*

Ball joints The 4 ball joints must be used to avoid damage due to vibration.

ATTENTION
At tightening of the fuel lines support the specific line, to prevent any internal stresses.

The ball joints should be greased with heat resistant lubricant (ie.: LOCTITE ANTI SEIZE) to avoid jams and locks of the ball joint

Vibration Springs to be secured with safety wire to prevent FOD!



08326

Figure 10.3: Graphic exhaust spring

The sketch illustrates a possibility how to interconnect the exhaust springs to prevent the vibration of these springs and thus premature wear. It is also recommended to apply the high heat silicone for additional damping of vibrations.

SYSTEM LIMITATIONS

⚠ WARNING

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

ATTENTION

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

ATTENTION

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

ATTENTION

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.

Operating limits

Refer to latest issue of the Operators Manual 912 i Series.

Technical data

Average radius of exhaust manifold:	at least 40 mm (1.57 in.)
Inner diameter of manifold pipe:	28 mm (1.10 in.)
Damping volume:	approx. 5 l (1.32 US gal)
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

If GENUINE-ROTAX®-exhaust is not in use

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

Exhaust sockets material:	X6CrNIMoTi 17 12 2 (DIN 1.4571)
Tightening torque of M8 lock nuts:	min. 15 Nm (133 in.lb.)

NOTE

The exhaust flange must not touch the cylinder head.

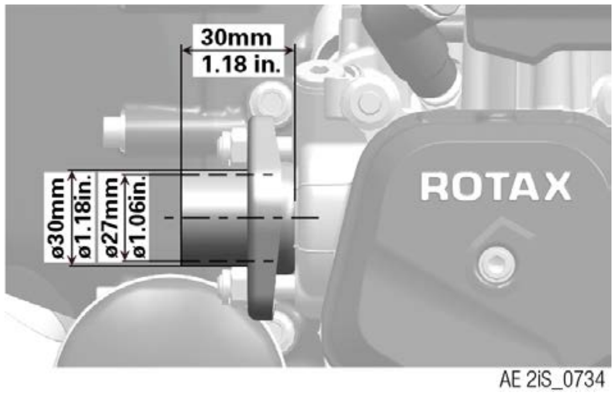


Figure 10.4: Exhaust sockets

ATTACHING THE EXHAUST SYSTEM

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 distances are given in relation to the reference coordinate system (P).

	Coordinates		
Location	**x-axis** [mm/in]	**y-axis**[mm/in]	**z-axis**[mm/in]
Cylinder 1	-160/-6.3	-196/-7.72	-68/-2.68
	-160/-6.3	-212/-8.35	-113/-4.45
Cylinder 2	-192/-7.56	196/7.72	-68/-2.68
	-192/-7.56	212/8.35	-113/-4.45
Cylinder 3	-408/-16.06	-196/-7.72	-68/-2.68
	-408/-16.06	-212/-8.35	-113/-4.45
Cylinder 4	-438/-17.24	196/7.72	-68/-2.68
	-438/-17.24	212/8.35	-113/-4.45

	Attachment points
Max. permissible forces (safe load) in (N/lbforce) 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

READING OF EGT TEMPERATURE

Location of the temperature sensor

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

The axis of the temperature sensor may be inclined up to 75 ° from the vertical, so that any residual water will not be collected in the tip of the temperature sensor.
The sensor element itself has no particular orientation, it can be rotated 360° around the axis. The tip of the temperature sensor must be positioned free in the gas flow.

Position

Approx. 50 mm (1.97 in.) from the cylinder head flange i.e. measured from the flat surface on the cylinder head to encoder axis. It is important that all 4 temperature sensors are placed at the same distance!

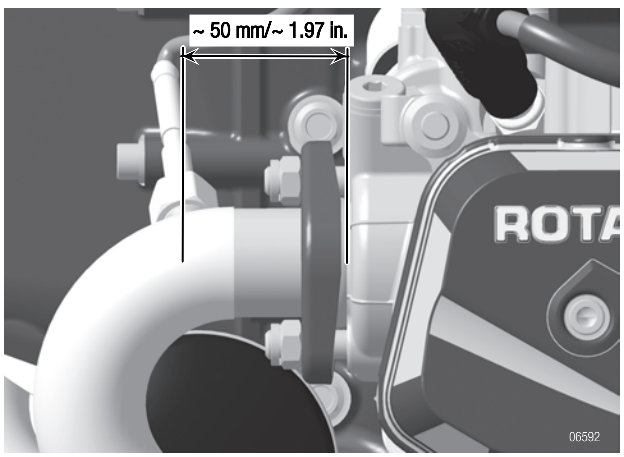


Figure 10.5: Position

Reading

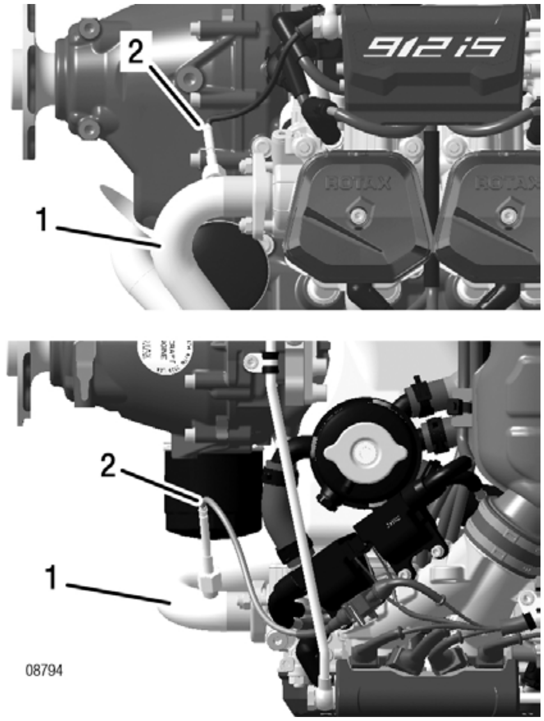


Figure 10.6: Readings of EGT

1 *Exhaust manifold*	2 *EGT sensor*

Operating limit

Refer to latest issue of the Operators Manual 912 i Series.

DATA FOR OPTIONAL COMPONENTS OF EXHAUST SYSTEM

Weight See Chapter 72-00-00 section Weight.

Exhaust elbow Material: X 15 CrNiSi20-12 (DIN 1.4828) (309 stainless steel)
Material strength: a = 1.5 mm (0.06 in.).

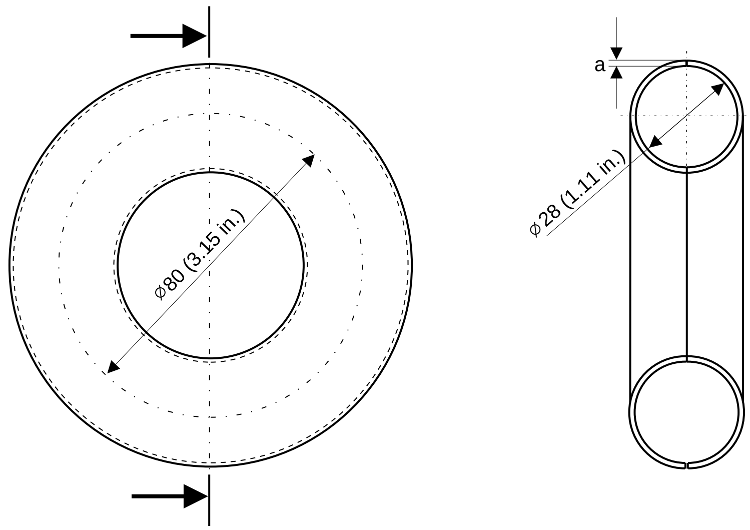


Figure 10.7: Exhaust elbow

Muffler Material: X 6CrNiTi 189 (DIN 1.4541) (321stainless steel)
Material strength: a= 1 mm (0.04 in.)

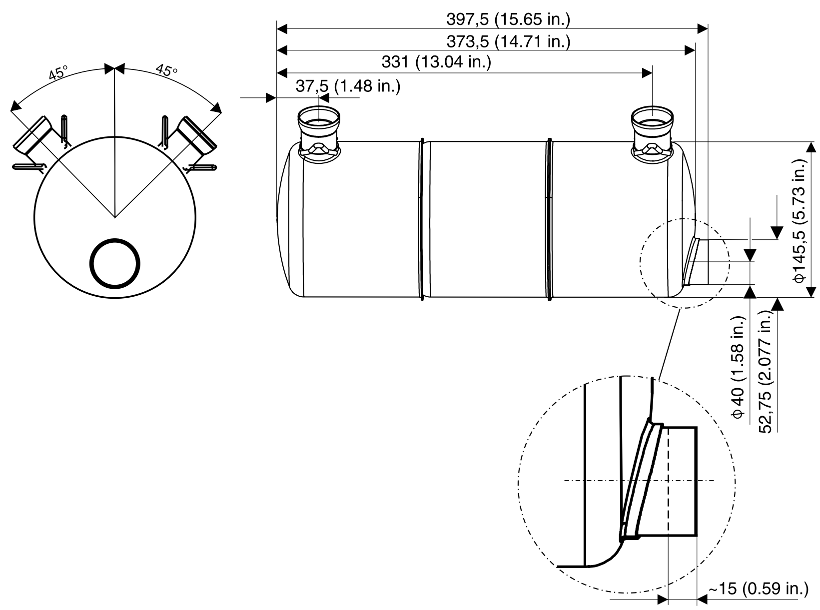


Figure 10.8: Muffler

Tailpipe Material: X 5CrNi 189 (DIN 1.4301) (304 stainless steel)
Material strength: a= 1 mm (0.04 in.)

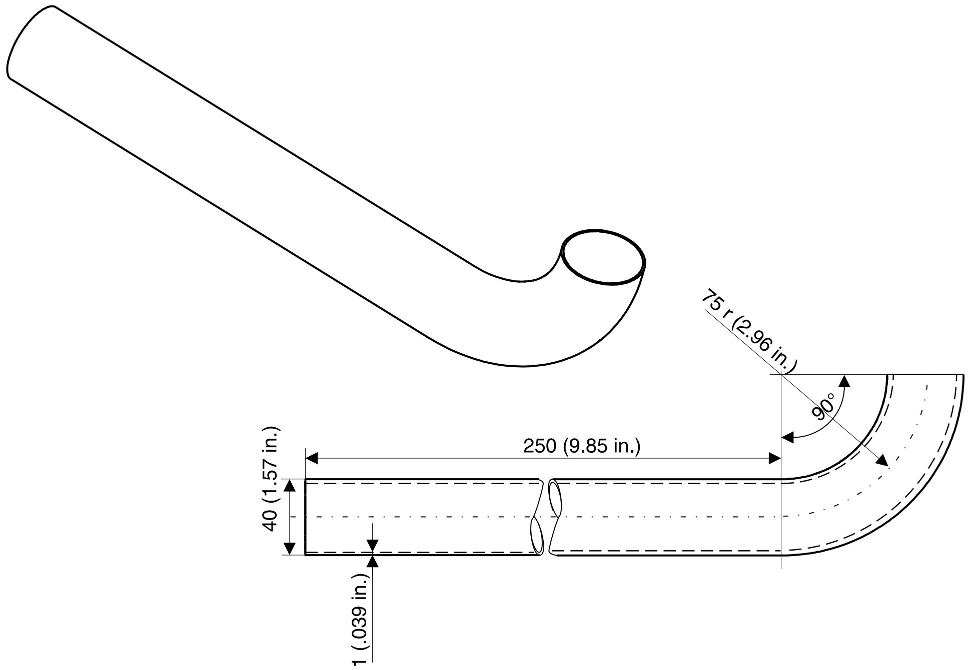


Figure 10.9: Tailpipe

Ball joint (male) Material: X 15CrNiSi 20, 12 (DIN 1.4301) (304 stainless steel)
Material strength: a= 1 mm (0.04 in.)

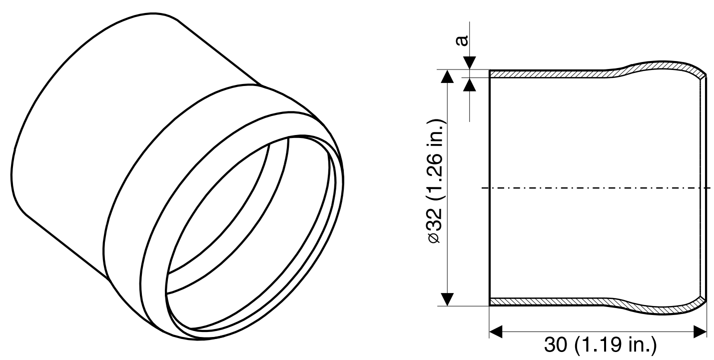


Figure 10.10: Ball joint (male)

Exhaust pipe

Material: X 15CrNiSi 20, 12 (DIN 1.4301) (304 stainless steel)
Material strength: a= 1 mm (0.04 in.)

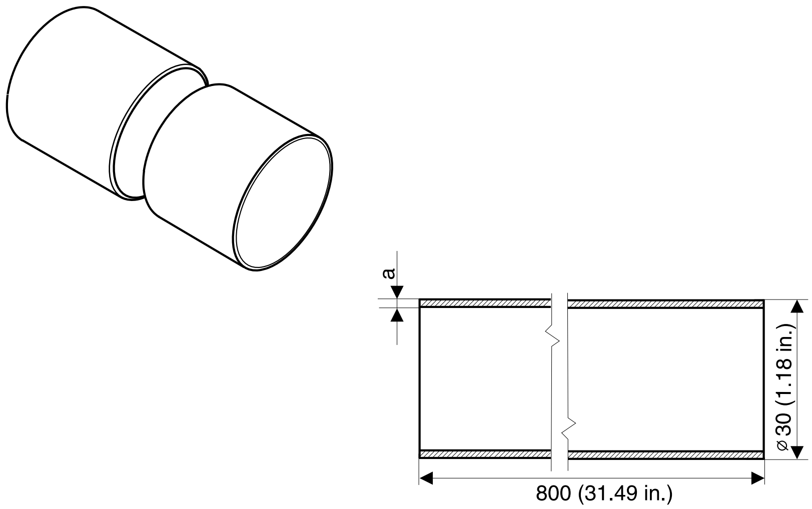


Figure 10.11: Exhaust pipe

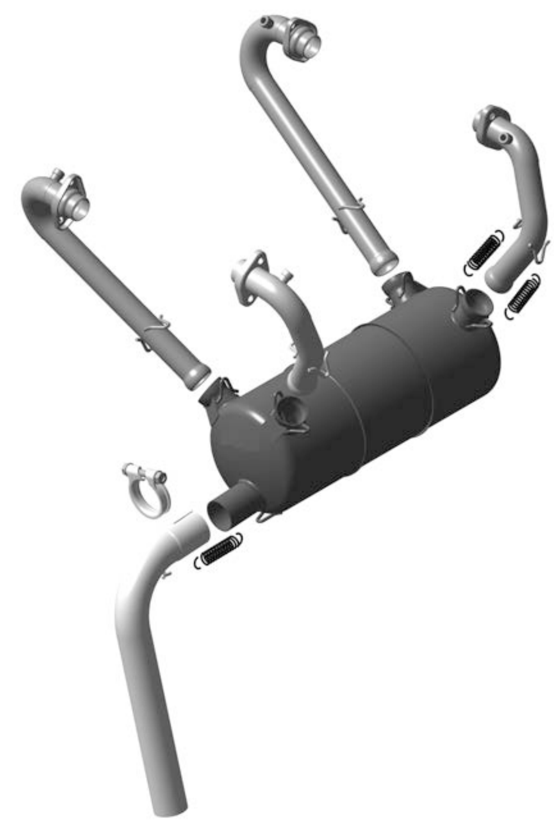


Figure 10.12: Exhaust assy. TYPICAL

Chapter: 79–00–00
LUBRICATION SYSTEM

TOPICS IN THIS CHAPTER

INTERFACE OVERVIEW

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

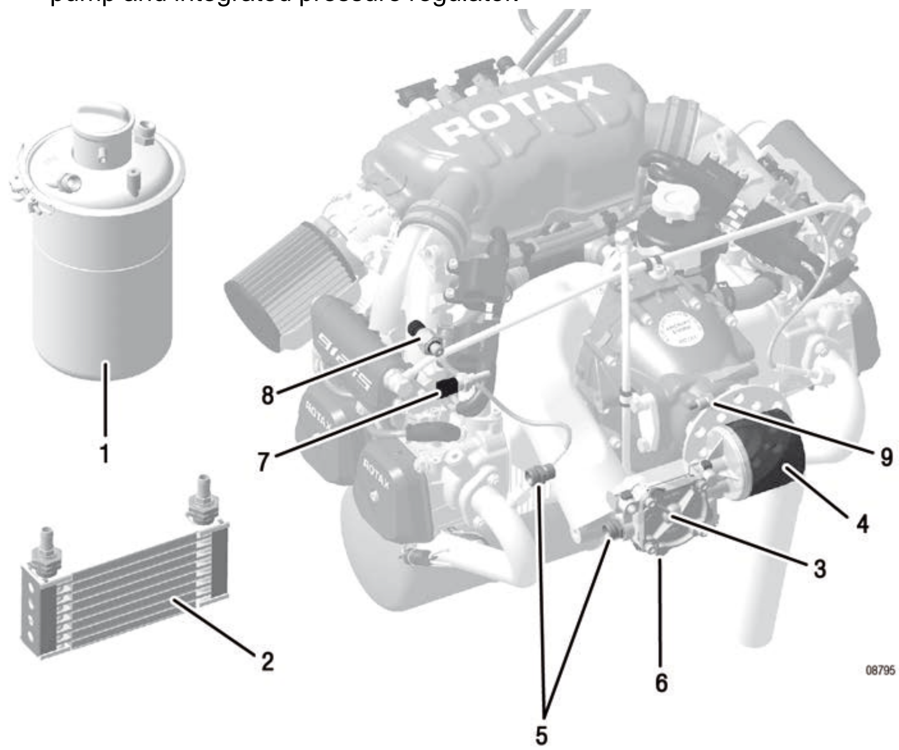


Figure 11.1: Overview lubrication system

1	*Oil tank*	2	*Oil cooler*
3	*Oil pump*	4	*Oil filter*
5	*Adapter (inlet fitting)*	6	*Plug screw M22x1.5 (alternate inlet port)*
7	*Oil temperature*	8	*Oil pressure sensor*
9	*Magnetic plug*		

NOTE

The oil pump inlet fitting 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 inlet fitting and gasket ring.

See the latest issue of the Maintenance Manual Heavy 912 i Series.

SYSTEM DESCRIPTION

⚠ 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.

NOTE

The oil pumps are driven by the camshaft.

The main oil pump sucks the motor oil from the oil tank (1) via the oil cooler (3) and forces it through the oil filter (4) to the points of lubrication (lubricates also the propeller governor).
The surplus oil emerging from the points of lubrication accumulates on the bottom of crankcase and is forced back to the oil tank by the blow-by gases.

NOTE

The oil circuit is vented to atmosphere via a nipple in the neck of the oil tank.

For the completion of the lubrication system only the following connections need to be established:

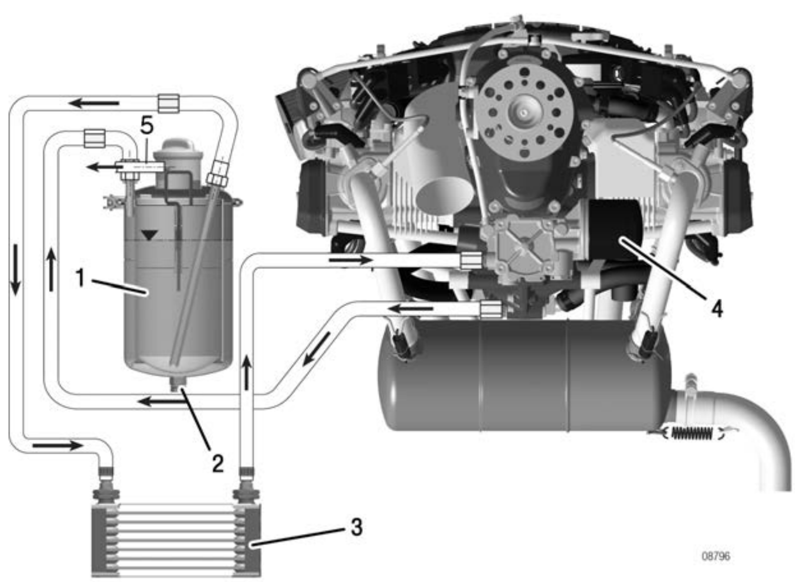


Figure 11.2: Lubrication system

1	*Oil tank*	*2*	*Oil drain screw*
3	*Oil cooler*	*4*	*Oil filter*
5	*Vent*		

Connections

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

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

Oil circuit, engine (main oil pump):

- Oil tank (outlet) to oil cooler
- Oil cooler to oil pump (inlet)
- Oil return to oil tank (inlet)
- Oil tank vent hose to atmosphere

NOTE

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

LOW AMBIENT TEMPERATURE

⚠ WARNING

Non-compliance can result in serious injuries or death!
At operation below normal operating temperature, formation of condensate in the oil system might negatively affect oil quality and may lead to corrosion.

Low temperature

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 the oil tank is located top high or "higher than recommended", 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.

Advantages of oil thermostat:

- safe oil pressure after cold start,
- prevention of fuel and water accumulation in the oil

See the Service Letter SL-912 i-002 "Use of an oil thermostat", current issue.

VALIDATION OF INSTALLATION

General The validation procedures described in this chapter do not claim to be complete. The correct execution and compliance with all given system limitations and interface descriptions as well as with standards and norms given by authorities must be proven by the aircraft manufacturer.

CRANKCASE PRESSURE MEASUREMENT

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

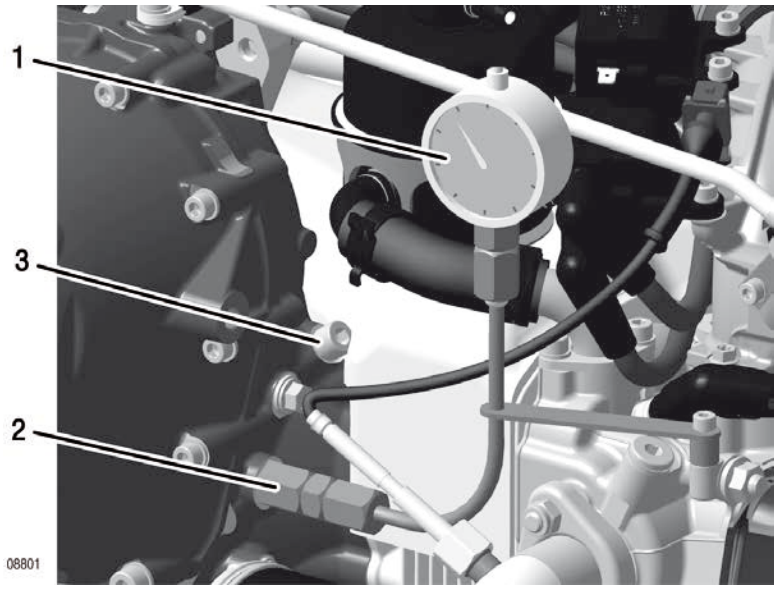


Figure 11.3: Measurement of crankcase pressure

1	*Pressure indicator*	2	*Magnetic plug (position for adapter)*
3	*Allen screw M8x20 (position for crankshaft locking screw*		

> **ATTENTION**
>
> **Leakage may occur!**
> Always use a new sealing ring with Allen screw M8 (position for crankshaft locking screw).

ATTENTION

Do not remove the magnetic plug for prolonged periods and do not use the measurement equipment during flight operations.

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

Magnetic plug

The thread for the magnetic plug must be M12x1.5 (metric).

Pressure values

The pressure in the crankcase at (full throttle) must not exceed the prevailing ambient pressure by more than 0.6 bar (8.7 psi) at 130 °C (266 °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.

MEASURING OF THE VACUUM

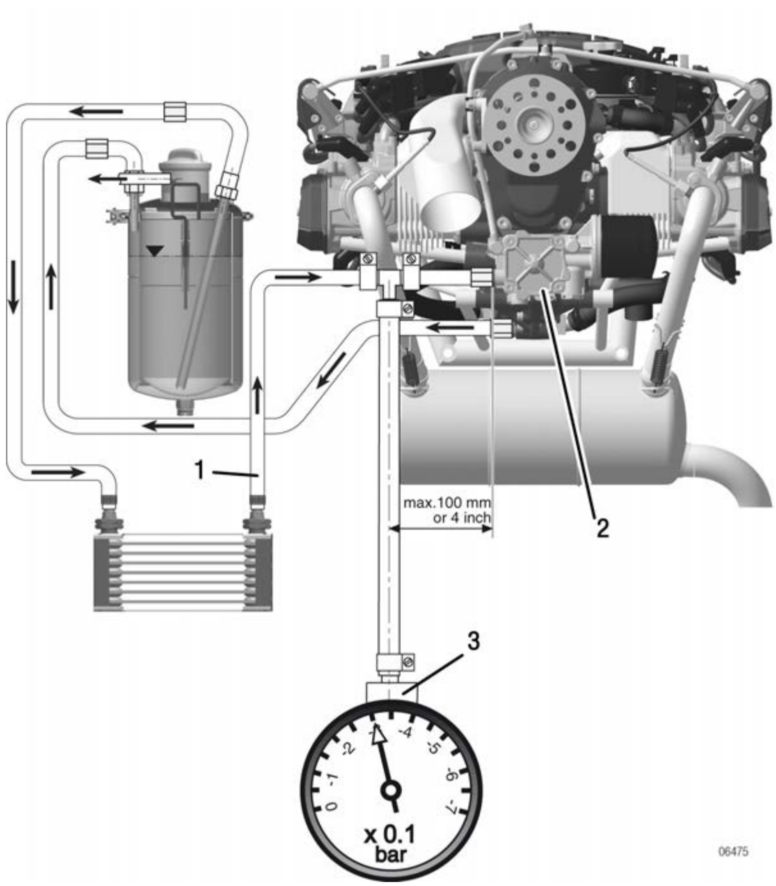


Figure 11.4: Measuring of the vacuum

1	*Suction oil hose*	2	*Oil pump*
3	*Pressure gauge with liquid damping for vacuum*		

Measure the vacuum in the suction oil hose- 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.

Full throttle At full throttle the max. negative pressure must not exceed 0.3 bar (4.35 psi) at 130 °C (266 °F).

⚠ WARNING

Non-compliance can result in serious injuries or death!
The vacuum 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.

OIL HOSE REQUIREMENTS

Main oil pump (Oil circuit, engine)

At negative pressure of -500 mbar (-7.25 psi) and a oil temperature of 150 °C (302 °F) the oil lines must not collapse.

A minimum inner diameter of at least 10 mm (0.39 in.) should be used.

NOTE

Obey the pressure requirements on interfaces as specified, see crankcase pressure and vacuum measurement.

VENT HOSE REQUIREMENTS

Oil tank

Route the vent hose 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 vent hose.

The vent hose must be routed in a continuous decline or furnished with a drain bore at its lowest point to drain any condensate.
The vent hose 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 hose with a bypass opening before the cowling outlet.

MAIN OIL PUMP (OIL CIRCUIT, ENGINE)

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

Position of connections

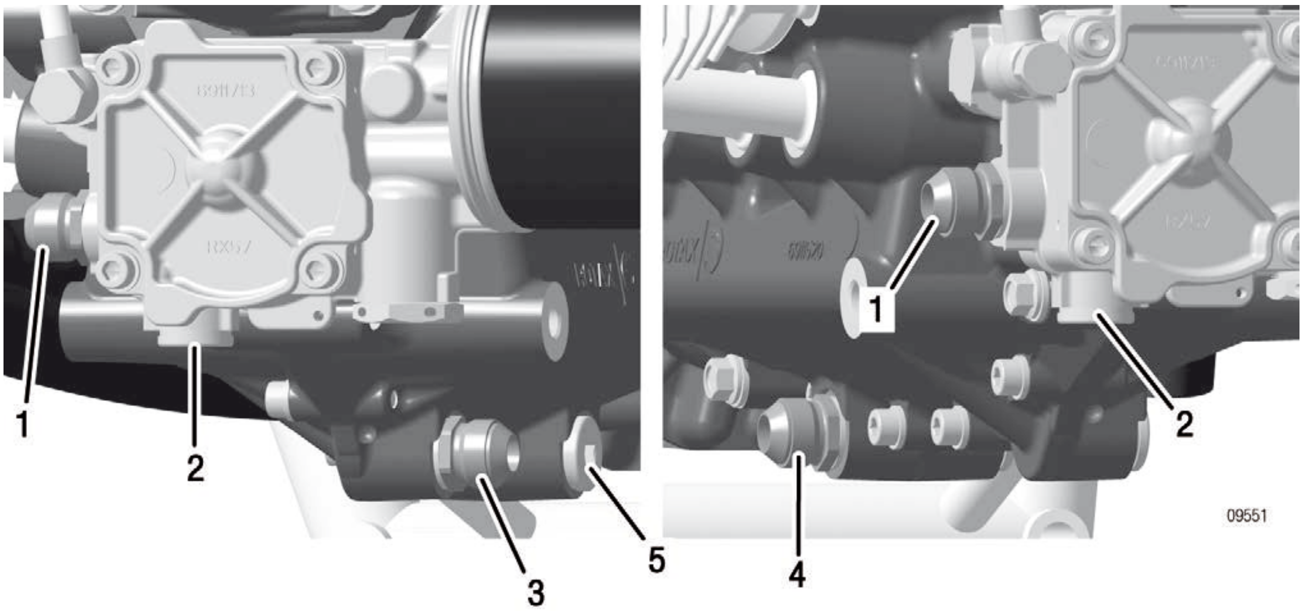


Figure 11.5: Connections to main oil pump outlet

1	*Adapter (inlet fitting) from oil tank or oil cooler*	2	*alternative connection oil feed line from oil tank or oil cooler*
3	*Adapter (outlet fitting) for pusher arrangement*	4	*Adapter (outlet fitting) for tractor arrangement*
5	*alternative connection oil return line for tractor arrangement*		

OIL INLET

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

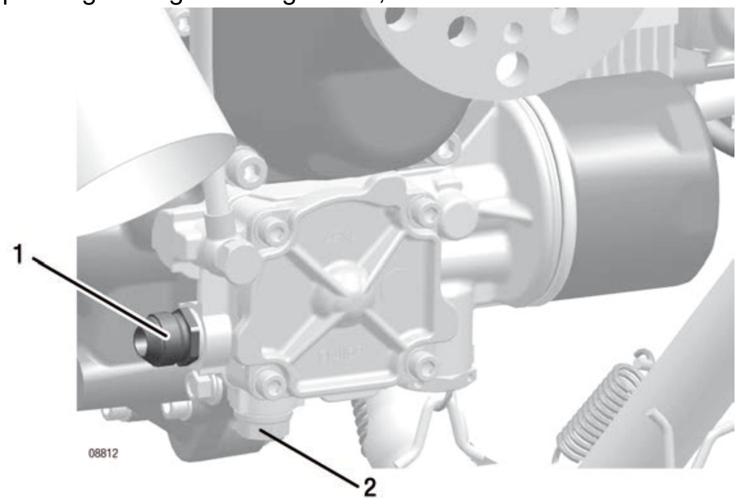


Figure 11.6: Oil pump inlet line

1 Adapter (inlet fitting) *2 Alternative connection*

Option 1

Adapter (inlet fitting)	M16x1,5
Tightening torque of inlet line	25 Nm (18.44 ft.lb.)

Option 2

Adapter (inlet fitting)	3/4-16 UNF
Tightening torque of inlet line	25 Nm (18.44 ft.lb.)

OIL RETURN

ATTENTION

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

See Fig. Connections to main oil pump outlet.

Option 1

Adapter (outlet fitting)	M16x1,5
Tightening torque of oil return line	25 Nm (18.44 ft.lb.)

Option 2

Adapter (outlet fitting)	3/4-16 UNF
Tightening torque of oil return line	25 Nm (18.44 ft.lb.)

OIL TANK

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

NOTE

Optional extra:
Fitting with either straight or with 90° elbow. Metric M18x1.5 or UNF 3/4-16 thread.

ATTENTION
Check what type of thread or connection is on the supplied oil tank.

ATTENTION
The oil tank cover is also marked with the designations IN - oil return line from crankcase OUT- outlet to oil cooler/oil pump.

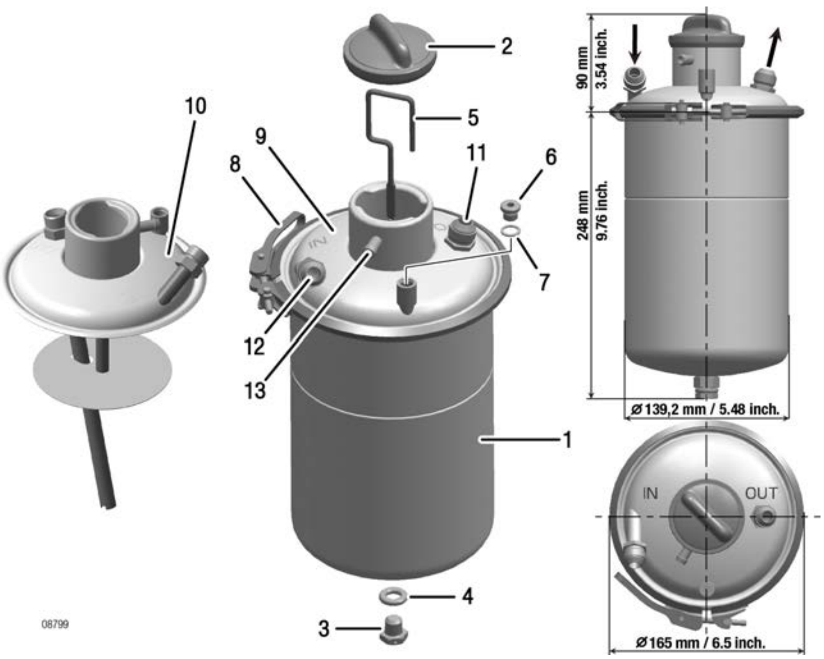


Figure 11.7: Oil tank

1	*Oil tank*	2	*Bayonet cap*
3	*Hex. screw M12x12*	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)*
11	*Oil outlet*	12	*Oil feed line*
13	*Vent nipple*		

CONNECTIONS FOR OIL CIRCUIT (ENGINE)

	Thread/ Outer dia.	Slip-on length	Tightening torque
UNF-thread optional (Screw connection) for oil feed line and outlet	3/4–16 UNF		25 Nm (18.44 ft.lb.)
Vent nipple (Metric)	8 mm (0.31 in.)	max. 15 mm (0.59 in.)	
Bent socket 90° optional with cap nut (M18x1,5)	12 mm (0.47 in.)	max. 24 mm (0.94 in.)	25 Nm (18.44 ft.lb.)
Nipple optional with cap nut / straight	12 mm (0.47 in.)	max. 24 mm (0.94 in.)	25 Nm (18.44 ft.lb.)

PERMISSIBLE POSITION AND LOCATION

⚠ WARNING

Non-compliance can result in serious injuries or death!
At higher positioning of the oil tank, oil might leak through clearances at bearings back into crankcase. Oil tank will be empty and all oil will be in the crankcase. If fitted too low it might happen, that the oil filter will be drained. In that case oil pressure is too low for the first seconds after starting the engine.

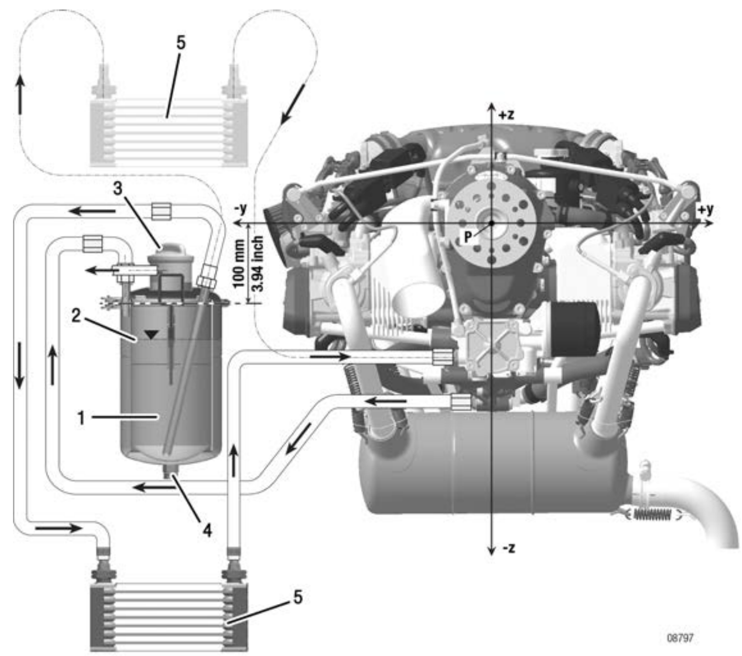


Figure 11.8: Position and location of the oil tank

1	*Oil tank*	*2*	*Oil level*
3	*Oil tank cover*	*4*	*Oil drain screw, hex. screw*
5	*Oil cooler*	*P*	*Zero reference point*

- Longitudinal axis z3 must be parallel to z-axis of the system of coordinates. The Permissible deviation from parallel: ±10°

NOTE

This applies to both planes.

- The oil tank (1) has to be positioned such that the oil level (2) is always between 0 and -400 mm (-15.75 in.) on the z-axis.

NOTE

The profile clamp of oil tank should be between +40 mm (1.57 in) and -360 mm (-14.17 in.) on the z-axis.

- Install the oil tank free of vibrations and not directly on the engine.
- Oil tank cover and oil drain screw must be easily accessible.

CAPACITY

- Without oil cooler and connecting lines min. 3 l (0.8 US gal) depending on the respective installation.
- Volume of oil tank:
  Up to the MIN. mark 2.5 l (0.66 US gal)
  Up to the MAX. mark 3.0 l (0.79 US gal)
- Perform oil level check and add oil if necessary.

OIL RADIATOR (OPTIONAL)

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

⚠ WARNING

Non-compliance can result in serious injuries or death!
The furnishing of proof in accordance to the latest FAR and EASA, has to be conducted by the aircraft manufacturer.

ATTENTION

The radiator must be designed to dissipate approx. 10 kW (9.48 BTU/s) of thermal energy at take-off performance.

ATTENTION

The oil radiator must not restrict oil flow. Test system as per section “Checking the oil circuit”.

NOTE

Experience has shown that an oil radiator of at least 160 cm² (25 in²) is required, provided that airflow is adequate.

Weight See Chapter 72-00-00 section Weight.

PERMISSIBLE POSITION AND LOCATION

⚠ WARNING

Non-compliance can result in serious injuries or death!
The components must be designed and installed such that the permissible operating temperatures are maintained and the max. values are not exceeded. This must also apply to “Hot day conditions“! If need be, take appropriate measures.

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

ATTENTION

Prevent unintentional draining of the oil cooler during longer periods of engine stop.
The oil cooler must be installed with the fittings pointing upwards i.e. in positive direction on the z-axis.

VARIANTS OF CONNECTORS

ATTENTION
Use backup wrench to counter-hold screw sockets when securing the oil lines.

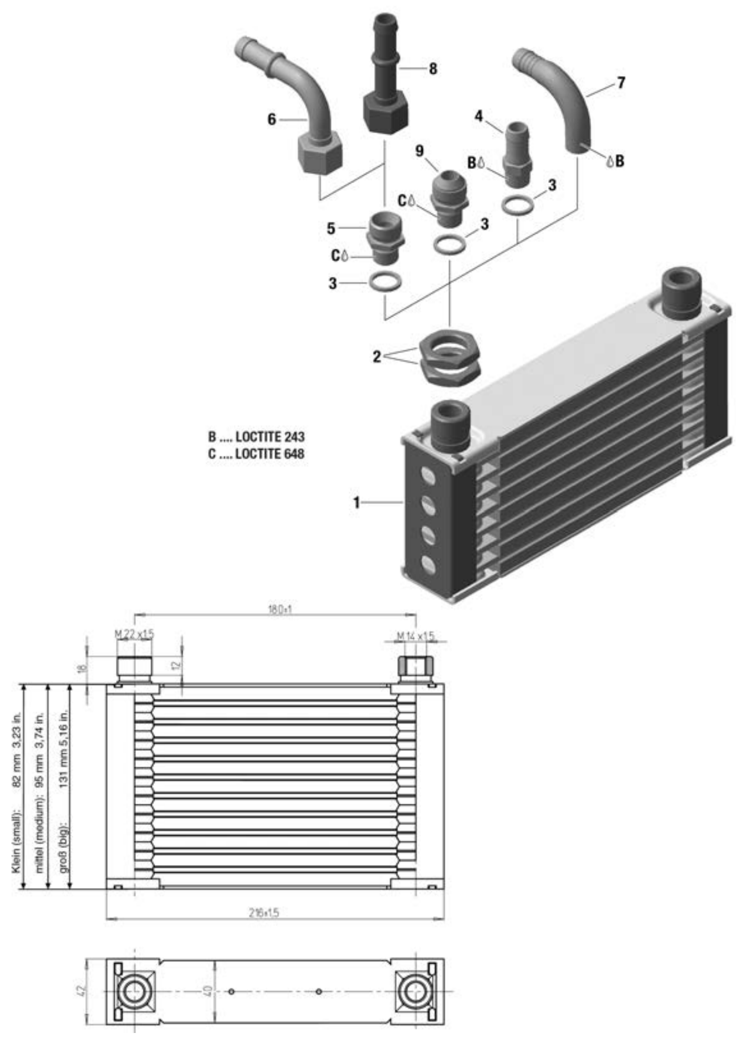


Figure 11.9: Oil cooler Variants of connectors

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*		

	Thread/ Outer dia.	Slip-on length	Tightening torque	Tightening torque of oil feed line and outlet, bent socket or hose nipple
UNF screw socket	3/4-16 UNF		22 Nm (16.23 ft.lb.) + LOCTITE 648	25 Nm (18.44 ft.lb.)
Nipple 13.2/9.5	13.2 mm (0.52 in.)	max. 21 mm (0.83 in.)	22 Nm (16.23 ft.lb.) + LOCTITE 243	
Metric screw sockets	M18x1,5		22 Nm (16.23 ft.lb.) + LOCTITE 648	25 Nm (18.44 ft.lb.)
Angular tube (90° Angular tube)	13.2 mm (0.52 in.)	max. 21 mm (0.83 in.)	22 Nm (16.23 ft.lb.) + LOCTITE 648	
Bent socket (90° Bent socket)	12 mm (0.47 in.)	max. 24 mm (0.94 in.)	25 Nm (18.44 ft.lb.)	
Hose nipple with cap nut (straight nipple)	12 mm (0.47 in.)	max. 24 mm (0.94 in.)	25 Nm (18.44 ft.lb.)	

REPLENISHING AND PURGING OF THE OIL SYSTEM

⚠ WARNING

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

See also SI-912 i-004 “Purging of lubrication system for ROTAX® Engine Type 912 i (Series), current issue.

NOTE

Perform oil level check and add oil if necessary. 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 liter (0.13 US gal)) may be added to the tank for the purpose of this procedure.

Work procedures

ATTENTION

Danger of severe engine damage.
Incorrectly connected oil lines to the oil tank or to the engine will result in severe engine damage.

1. Disconnect oil return line from the oil tank.
2. Place the free end of the return line into a suitable container below the engine.
3. Plug open connection 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.

ATTENTION

Prevent any foreign objects entering through hole.

6. Using a compressed air line, pressurize the oil tank through its vent nipple connection (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.

ATTENTION
The oil tank may empty and as a result introduce air into the oil system. The pressure in the oil tank has to be maintained. Pay attention to the oil level and fill tank as required. Turn the engine by hand in direction of normal rotation until the first pressure indication appears on the oil pressure gauge. Do not use the starter.

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 pressurization.

9. Open the cap for the oil return line on the oil tank and reconnect the engine oil return line to the tank.
Ensure that the suction oil line and oil return lines are connected to the proper fittings on the oil tank.

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

10. Re-fit the spark plugs. Restore aircraft to original operating condition.

11. Residual oil may have accumulated in the crankcase. Return it to the oil tank by following the oil level check procedure in the relevant Operators Manual.

12. Fill the oil in the tank up to the full mark on the dipstick.

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

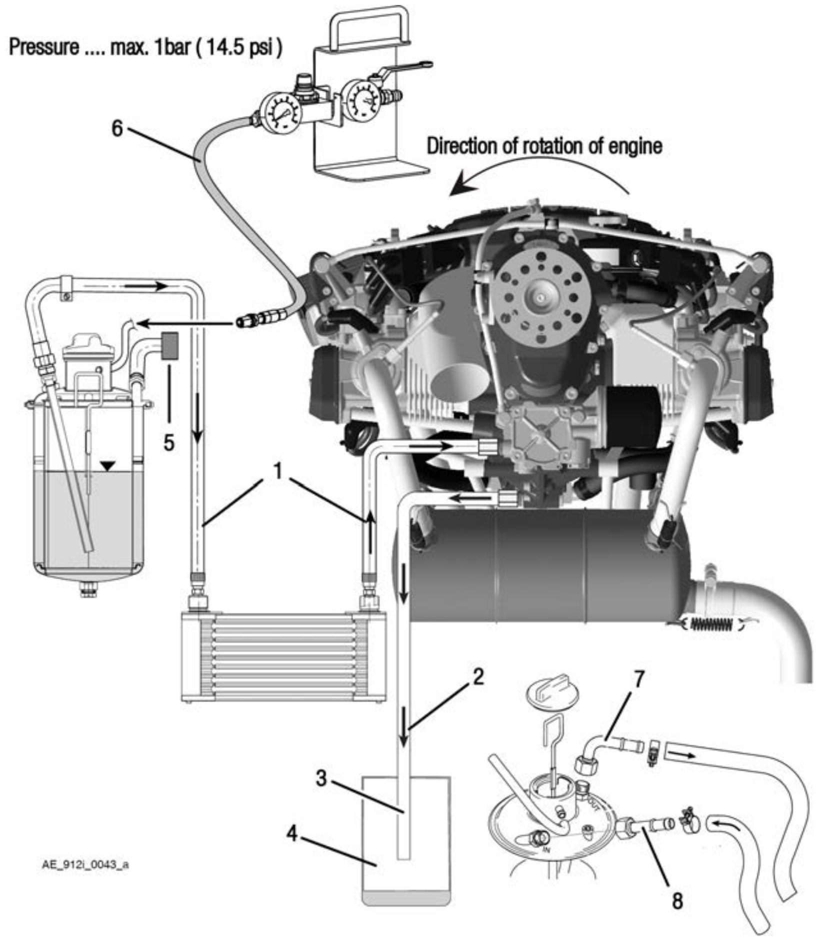


Figure 11.10: Purging the engine oil system

1 Suction line	*2 Oil return line*
3 Free end	*4 Tank*
5 Plug	*6 Pressurized air connection*
7 To oil pump	*8 Return from engine*

CHECKING THE HYDRAULIC VALVE TAPPET FOR CORRECT PURGING

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

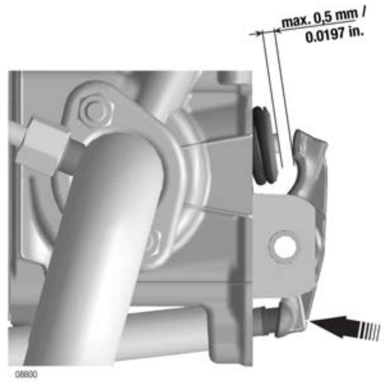


Figure 11.11: Hydraulic valve

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 fan belt tester, for example, to check approximately how much force is being exerted.
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.).

ATTENTION
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.

Repeat on all other cylinders.

Replace hydraulic valve tappet 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.

All work must be performed in accordance with the relevant Maintenance Manual Heavy 912 i Series.

Chapter: 80–00–00
STARTING

TOPICS IN THIS CHAPTER

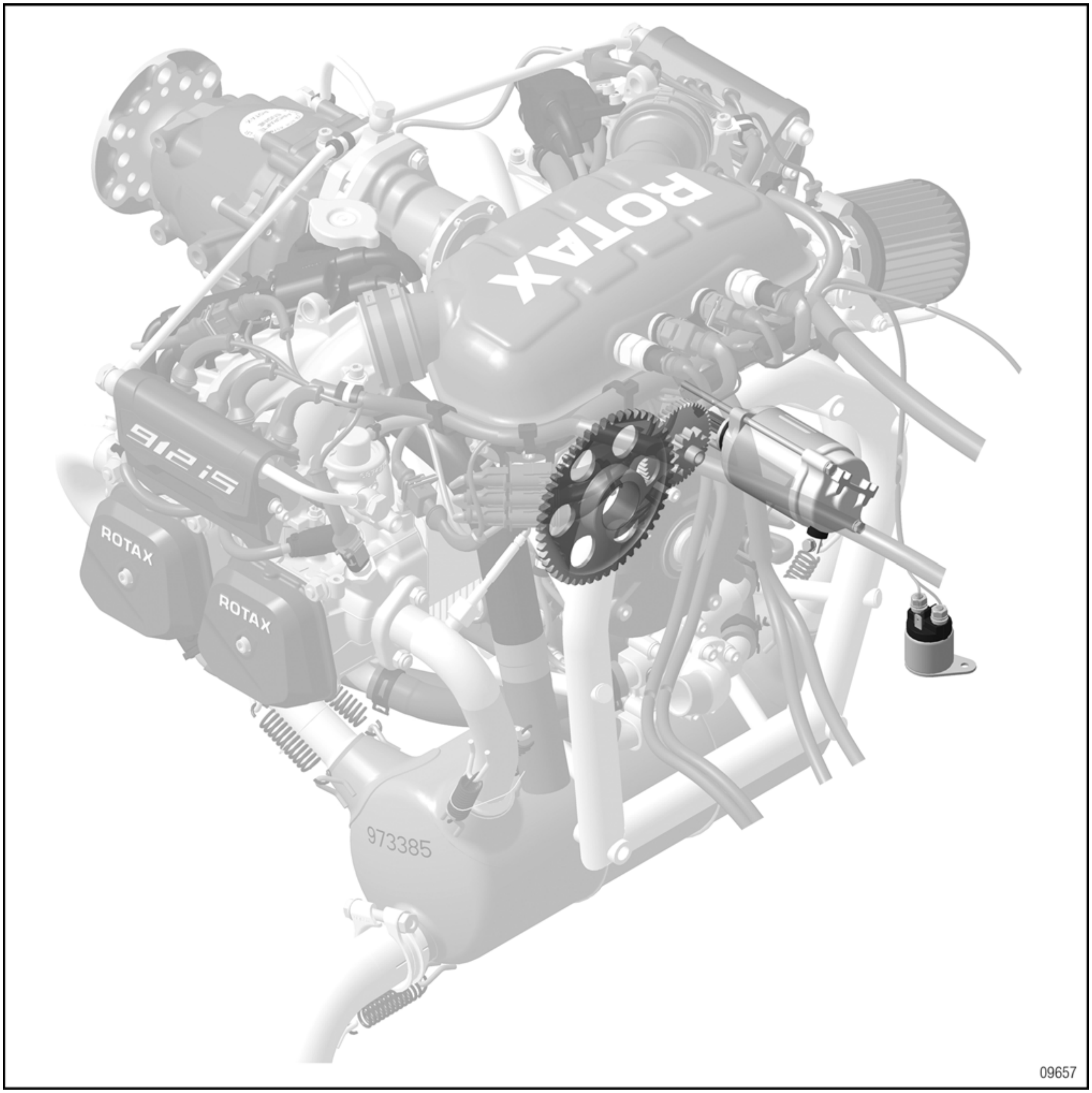


Figure 12.1: Starting

INTERFACE OVERVIEW

⚠ 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.

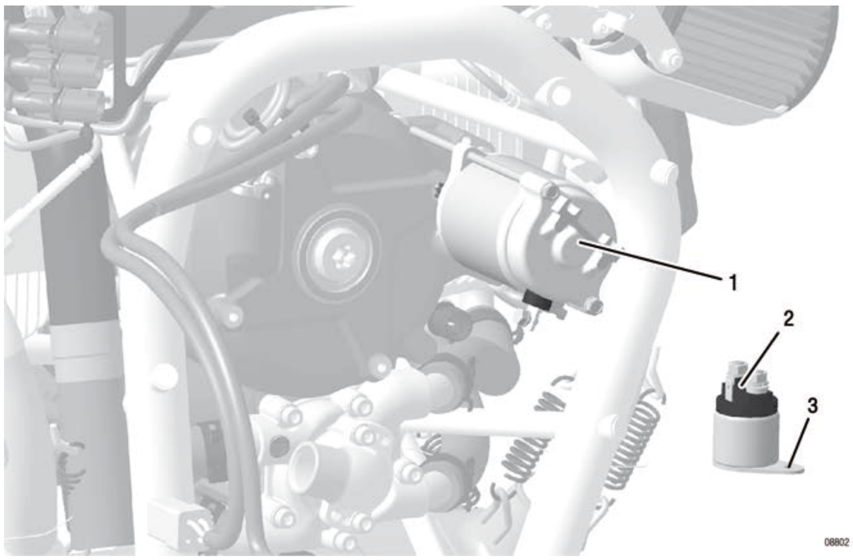


Figure 12.2: Electric starter

1 *Electric starter*

2 *Starter relay assy.*

3 *EMS ground*

ATTENTION
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.

POWER SUPPLY WIRES FROM STARTER RELAY TO THE ELECTRIC STARTER

Cross section At least 16 mm² (2.48 in²)

Output 0.8 kW

Grounding cable Grounding cable via engine block.

Positive terminal M6 screw connection (tightening torque 4 Nm (36 in.lb))
suitable for cable terminals according to DIN 46225 (MILT7928; PIDG or equivalent).

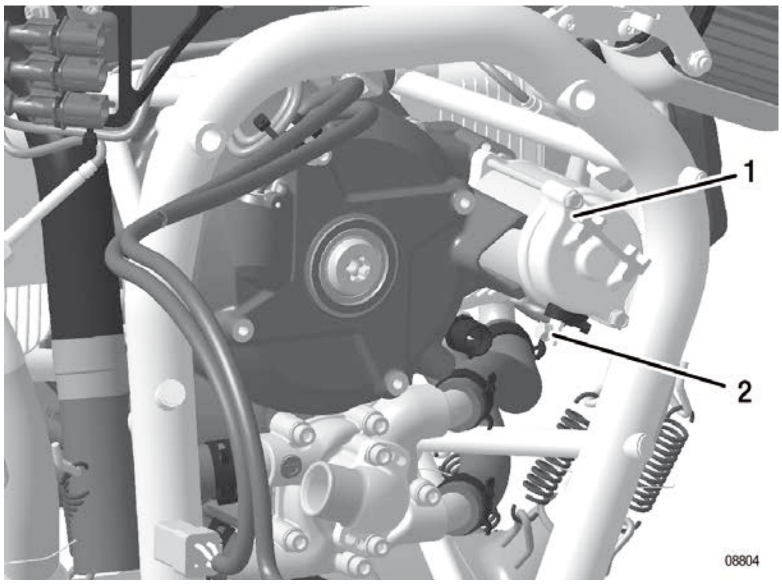


Figure 12.3: Positive terminal

1 Electric starter *2 Positive terminal*

STARTER RELAY ASSY. TECHNICAL DATA

ATTENTION

Activation of starter relay limited to short duration. The duty cycle over an interval of 4 minutes is 25%.

NOTE

Starter relay must be installed isolated from airframe ground.

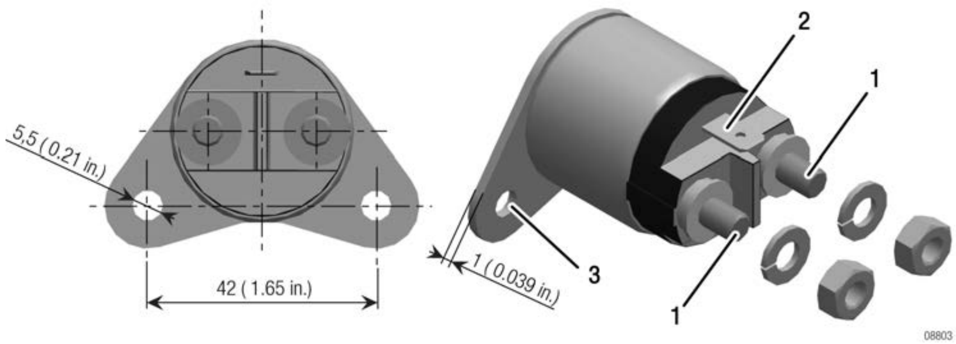


Figure 12.4: Starter relay

1 *Main current connections*
2 *Control wiring*
3 *Ground*

Nominal voltage	12 V/DC
Control voltage	min. 6 V / max. 18 V
Switching current	max. 75 A (permanent) max. 300 A/1 s (short duration)
Permissible ambient temperature	min. -40 °C (-40 °F) / max. +100 °C (212 °F)
Weight	See Chapter 72-00-00 section Weight
Main current connections	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	6.3x0.8 plug connector suitable for Faston connector (female) according to DIN 46247 (MIL-T-7928; (PIDG) or equivalent).
Grounding	must be installed isolated from the airframe ground.

INTENTIONALLY LEFT
BLANK

Index

A

B

C

D

E

F

G

H

I

L

M

O

P

R

S

ROTAX®

Engine serial no.

Type of aircraft

Aircraft registration no.

Rotax® authorized distributor

PEFC
PEFC/06-39-364/22

PEFC Certified

This product is from sustainably managed forests and controlled sources

www.pefc.org

FLYROTAX.COM

A BRP BRAND