INSTALLATION MANUAL

FOR ROTAX ENGINE TYPE 916 i A/C24 SERIES

REF NO.: IM-916 i A/C24 | PART NO.: 898874

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.

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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.

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Chapter: TOA
TABLE OF AMENDMENTS

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

Edition 0/Rev. 0	July 01 2023	Obsolete with Revision 1, which is a complete re-revision
Revision 1	December 01 2023	

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Summary of amendments

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

Current no.	Chapter	Page	Date of change	Comment
1	all	-	December 01 2023	New additional designation of engine type (C24)

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Chapter: 00–00–00
GENERAL NOTE

TOPICS IN THIS CHAPTER

GENERAL

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, its 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 (OM) 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.

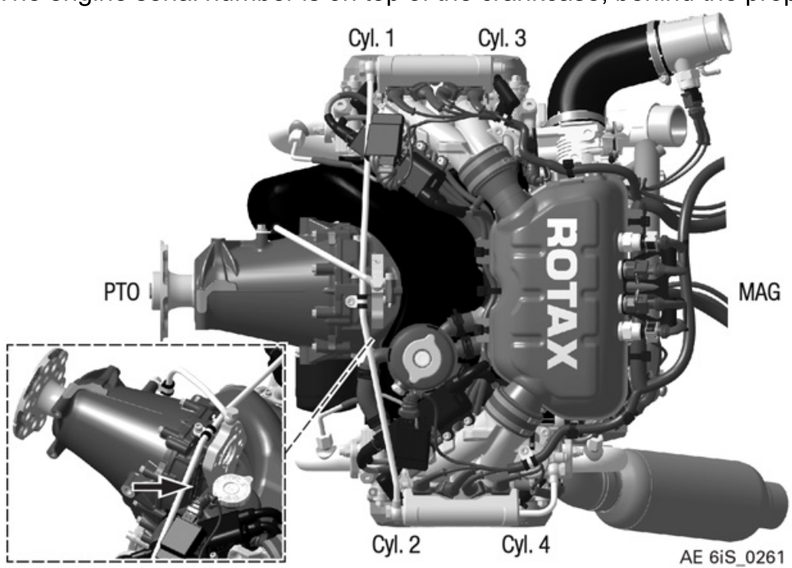

Figure 1.1: Engine serial number

TYPE DESCRIPTION

The type description consists of the following parts:

e. g. **ROTAX**	**916**	**iSc**	**3**	**A**
	type	certification	configuration	additional designation

Designation

Designation		**Description**
Type	**916**	4-cylinder horizontally opposed, turbocharged engine
Certification	**iSc**	Certified to EASA CS-E (TC No.EASA.E.121)
	iS	Approved to according ASTM F2339
Configuration	**2**	Propeller shaft with flange for fixed pitch propeller.
	3	Propeller shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller.
Additional designation	**A**	High altitude version
	C24	24 Volt Board Net Supply version

Options

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

	external alternator	**governor**	**exhaust system**
for configuration 2	YES	NO	YES
for configuration 3	YES	YES	YES

NOTE

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

SCOPE OF SUPPLY

Basic

- 4- stroke-, 4 cylinder horizontally opposed-, spark ignition engine, single central cam-shaft 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 torsional vibration absorber and overload clutch
- Oil tank
- Electric starter
- Turbocharger
- Electronic/pneumatic control of boost pressure
- Exhaust system

Optional

- Accessory drive for hydraulic propeller governor (configuration 3 only)
- Cooling air baffle

AUXILIARY EQUIPMENT (OPTIONAL)

Any equipment not included as part of the standard engine version and thus not a fix 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.

- See relevant Illustrated Parts Catalog (IPC)

Auxiliary equipment not certified

The following auxiliary equipment has been developed and tested, but NOT certified for this engine. Certification of auxiliary equipment is the responsibility of the aircraft manufacturer.

- See relevant Illustrated Parts Catalog (IPC)

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 Maintenance Manual Heavy)
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
rpm	Revolutions per minute
A	Ampere
AAPTS	Ambient Air Pressure Temperature Sensor
AC	alternating current
AD	Airworthiness Directives
Ah	Ampere hour
A/C	Aircraft
AC-DC	EMS Modul voltage converter
AR	as required
assy.	assembly
ASB	Alert Service Bulletin
ACG	Austro Control GmbH
ACL	Anti Collision Light
API	American Petrol Institute
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
AWG	American Wire Gauge
CAN	Controller Area Network
CCS	Camshaft position sensor
Coil 1–4	Ignition coils 1–4
CPS 1+2	Crankshaft Position Sensor 1+2
CSA	Constant Speed Actuator
CTS	Cooling Temperature Sensor

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

Abbreviations	Description
IPC	Illustrated Parts Catalog
ips	inch per second
iRMT	independent ROTAX Maintenance Technician
ISA	International Standard Atmosphere
kg	Kilograms
KNOCK	Knock sensor
Lane A	System A of Engine Management System
Lane B	System B of Engine Management System
LOPC	Loss of power control
MAPS 1 & 2	Manifold Air Pressure Sensor 1 & 2
MATS 1 & 2	Manifold Air Temperature Sensor 1 & 2
MON	Motor Octane Number
MAG	Magneto Side
N	Newton
n.a.	not available
NDT	Non Destructive Testing
NEW	Part must be replaced against NEW (mentioned in figures)
Nm	Newtonmeter
NVFR	Night Visual Flight Rules
OAT	Outside Air Temperature
OHM	Overhaul Manual
OHV	Over Head Valve
OM	Operators Manual
OPS	Oil Pressure Sensor
OTS	Oil Temperature Sensor
PCD	Pitch Circle Diameters
PCV	Pressure Control Valve
PMA	Permanent magnet alternator
POA	Production Organization Approval
PS	Power supply
PTFE	Polytetrafluoroethylene (Teflon)

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

Abbreviations	Description
X3	Connector on Engine Management System wiring harness which serves as an interface for power supply
XXXX	shows the component serial number

WIRING COLOR CODES

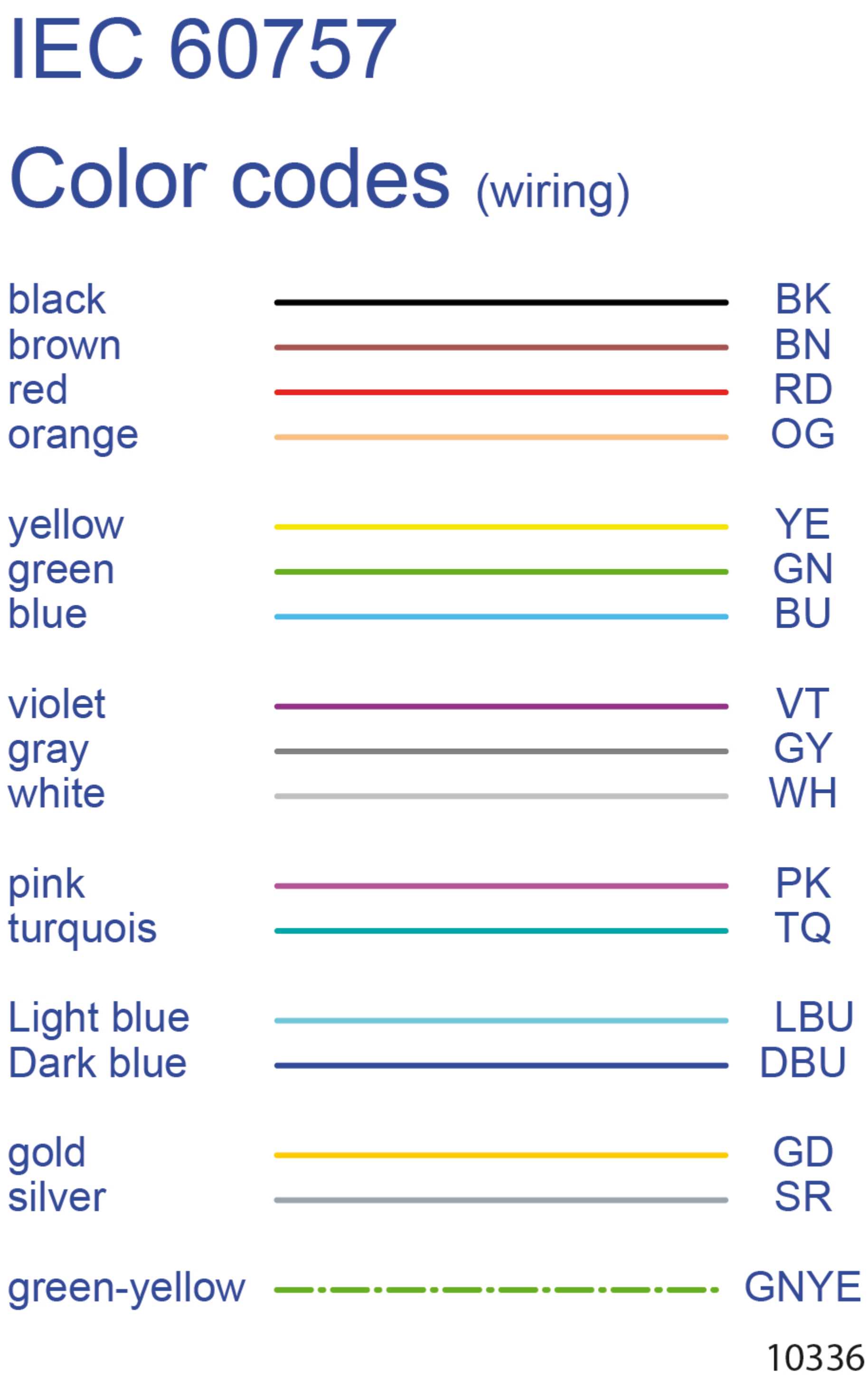

Figure 1.2

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-mm²**
1 N = 0.224809 lbf 1 lbf = 4.4482 N	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
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	

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.

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

NOTE

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

ENVIRONMENTAL NOTE
Environmental notes give you tips on environmental protection.

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

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 (MML)
- 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 (OM)
- 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 (IPC), latest issue for the respective engine type.

NOTICE

Only use GENUINE ROTAX® spare parts. Spare parts must meet the requirements defined by the engine manufacturer. This can only be guaranteed when using spare parts and/or accessories. Spare parts are available at Authorized Distributors and their independent Service Centers. Any warranty by will become void if spare parts and/ or accessories other than spare parts and/or accessories are used (see latest Warranty Conditions).
See relevant Service Letter on www.flyrotax.com.

Standard tools / Special tools

NOTICE

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 (OM) and Service Instruction SI-916 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 MML, Chapter 05–00–00 section “Authorized Personnel”) 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 (IM)
- Operators Manual (OM)
- Maintenance Manual Line (MML)
- Maintenance Manual Heavy (MMH)
- Overhaul Manual (OHM)
- Illustrated Parts Catalog (IPC)
- Alert Service Bulletin (ASB)
- Service Bulletin (SB)
- Service Instruction / Service Instruction-Parts and Accessories (SI-PAC)
- Service Letter (SL)

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 (OM), Maintenance Manuals and Illustrated Parts Catalog (IPC).

NOTICE
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.

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

Illustrations

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

NOTE

The Illustrations in this Manual are stored in a graphic 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.

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 916 i A Series 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. BD
DO-160G, Section 8 — Vibration	Cat. S (L)
DO-160G, Section 9 — Explosion Proofness	Test not performed
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	Test not performed
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. A
DO-160G, Section 18 — AF Cond. Susceptibility	Cat. Z
DO-160G, Section 19 — Induced Signal Susceptibility	Cat. ZCX
DO-160G, Section 20 — RF Susceptibility Conducted DO-160G, Section 20 — RF Susceptibility Radiated	Cat. M Cat. D
DO-160G, Section 21 — Emission RF Energy Conducted DO-160G, Section 21 — Emission RF Energy Radiated	Cat. B Cat. B
DO-160G, Section 22 — Lightning Induced Trans. Suspectibility	Cat. B3H3L3
DO-160G, Section 23 — Lightning Direct Effects	Test not performed

1. Components were tested at „operating low temperature“ of - 40 °C (- 40° F) instead of - 45 °C (- 49 ° F).

DO-160G, Section 24 — Icing	Test not performed
DO-160G, Section 25 — Electrostatic Discharge	Cat. A

Component surface temperature limits

System Limit	Min.	Max.
ECU	- 40 °C (- 40 °F)	80 °C (176 °F)
EGT Sensors (electronic box)	- 40 °C (- 40 °F)	80 °C (176 °F)
Fusebox	- 40 °C (- 40 °F)	80 °C (176 °F)
AC-DC Converter assy.	- 40 °C (- 40 °F)	80 °C (140 °F)

Chapter: 10–10–00
STORAGE AND INSTALLATION

TOPICS IN THIS CHAPTER

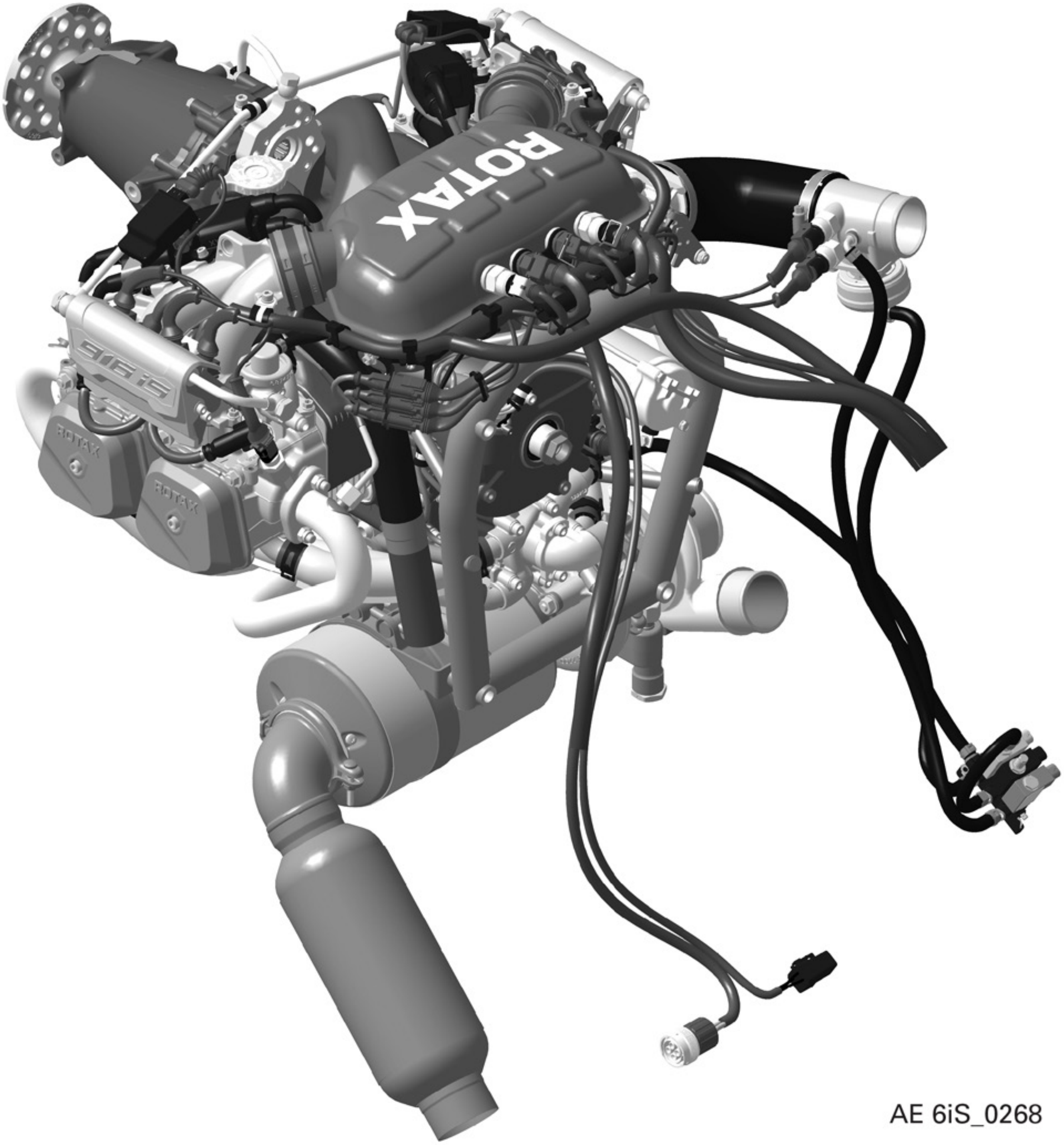

Figure 2.1: 916 I A engine

SPECIAL TOOLS

Description	Part number
Engine lift set	876040

GENERAL

NOTICE

Risk of consequential damage to engine and aircraft as a result of corrosion and damage. Under no circumstances is a corroded or damaged engine to be installed in an aircraft!

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 flat 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 (not stored in the GENUINE-ROTAX®-packing) then maintenance tasks must be carried out every 3 months as per the currently valid Maintenance Manual, section “Preservation of a new engine“.

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

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

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

Advisory Circular AC 43-4B This advisory circular (AC) is a summary of the current available data regarding identification and treatment of corrosive attack on aircraft structures and engine materials. Corrosion inspection frequency, corrosion identification, and especially corrosion treatment continues to be the responsibility of the operator. These inspections should be accomplished per this AC, the manufacturer’s recommendations, or the operator’s own maintenance program. The procedures in this AC are an acceptable means, but not the only acceptable means, of corrosion treatment. The information in this AC is applicable to aircraft for which the manufacturer has not published corrosion control information.

UNPACKING THE ENGINE

NOTICE

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

NOTICE

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. Check 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. Screw off the transport bracket screws from wooden bottom of the box.
6. Remove transport brackets from engine.

Protective coverings

NOTICE

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 feed line.

The protective coverings can be found at following locations:

Pos.	Installation location	Amount
1	Muffler assy. with resonator assy.	
2	Fuel rail 2/4 outlet line / fuel pressure regulator	
3	Fuel rail 1/3 feed line	
4	Oil inlet/outlet and turbo return line to tank	
5	Coolant inlet/outlet	
6	Throttle body socket assy.	
7	Air intake socket on turbocharger	
8	Connection to / from intercooler	
9	Propeller shaft	
10	Intercooler	
11	Pressure Control Valve (PCV)	
12	Governor flange	

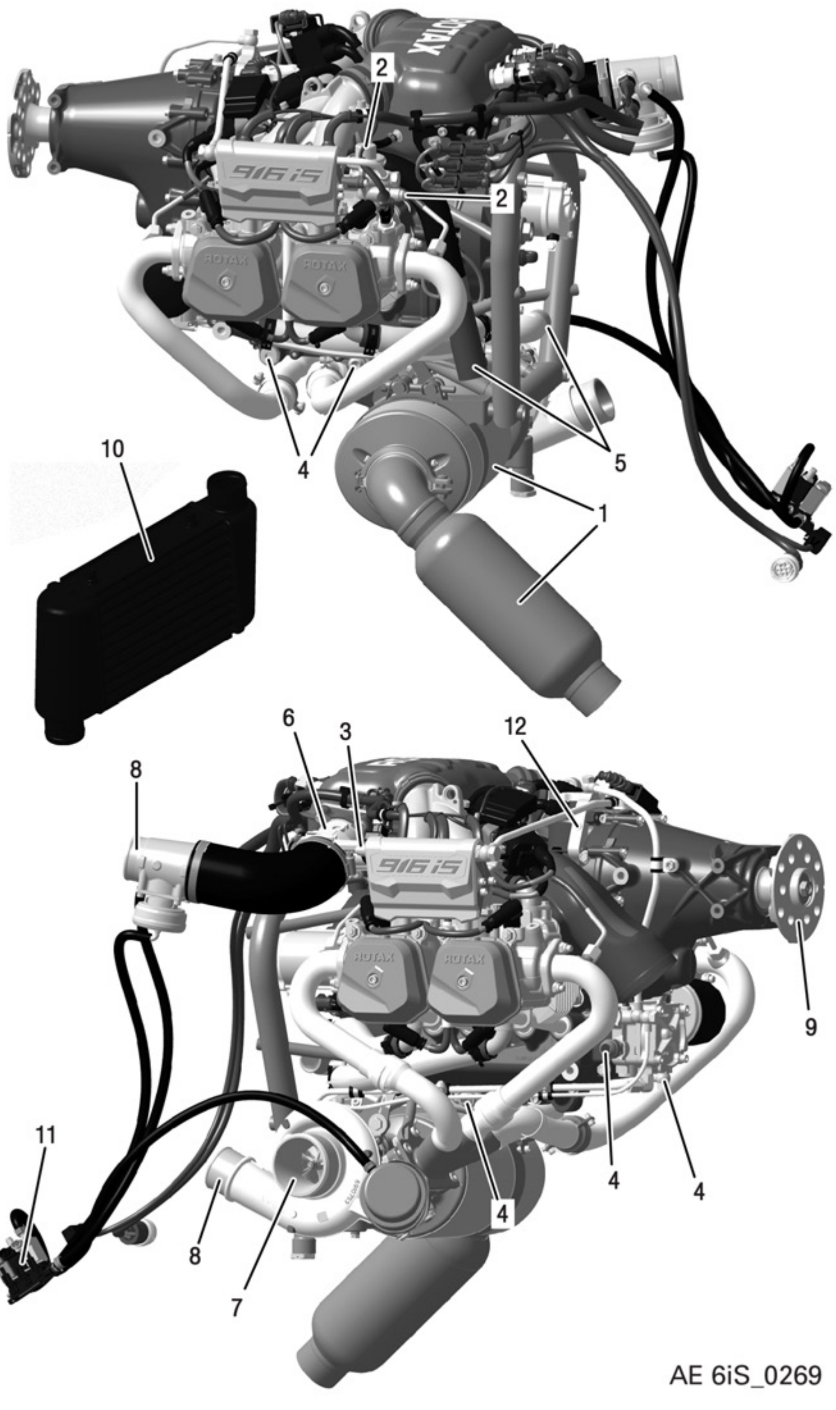

Figure 2.2: Protective covering positions

1	*Muffler assy. with resonator assy.*	*2*	*Fuel rail 2/4 outlet line / fuel pressure regulator*

3	*Fuel rail 1/3 feed line*	4	*Oil inlet/outlet and turbo return line to tank*
5	*Coolant inlet/outlet*	6	*Throttle body socket assy.*
7	*Air intake socket on turbocharger*	8	*Connection to / from intercooler*
9	*Propeller shaft*	10	*Intercooler*
11	*Pressure Control Valve (PCV)*	12	*Governor flange*

ENGINE HANDLING

NOTICE
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.

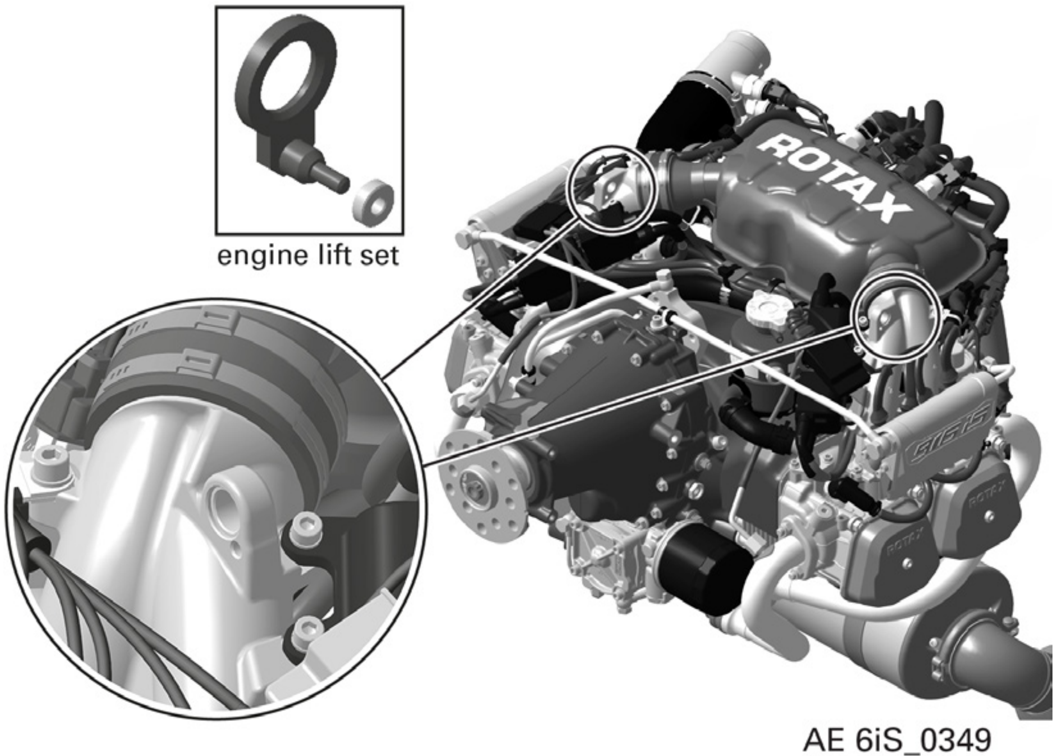

Figure 2.3: Attachment points

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Chapter: 24–00–00
ELECTRICAL POWER

TOPICS IN THIS CHAPTER

916 i TYPE A

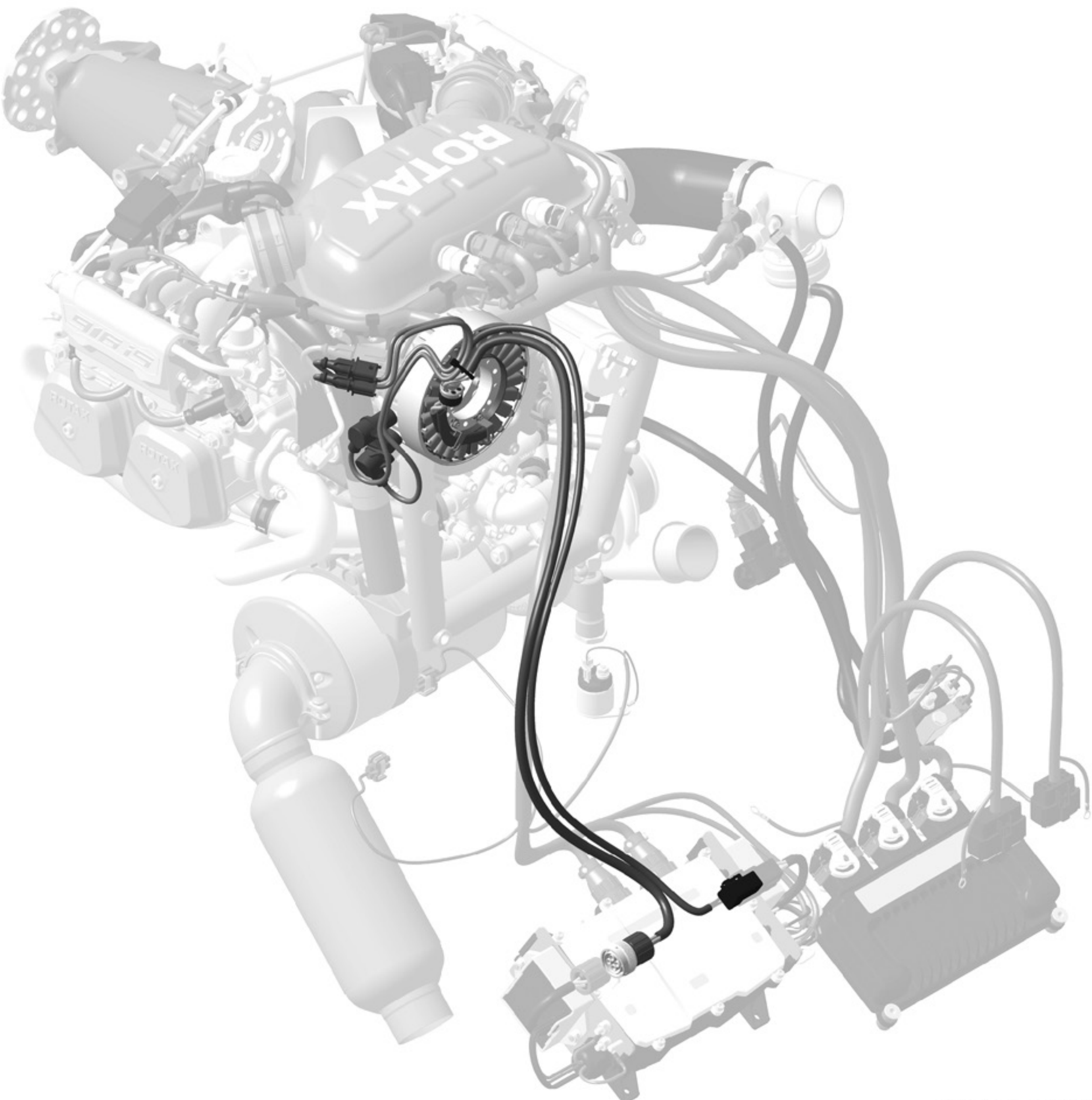

Figure 3.1: Internal power supply

916 i TYPE C24

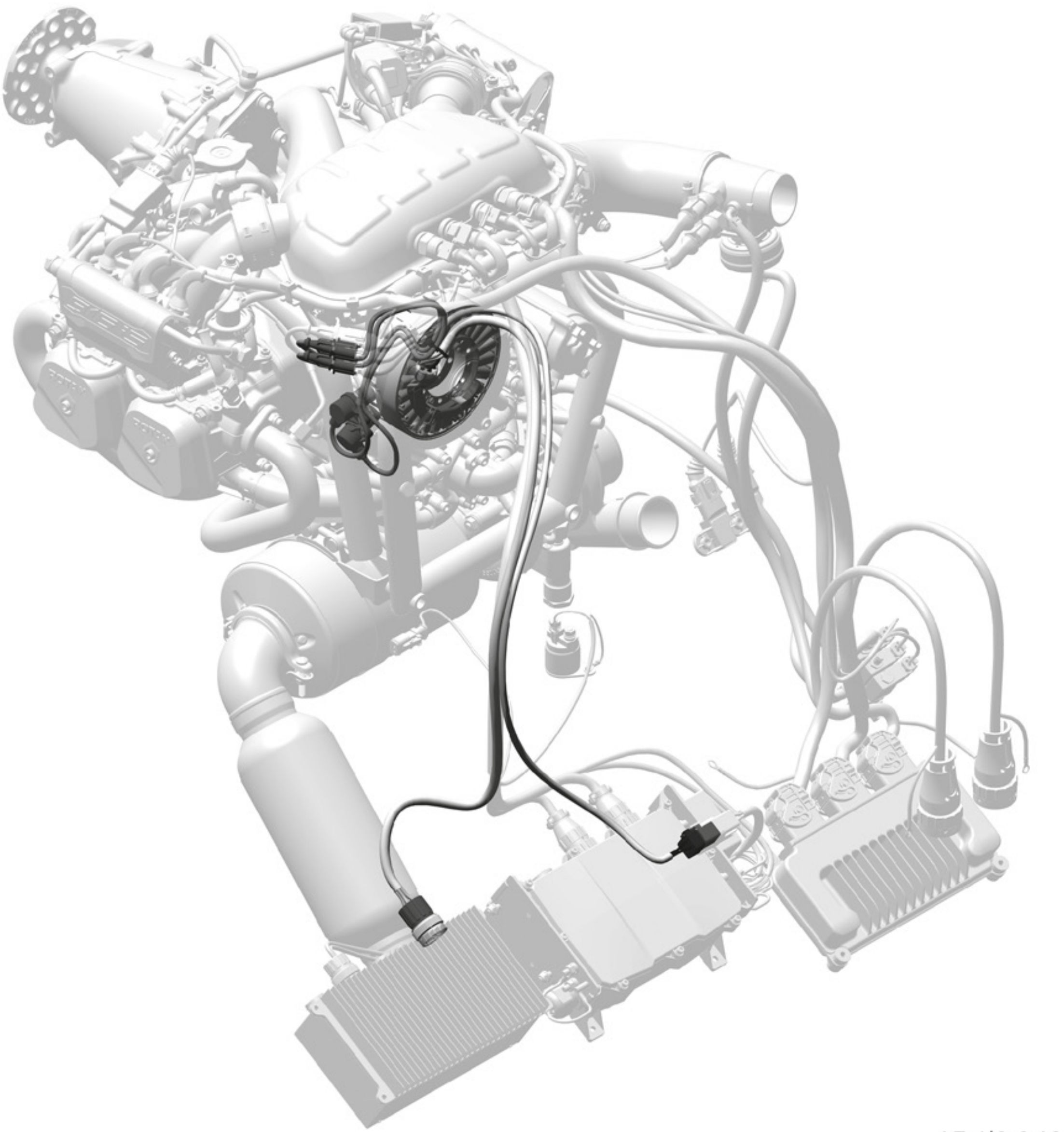

Figure 3.2: Internal power supply

SYSTEM DESCRIPTION

For a detailed system description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

NOTICE

Consumer cables must NOT be routed alongside the ignition cables. There is a risk of electromagnetic interference.

Valid installation positions The Fusebox must not be installed in the cockpit. Installation is only allowed in the engine compartment.

Component temperatures limitation Limitations see Chapter 00-00-00 Approval of electric and electronic components.

The Regulator temperature must be measured as shown within the following figure:

916 i TYPE A

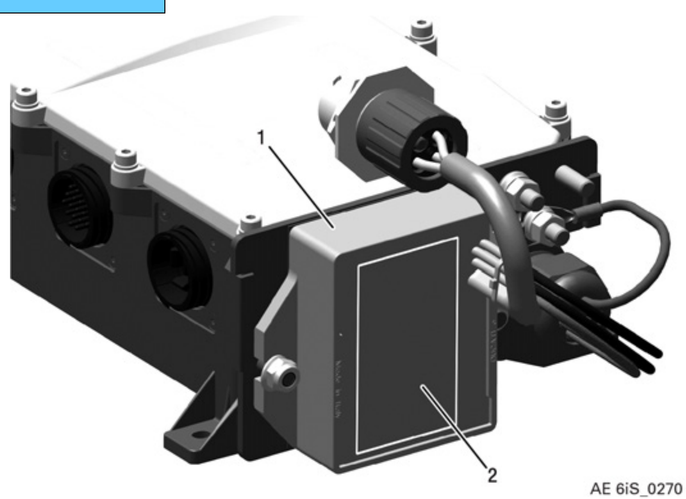

Figure 3.3: Regulator temperature measurement area

1	*Rectifier regulator*	*2*	*Component temperature measurement area*

916 i TYPE C 24

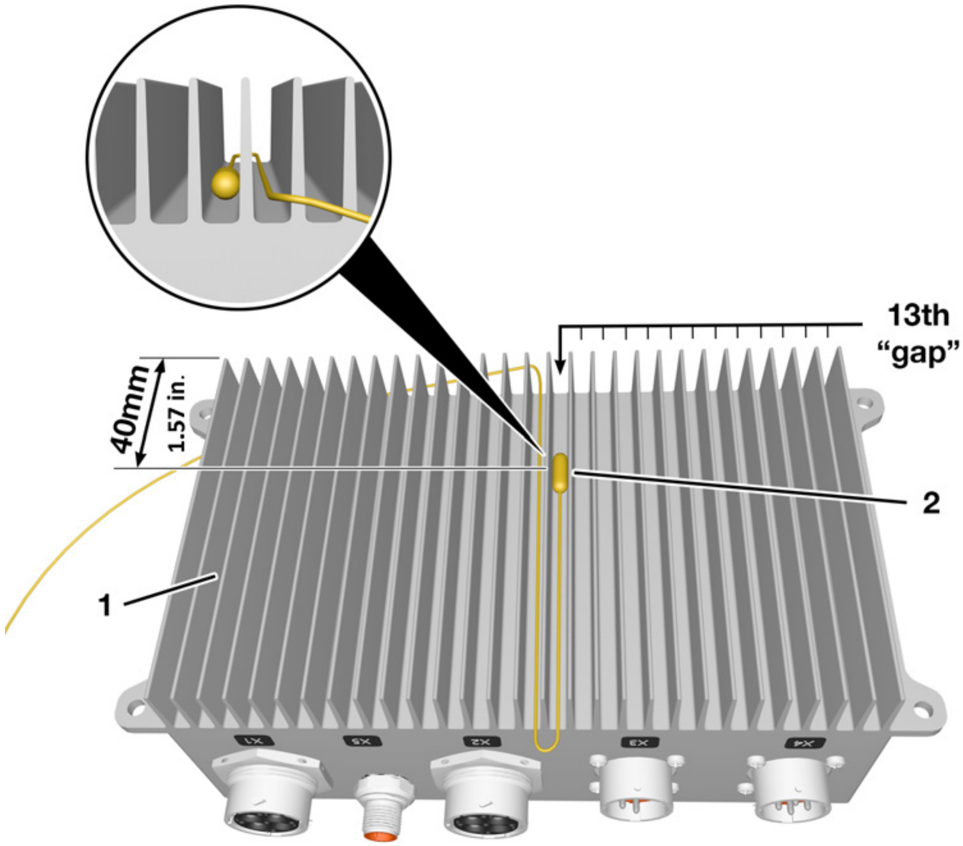

Figure 3.4: Regulator temperature measurement area

1	*28 V AC-DC Converter assy.*
2	*Component temperature measurement area*

Separation of EMS and Airframe circuit

A connection between regulator plate A (EMS ground) and airframe ground should only be done during supply of the EMS System by an external power source (e.g. during engine start). Although it would have no impact on the redundancy of the EMS, the fault tolerance of the system will be degraded if the EMS ground is connected permanently with the airframe ground.

INTERFACE DESCRIPTION– 916 I TYPE A

INTERFACE OVERVIEW

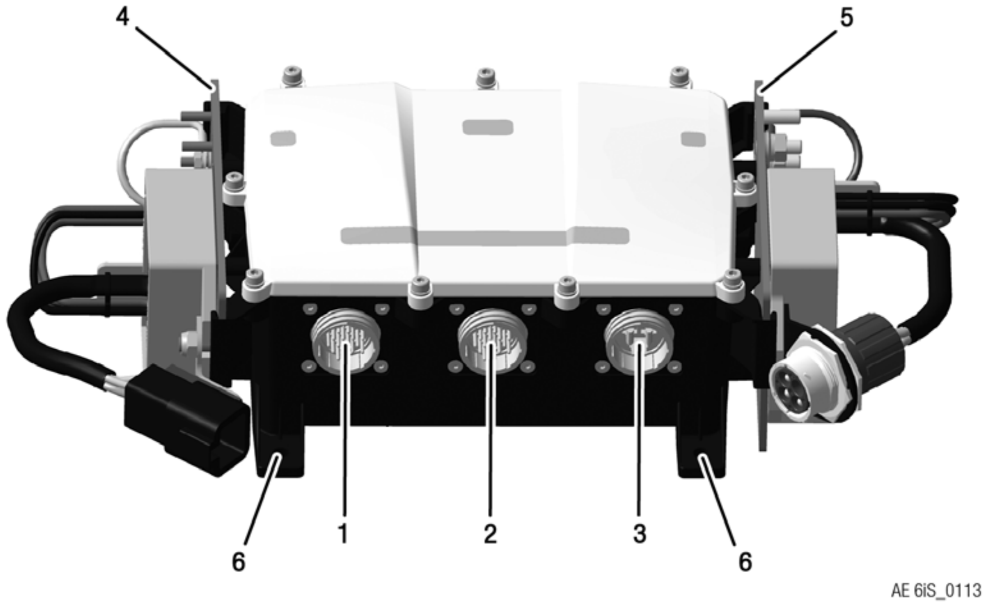

Figure 3.5: Fusebox connections, TYPICAL

1	*X1 Connector (electrical interface)*	2	*X2 Connector (electrical interface)*
3	*X3 Connector (electrical. interface)*	4	*Regulator Plate A (electrical interface)*
5	*Regulator Plate B (electrical interface)*	6	*Fusebox mounting points (mechanical interface)*

ELECTRICAL INTERFACES

The seals supplied with the Fusebox must be inserted into the X1,X2 and X3 Connector (Fusebox side) to enable a good connection between plug and socket and thus avoid unnecessary vibrations and misalignment of connector pins.

Fusebox –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.

Fusebox–X3 Connector For information on the X3 Connector, see the relevant SI-PAC-012.

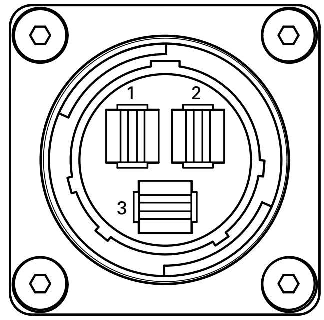

Figure 3.6: X3-Connector: Fusebox side

1 Terminal 1
2 Terminal 2
3 Terminal 3

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[2]	14.5 V	12 V
	Input load:		230 W DC cont. 290 W DC peak	
2	Input: voltage:	9 V	14.5 V	12 V
	Input load:		230 W DC cont. 290 W DC peak	
3	Output voltage:	13.9 V	14.5 V	12 V
	Output capacity:		max. 420 W DC (at 20°) (68 °F) see section performance diagram	

2. This limit must also be considered when the starter motor is actuated

NOTICE
In failure conditions the output voltage can exceed the specified limits.

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

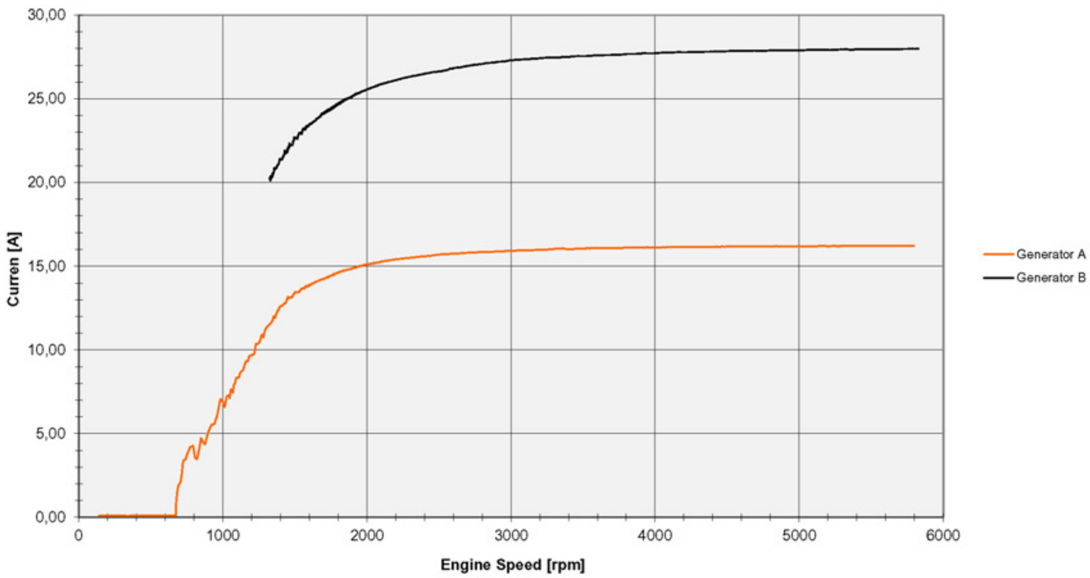

Figure 3.7: Characteristic curve of internal generators

Fusebox Regulator A

The regulator plate A needs to be connected with the EMS Ground (cable lugs on the (engine-) wiring harness). The terminal is conducted as a M4 screw connection suitable for cable lug according to DIN 46225 (Tightening torque: 1.2 Nm (11 in. lb)). The cable lugs need to be evenly spread onto the three available terminals.

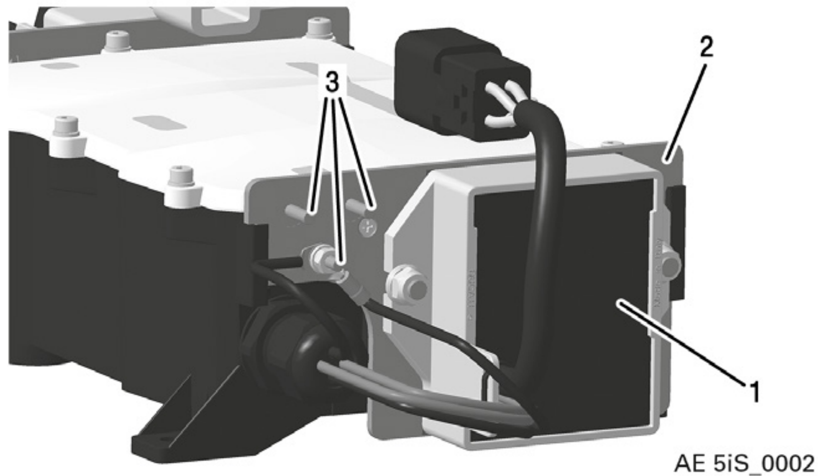

Figure 3.8: Fusebox -Regulator A

1	*Regulator*	*2*	*Regulator plate A*
3	*Ground terminals*		

NOTICE

A connection between regulator plate A and airframe ground should only be done during supply of the EMS System by an external power source (e.g. during engine start).

Fusebox Regulator B

The Regulator B needs to be connected with the Airframe Ground. The terminal is conducted as a M6 screw connection suitable for cable lug according to DIN 46225 (Tightening torque: 5.9 Nm (52.5 in. in. lb)).

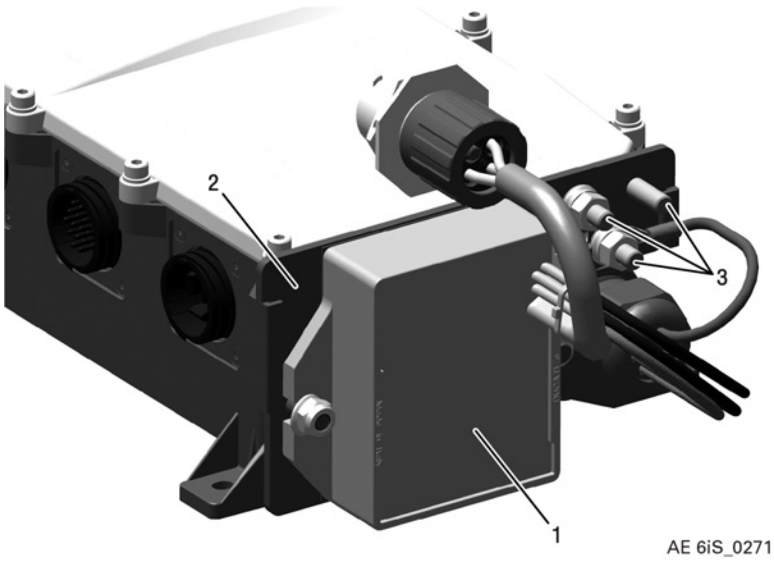

Figure 3.9: Fusebox -Regulator B

1 *Regulator*

2 *Regulator plate B*

3 *Ground terminals*

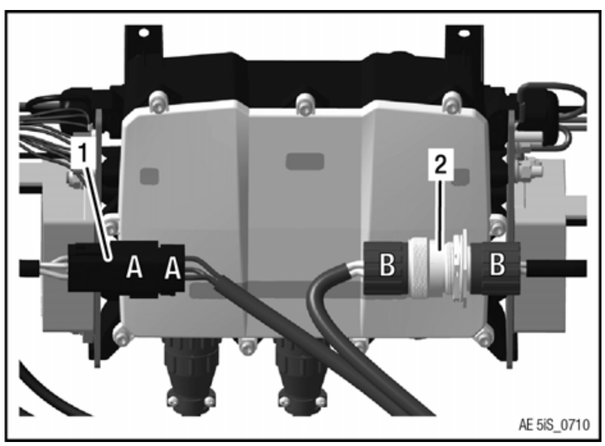

Figure 3.10: Fusebox

1 *Connector Regulator A*

2 *Amphenol connector Regulator B*

MECHANICAL INTERFACES

Fusebox mounting points

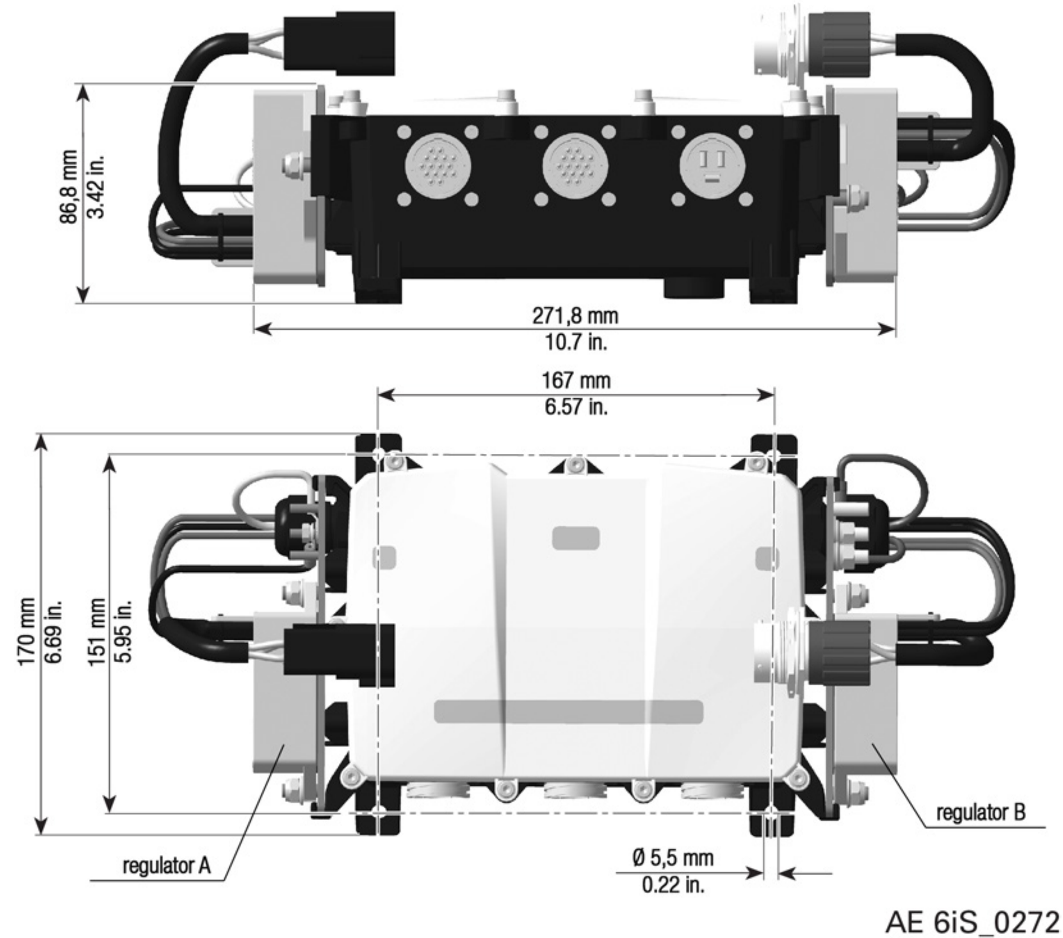

Figure 3.11: Fusebox –Connections and dimensions

INTERFACE DESCRIPTION – 916 I TYPE C24

INTERFACE OVERVIEW.– 916 I TYPE C24

916 i TYPE C 24

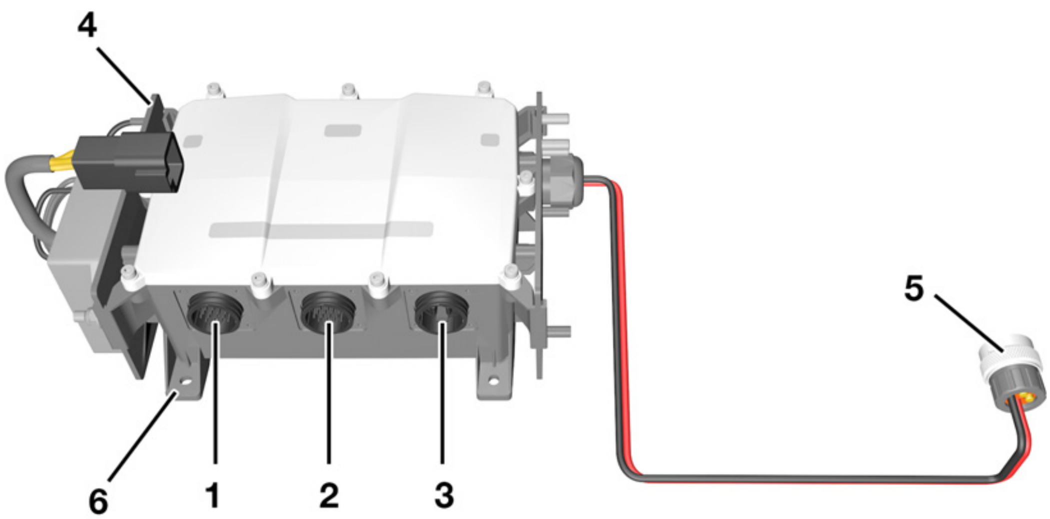

Figure 3.12: Fusebox connections

1	*X1 Connector (electrical interface)*	2	*X2 Connector (electrical interface)*
3	*X3 Connector (electrical. interface)*	4	*Regulator Plate A (electrical interface)*
5	*Connector to 28 V AC-DC Converter assy.*	6	*Mounting points*

ELECTRICAL INTERFACES – 916 I TYPE C24

916 i TYPE C24

The seals supplied with the Fusebox must be inserted into the X1,X2 and X3 Connector (Fusebox side) to enable a good connection between plug and socket and thus avoid unnecessary vibrations and misalignment of connector pins.

Fusebox –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.

Fusebox – X3 Connector Terminal 1 enables the EMS to be supplied with an external power source (e.g. in case the internal power supply fails supplying the EMS).

Terminal	Interface Parameter	Min.	Max.	Nominal
1	Input voltage:			24 V
	Input load:		230 W DC cont. 290 W DC peak	
2	Plugged, do not pierce the plug seal.			
3	Plugged, do not pierce the plug seal.			

NOTICE

In failure conditions the output voltage can exceed the specified limits.

Fusebox Regulator A

The regulator plate A needs to be connected with the EMS Ground (ring terminals on the (engine-) wiring harness). The stud has M4 threads suitable for ring terminals according to DIN 46225 or MS25036– 149 (size #8) (tightening torque: 1.2 Nm / 11 in lb). The ring terminals need to be evenly spread onto the three available studs.

916 i TYPE C24

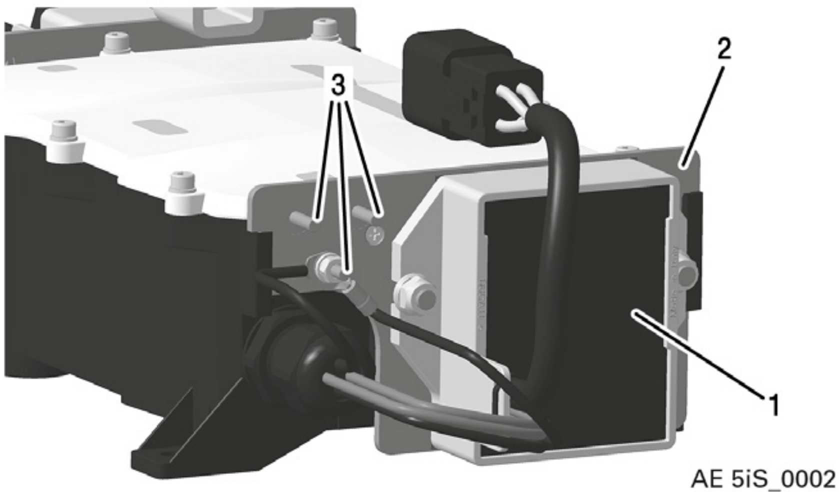

Figure 3.13: Fusebox -Regulator A

1 *Regulator*
2 *Regulator plate A*
3 *Ground studs*

NOTICE

A connection between regulator plate A and airframe ground should only be done during supply of the EMS System by an external power source (e.g. during engine start).

Fusebox The Fusebox needs to connected with the 28 V AC-DC Converter assy..

916 i TYPE C24

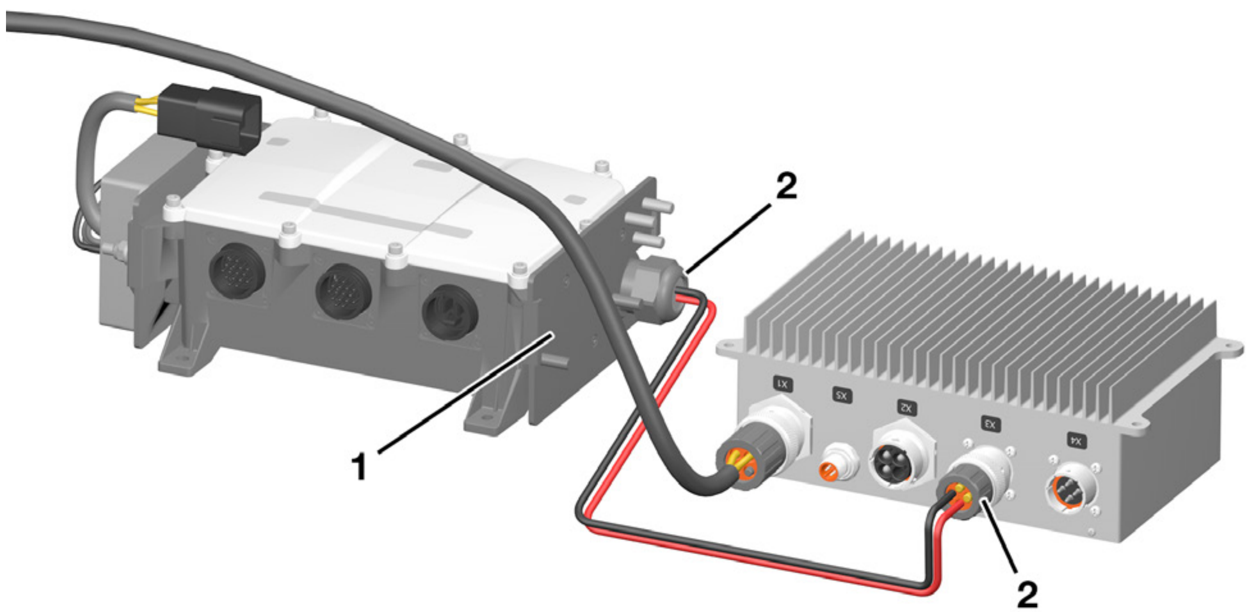

Figure 3.14

1	*Fusebox*	2	*Connector to 28 V AC-DC Converter assy.*

28 V AC-DC CONVERTER ASSY.

916 i TYPE C24

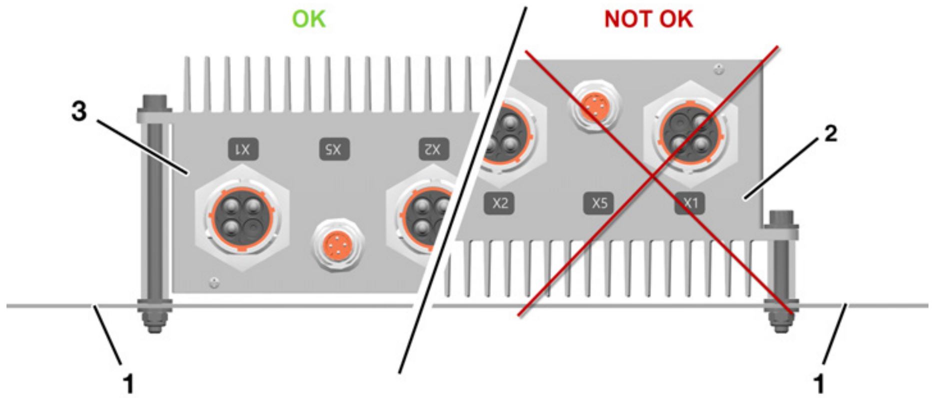

Figure 3.15: 28 V AC-DC Converter assy.

1	*Firewall*	2	*Orientation of the heat sink NOT to the firewall*
3	*Orientation of the heat sink to the firewall*		

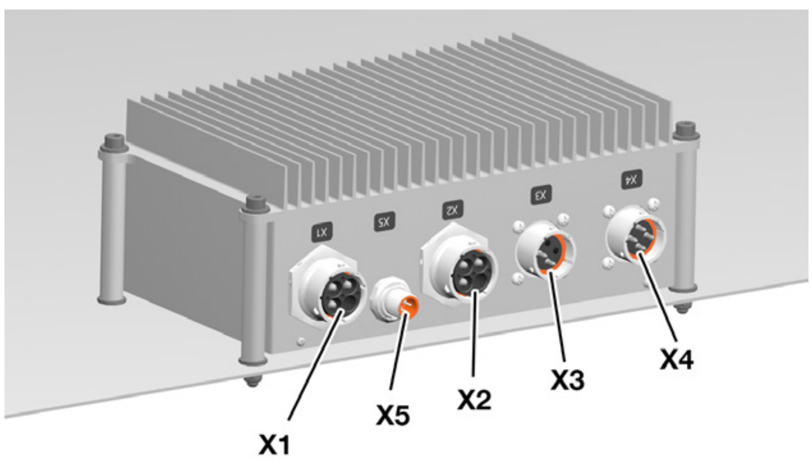

Figure 3.16: 28 V AC-DC Converter assy.

X1	*Generator B (stator cable from ignition housing)*	*X2*	*Aircraft 28 V Bus / Battery 24 V*
X3	*Generator B (connector from Fusebox)*	*X4*	*Cockpit Airframe side*
X5	*See Chapter 77–00–00*		

Generator B (stator cable from ignition housing)

Connector	PIN	Function	Type
X1	A	Phase 1 of Generator	Input
	B	Phase 2 of Generator	Input
	C	Phase 3 of Generator	Input

Aircraft 28 V Bus / Battery 24 V

Connector	PIN	Function	Type
X2	A	28 V (output for Aircraft)	Output
	B	28 V GND (output for Aircraft)	Output
	C	+24 V (Aircraft Battery Plus Pol)	Input

Generator B (connector from Fusebox)

Connector	PIN	Function	Type
X3	A	14 V (for EMS, connected at Fusebox B Minus Pol)	Output
	B	14 V GND (for EMS, connected at Fusebox B Minus Pol)	Output

Cockpit Air-frame side

Connector	PIN	Function	Type
X4	A	14 V (for EMS, Battery Backup)	Output
	B	14 V GND (for EMS, Battery Backup)	Output
	C	14 V (for Fuel Pump 2 / Aux.)	Output
	D	14 V GND (for Fuel Pump 2 / Aux)	Output
X5		See Chapter 77-00-00.	

MECHANICAL INTERFACES – 916 I TYPE C24

Fusebox and Converter assy. mounting points

916 i TYPE C 24

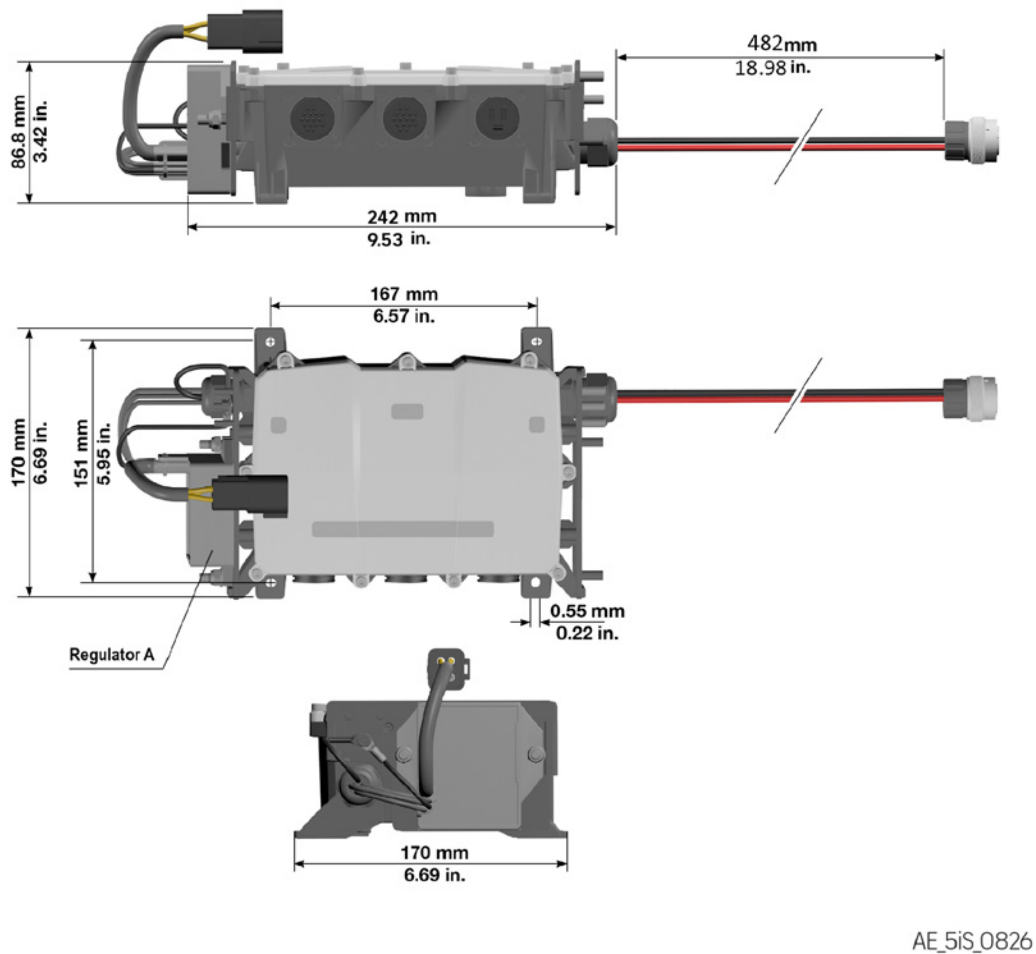

Figure 3.17: Fusebox –Connections and dimensions

916 i TYPE C 24

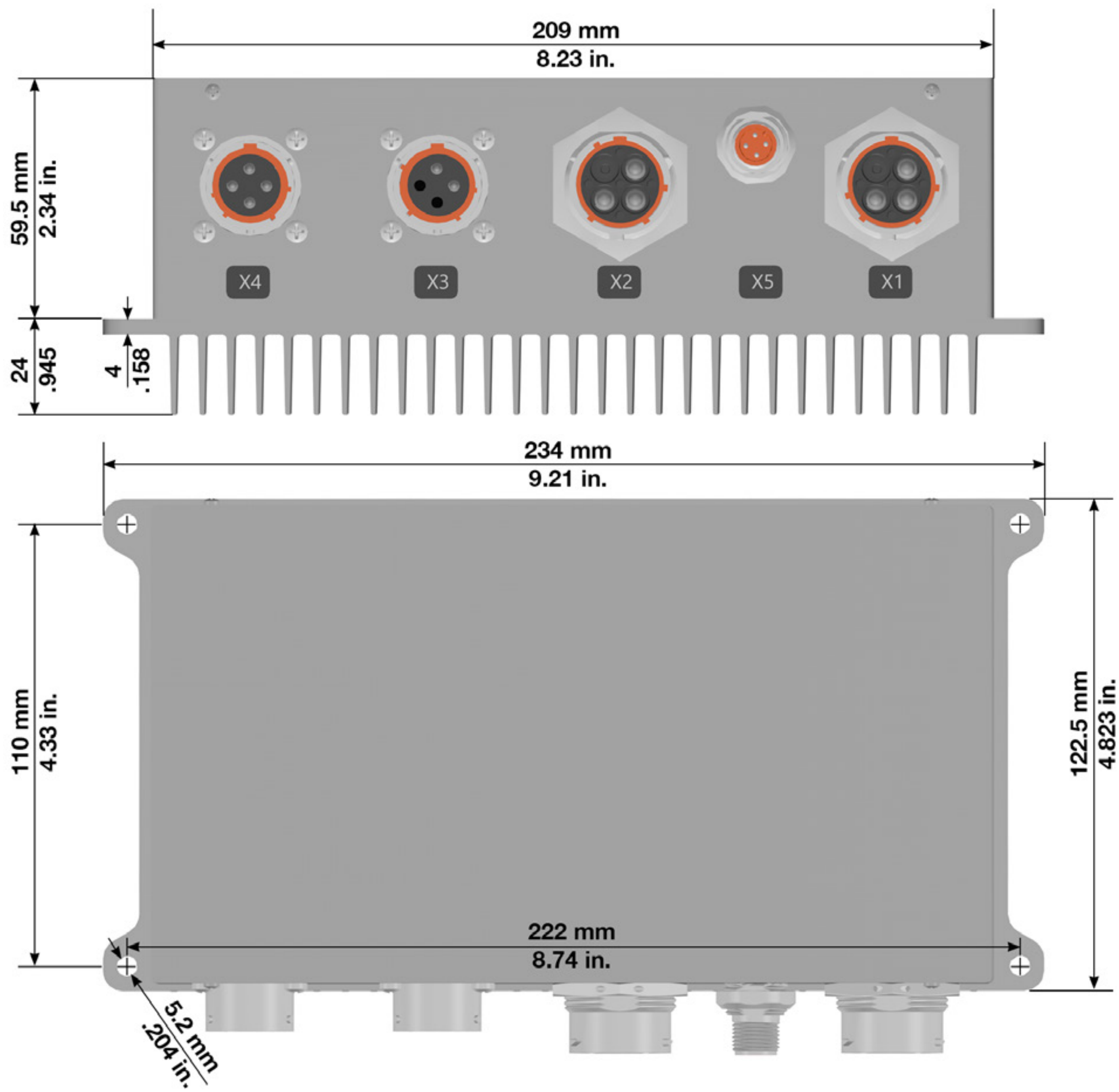

Figure 3.18: 28 V Converter: Connections and dimensions

NOTE

28 V AC-DC converter need to be installed with connector facing down.

INSTALLATION NOTES

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.
The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.
The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

Wiring diagram

NOTE

For improved clarity, see diagrams in Chapter 92-00-00 "Wiring diagrams".

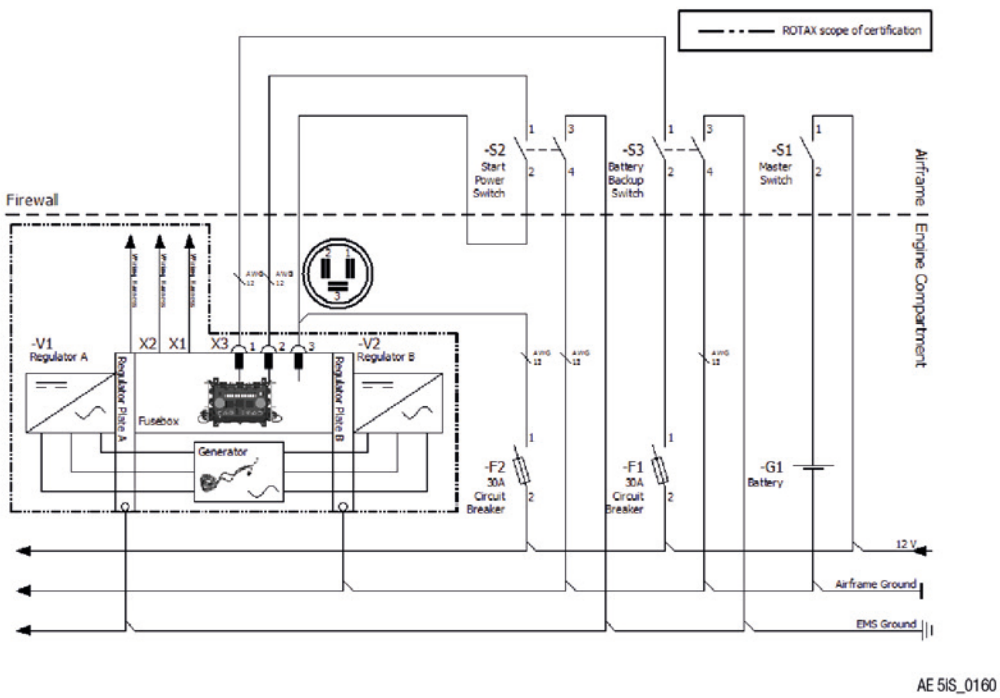

Figure 3.19: Wiring diagram

GROUNDING CABLES

The wiring of the grounding cables is an essential point when conducting engine electronics. Following two circuits must be distinguished:

- Airframe circuit
- Engine management system circuit (EMS circuit)

During engine start (dynamic condition, transient), the two circuits are connected to each other.
When the engine is running or when the engine is turned off (and the Fusebox is not supplied with external power), the EMS circuit is electrically isolated from the rest of the aircraft.
Therefore, the following components need to be installed without any contact to the airframe ground:

- ECU
- Regulator A (mounted on Fusebox)

The engine block must be connected to the airframe using a properly sized ground strap (minimum the same cable cross section as the starter supply but at least 10 mm^2), for carrying the starter current and to avoid static electricity between the engine and the airframe.
To gain full lighting strike compliance the rubber shock mounts must be bridged by using ground straps (min. 10 mm^2).

BATTERY

NOTICE

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

The specification of the battery must ensure that during each operating state and also during the transition between two operation states a sufficient supply of the avionics is guaranteed (e.g. during engine start). Depending on the applicable regulations avionics need to be supplied for at least 30 minutes with energy after a failure of the primary power supply in case they are required for safe operation of the aircraft.
If the aircraft is regularly started at temperatures below - 5 °C (23 °F) (ambient- and oil/ coolant temperature are below this temperature) it is recommended to provide a connection for an external power supply and a possibility for adequate engine pre-heating.

NOTICE

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

Following battery specifications are recommended:

916 i TYPE A

Interface Parameter	Min.	Max.	916 i Type A Nominal
Nominal Input Voltage			12 V
Internal resistance		Maximum 10 mΩ at -18 °C (-0.4 °F)	
Cold Cranking Ampere	350 A at -18 °C (-0.4 °F) (SAE J537)		
Capacity	16 Ah		

Following battery specifications are recommended:

916 i TYPE C24

Interface Parameter	Min.	Max.	916 i Type C24 Nominal
Nominal Input Voltage			24 V
Internal resistance		Maximum 40 mΩ at -18 °C (-0.4 °F)	
Cold Cranking Ampere	175 A at -18 °C (-0.4 °F) (SAE J537)		
Capacity	8 Ah		

The usage of a battery with lower capacity may have a negative impact on the starting behavior of the engine. Additional electrical loads, which are in some cases required by law, may affect the battery performance during the starting process,(e.g. ACL (Anti Collision Light), Navigation Light, Avionics).

CONTROL ELEMENTS

916 i TYPE A

START POWER CONTROL	
Parameter	**Value**
Contact type	Momentary (must not be active after engine start)
Nominal voltage	28 V DC
Nominal current	20 A

BATTERY BACKUP CONTROL	
Parameter	**Value**
Contact type	Toggle (must not be active during normal operation)
Nominal voltage	28 V DC
Nominal current	20 A

916 i TYPE C24

START POWER CONTROL	
Parameter	**Value**
Contact type	Momentary (must not be active after engine start)
Nominal voltage	24 V DC
Nominal current	20 A

BATTERY BACKUP CONTROL	
Parameter	**Value**
Contact type	Toggle (must not be active during normal operation)
Nominal voltage	24 V DC
Nominal current	20 A

916 i TYPE C24

The 28 V output of the AC-DC Converter is able to supply a maximum current of 27.9 A. If this current flow is exceeded, the 28 V output is switched off because an overload has been detected. The so-called hiccup mode now performs a cyclic activation of the output and queries the elimination of the overload. This is done in intervals of about three seconds.
If an accumulator is connected to the 28 V output and its charge state is very low, it can happen that the charge current exceeds the 27.9 A mentioned above. A switch-off of the 28 V output is the consequence and an overload is permanently detected by the hiccup mode. Charging the accumulator is therefore not possible.

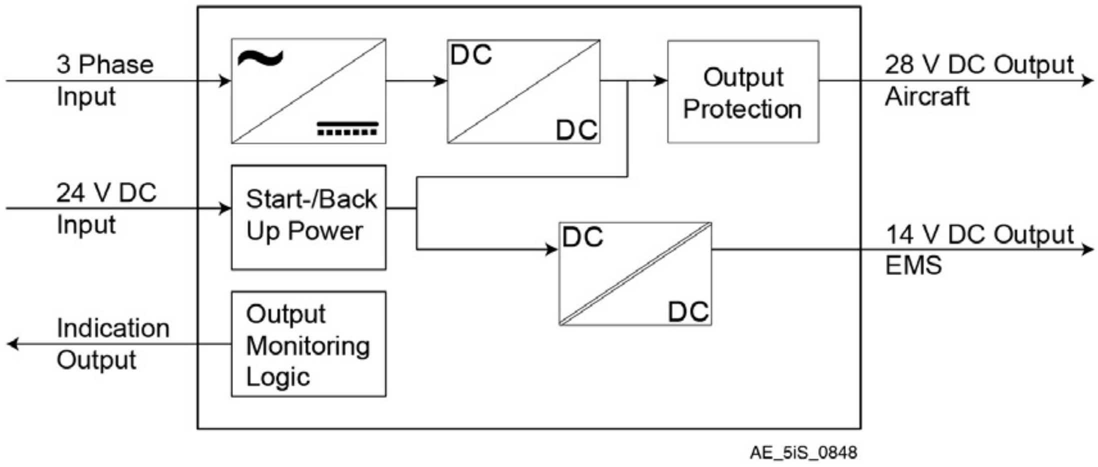

Figure 3.20: Schematic AC-DC Converter

Concept for limiting the charging current:
In order to limit the charging current, a series resistor can be used. In following Figure this resistor is called R_I. R_L1 and R_L2 are symbolically shown as load (L= Load) of the 28 V output and define the current flow I_Load.

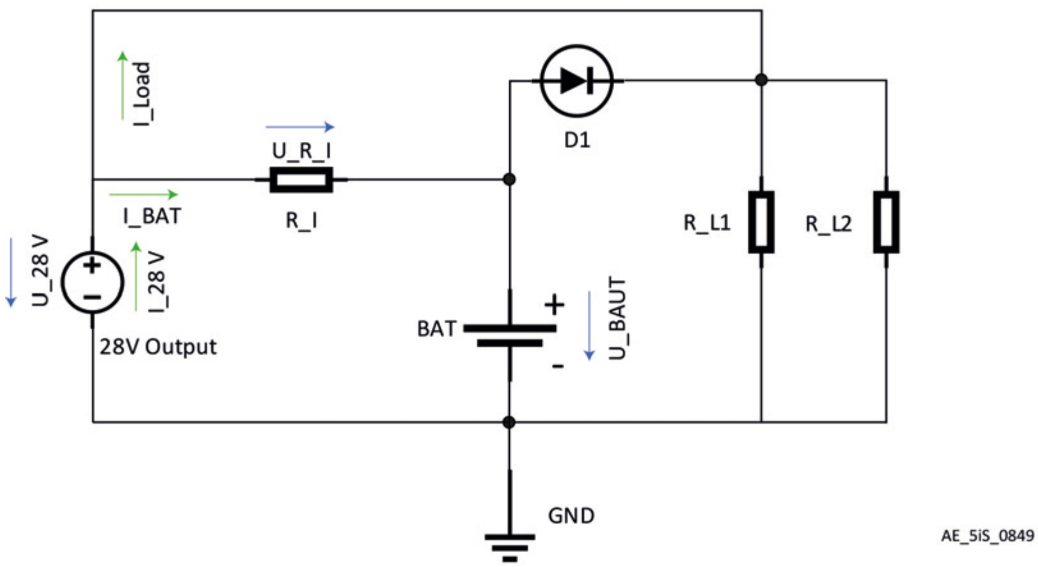

Figure 3.21: Simple Charging Circuit

Formula 1 The voltage drop U_R_I is the difference of U_28 V and U_BAT:

$$U\_R\_I = U\_28\ V - U\_BAT$$

Formula 2 The current flow I_BAT can be calculated as follows:

$$I\_BAT = \frac{U\_R\_I}{R\_I}$$

Example 1 – Calculate series resistance
U_28 V = 28.9 V, U_BAT = 20 V, I_BAT = 10 A
The accumulator is discharged, and the State of Charge is 0%. For U_BAT in this case 20 V is assumed. The AC-DC converter supplies a voltage of 28.9 V. The maximum charge current is set to 10 A. U_R_I is therefore 8.9 V.
Formula 2 is transformed to R_I and from the division U_R_I to I_BAT a resistance value of 0.89 Ω results.
The following figures show the relationship between resistance R_I and current I_BAT and the resulting power dissipation once for U_R_I = 9 V and U_R_I = 5 V.

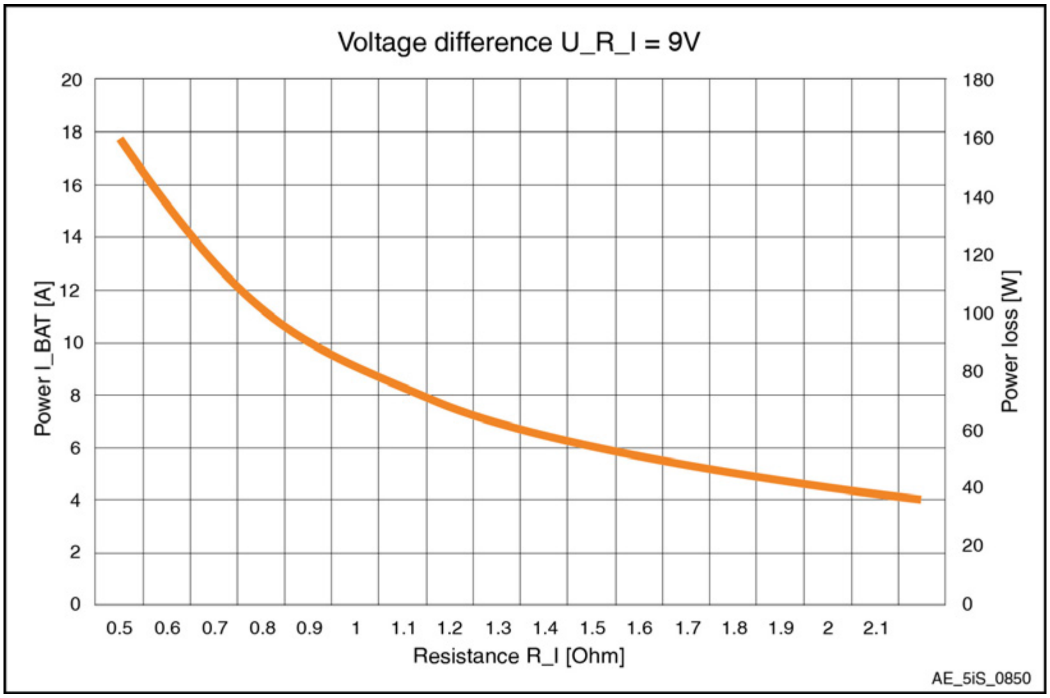

Figure 3.22: U_R_I = 9 V

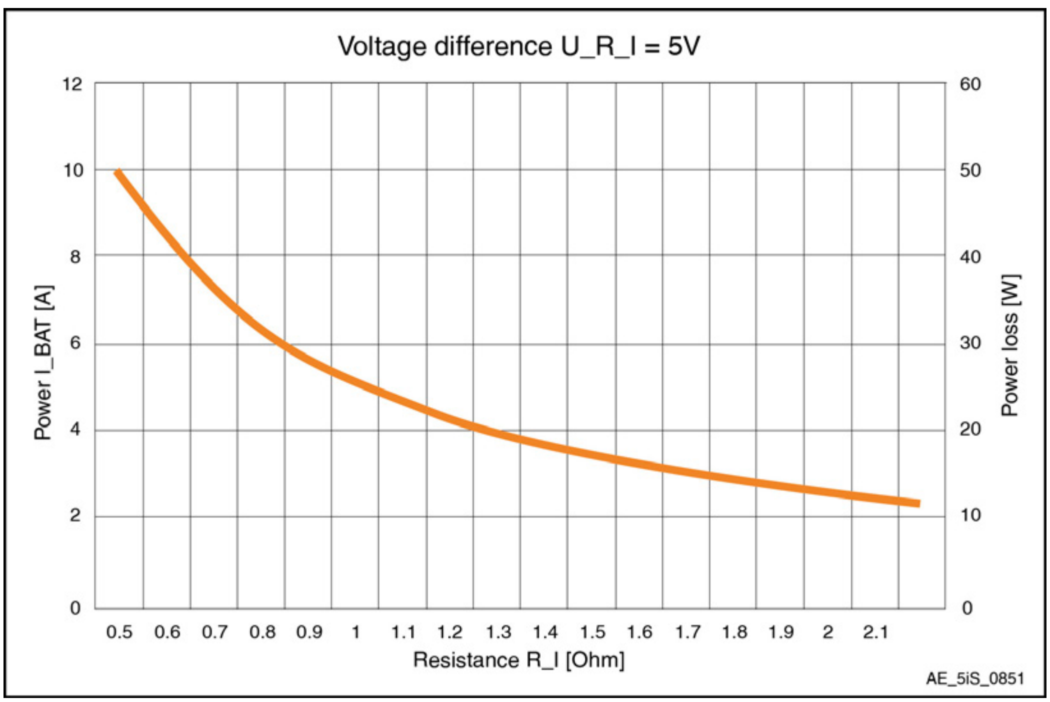

Figure 3.23: U_R_I = 5 V

Formula 3

The sum of the currents from I_BAT and I_Load results in I_28 V and must not exceed 27.9 A:

$$I\_BAT + I\_Lad < 27.9\ A$$

Formula 4

$$I\_BAT + I\_Load = I\_28\ V$$

If I_28 V is greater than 27.9 A, the 28 V output is switched off, as already mentioned at the beginning. Therefore, the condition from formula 3 must always be fulfilled. The expected load current I_BAT and the load current I_Load must be calculated by the installer.

Formula 5

Special attention must be paid to the dimensioning of the resistor with regard to the power dissipation:

$$P = I_2 * R$$

Once the battery is charged, the current flow is reduced to a minimum and thus also the power loss, which is converted into heat.

Example 2 – Calculate power dissipation:
I = 10 A, R_I = 0.89 Ω
From formula 5, the worst-case power dissipation is 89 Watts.
To supply the aircraft with voltage when the AC-DC converter is not active, the accumulator is used. Therefore, it must also be connected to the loads R_L1 and R_L2. Without the diode D1, the resistor R_I would be bypassed, and a current limitation would no longer exist. The choice and dimensioning of the diode must be adapted to the individual requirements of the aircraft. Parameters like voltage drop, current and cooling must be considered.

Summary:
By using a series resistor R_I the charging current to the accumulator can be limited.
Feeding the aircraft via the accumulator gate is made possible by a diode which prevents bridging of the series resistor R_I.
Special attention must be paid to the component dimensioning in order to achieve the desired reliability at these relatively high currents.

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.

External Power Supply

If an engine is installed in a specific aircraft type for the first time, it is required to measure the voltage on three positions:

- Battery Voltage (separate Voltmeter)
- Voltage on Electric Starter (separate Voltmeter)
- ECU Bus Voltage (displayed in BUDS Aircraft diagnostic tool)

Depending on the location where the engine should be used, this measurement must be done at the lowest reachable temperature. In case the measured voltages drop below 9 V especially during engine start, the installation is insufficient. In this case specification of the external power source the execution of the wiring as well as the total consumption of all electrical loads needs to be checked.

Separation of EMS and Airframe circuit

Proof the continuity between Fusebox Regulator A and Fusebox Regulator B in static condition (Fusebox is not supplied with power by an external power source). To determine the ECU BUS voltage at the transient moment of the engine start a oscilloscope must be used as well as the total consumption of all electrical loads needs to be checked.

916 i TYPE A

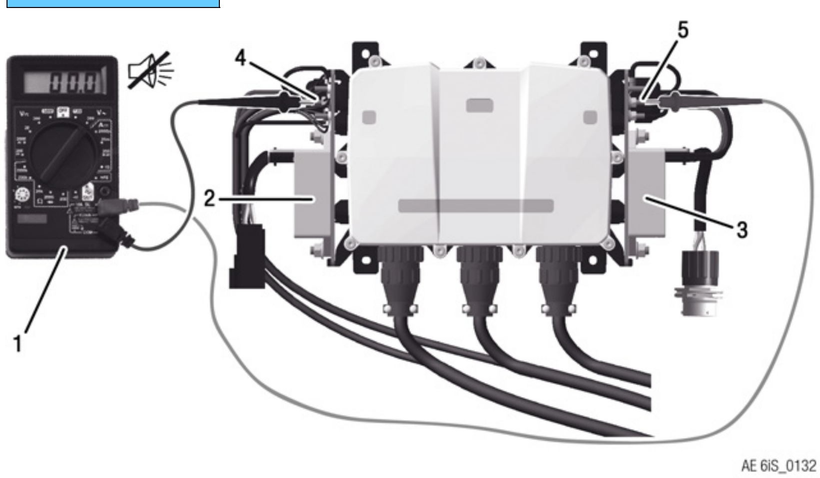

Figure 3.24: Validation of EMS and Airframe Circuit separation

1	*Multimeter*	2	*Regulator A (black connector)*
3	*Regulator B (Amphenol connector)*	4	*Ground connectors regulator A*
5	*Ground connectors regulator B*		

In case of continuity the installation is not sufficient and the wiring concept needs to be revised.

Separation of EMS and Airframe circuit

916 i TYPE C24

Test to ensure there is no continuity between Fusebox Regulator A and Fusebox Regulator B in static condition (Fusebox is not supplied with power by an external power source). To determine the ECU BUS voltage at the transient moment of the engine start an oscilloscope must be used and also the total consumption of all electrical loads needs to be checked.

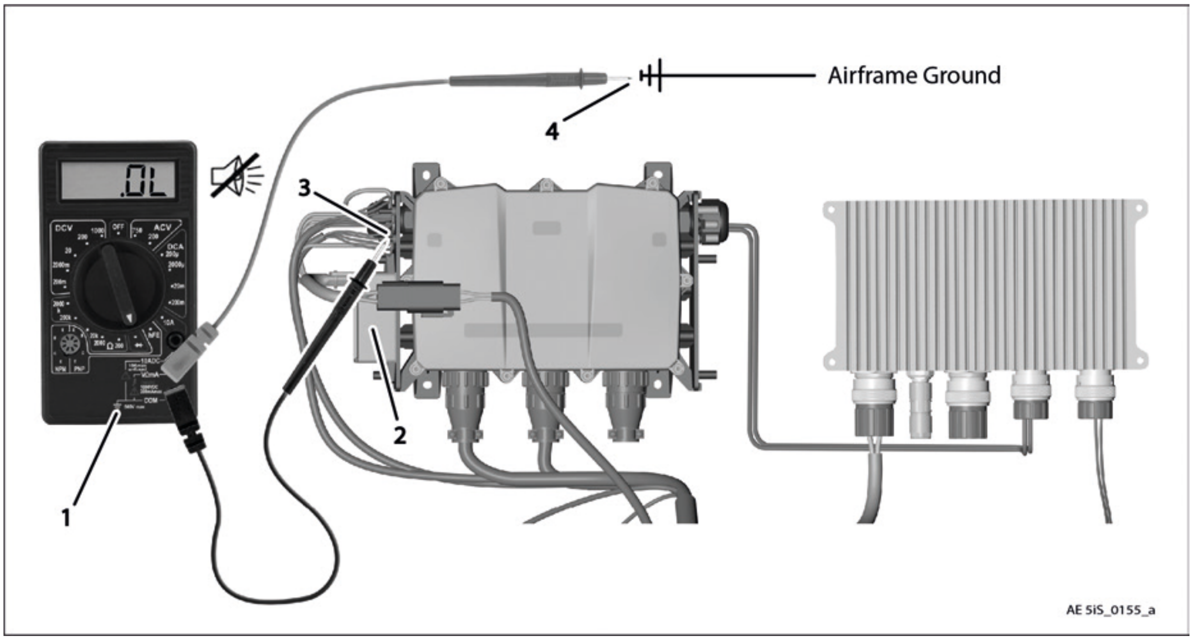

Figure 3.25: Validation of EMS and Airframe Circuit separation

1	*Multimeter*	2	*Rectifier regulator A (black connector)*
3	*Ground connections regulator A*	4	*Airframe ground*

In case of continuity the installation is not sufficient and the wiring concept needs to be revised.

EMS and Airframe circuit test for AC-DC Converter

916 i TYPE C24

Test to ensure there is no warning or caution lamp indication between AC-DC Converter and any known airframe (aircraft) ground when EMS system is powered (EMS system is powered on, engine need to run for this test - please follow the procedures mentioned in the current Operators Manual. The engine must run on an engine speed at 3000 1/min for at least 2 minutes.)

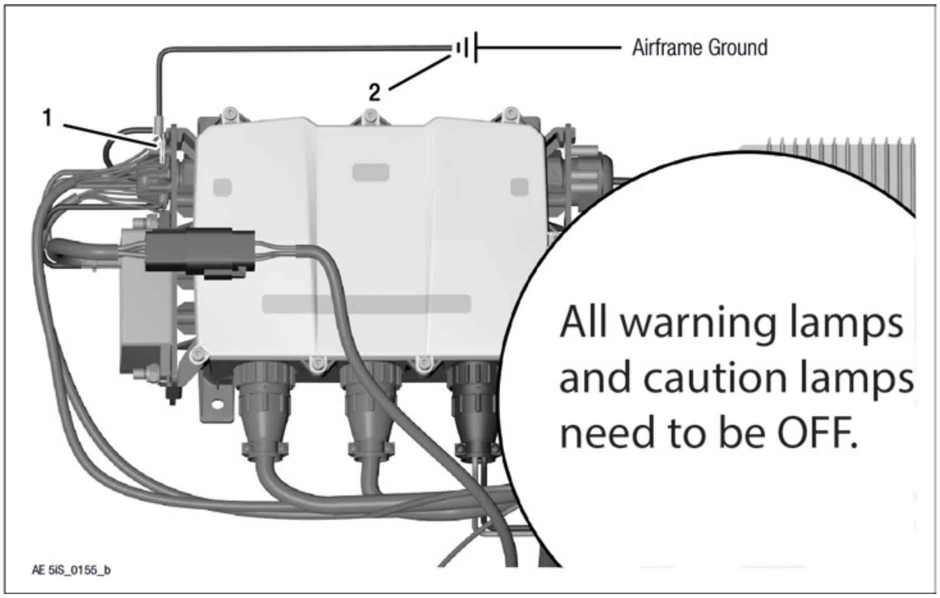

Figure 3.26: Airframe circuit test for AC-DC Converter

1 Ground connections regulator A *2 Airframe ground*

- Connect a cable between ground connections regulator A to any airframe ground point
- Check all safety regulations, because EMS system now gets powered ON and the engine will be started
- Run the engine for 2 minutes at 3000 1/min (follow the procedures mentioned in the current Operators Manual).

Check for warning and/ or caution lamp indication

916 i TYPE C24

Check that warning lamps and caution lamps stay OFF at an engine speed of 3000 1/min and for 2 minutes engine run. If not, there is a connection between EMS ground and airframe ground which need to be detected and removed before engine and aircraft can be released.

Chapter: 61–00–00
PROPELLER DRIVE

TOPICS IN THIS CHAPTER

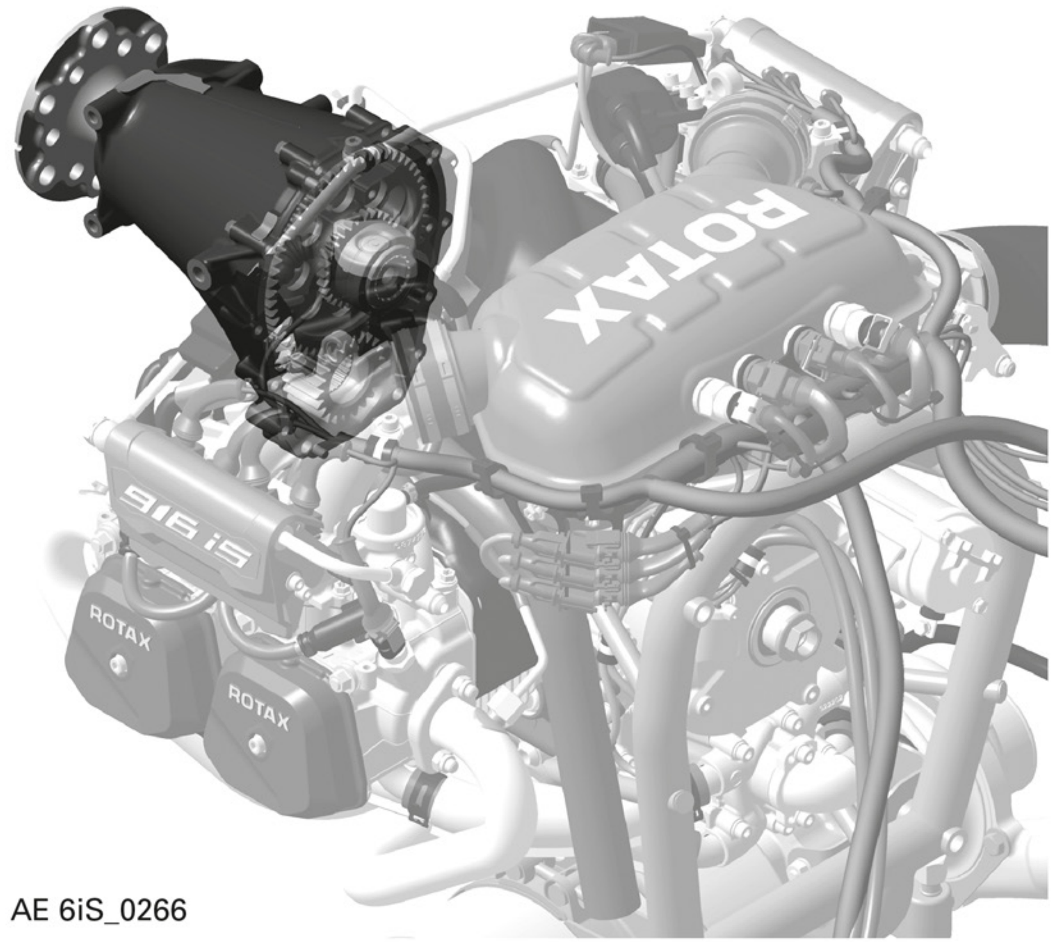

Figure 4.1: Propeller drive

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

Moment of inertia

System Limit	Min.	Max.
Moment of inertia on propeller	1500 kg cm^2 (3.559 lb ft^2)	9000 kg cm^2 (21.357 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	-	Maximum 70 mm (2.75 in.)

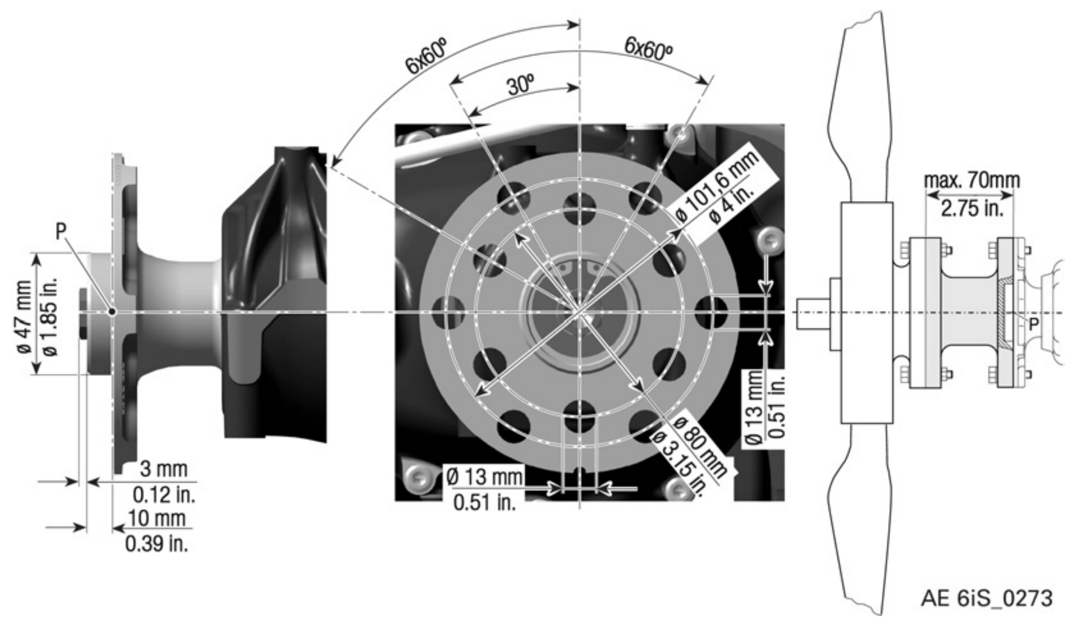

Figure 4.2

Hydraulic governor flange/drive/ oil supply

System Limit	Min.	Max.
Power consumption of governor	-	600 W
Operating pressure of governor	-	10 bar (145 psi) peak pressure: 30 bar (435 psi)

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

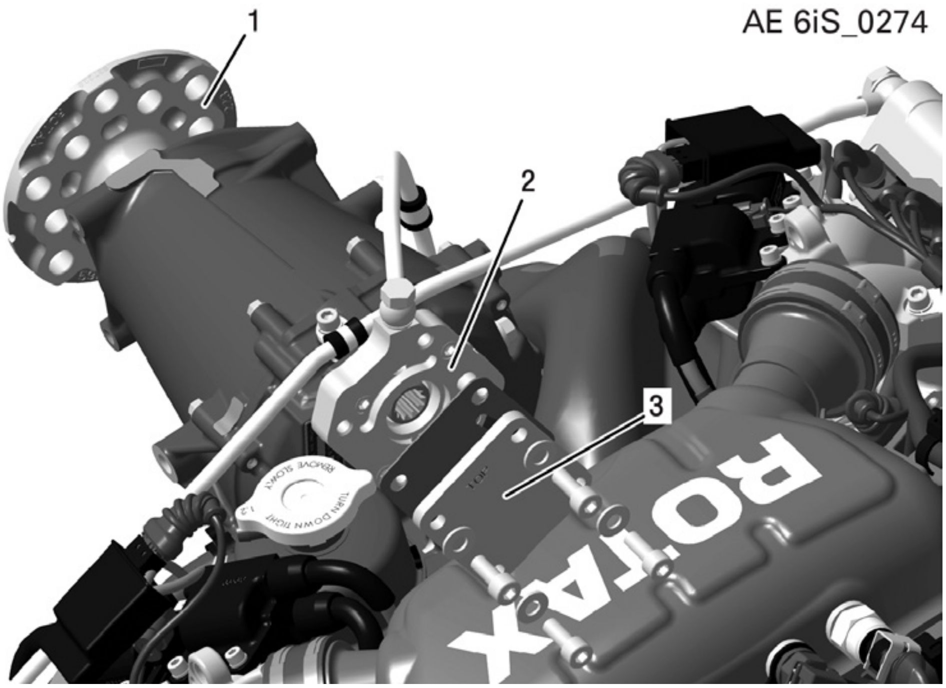

Figure 4.3: Interface (configuration 3)

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

NOTE

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

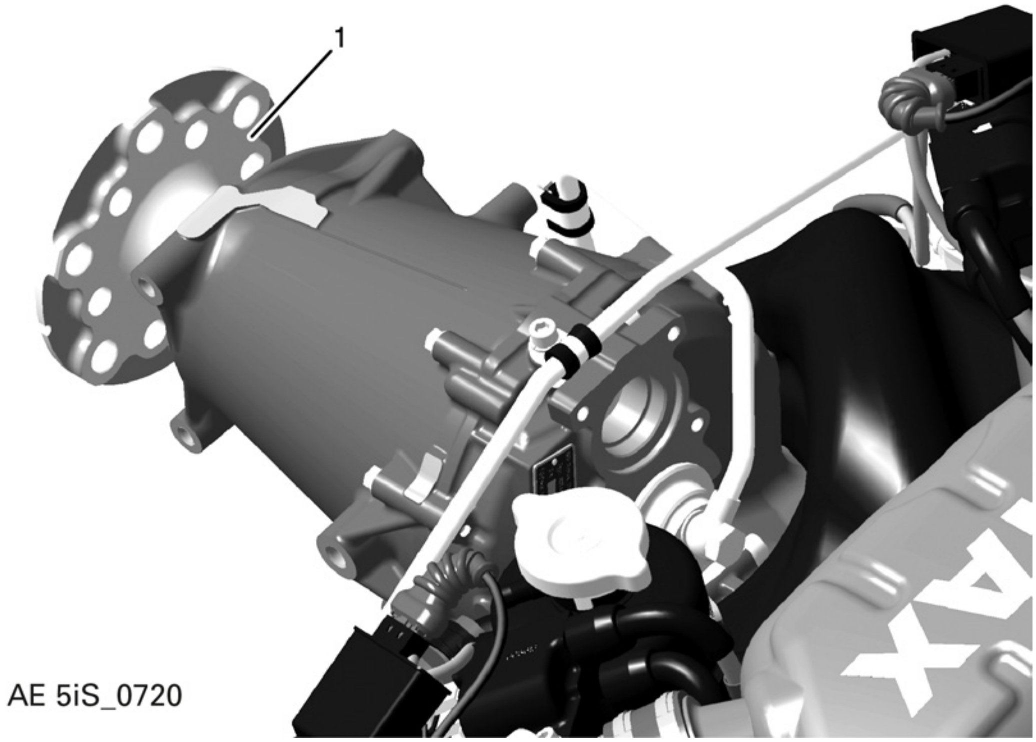

Figure 4.4: Interface (configuration 2)

1 *Propeller shaft (mechanical. Interface)*

MECHANICAL INTERFACES

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.

NOTICE
Modification of the propeller shaft is not permitted.

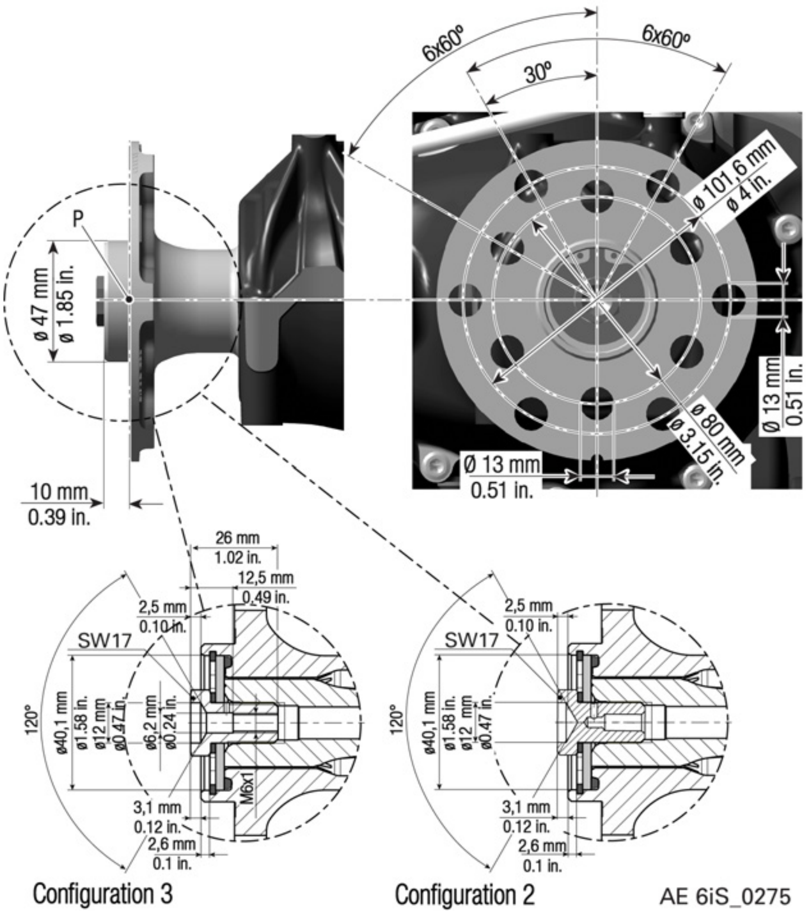

Figure 4.5: Propeller shaft flange

NOTICE
Propeller hub has to be centered on diameter 47 mm (1.85 in.).

Interface Parameter	Value
Pitch circle diameter 80 mm (3.15 in.)	6x through holes 13 mm (0.51 in.)
Pitch circle diameter 101.6 mm (4 in.)	6x through holes 13 mm (0.51 in.)
Hub diameter	47 mm (1.85 in.)
Gear transmission	i=2.54. Propeller shaft turns with 0.395 times engine speed.

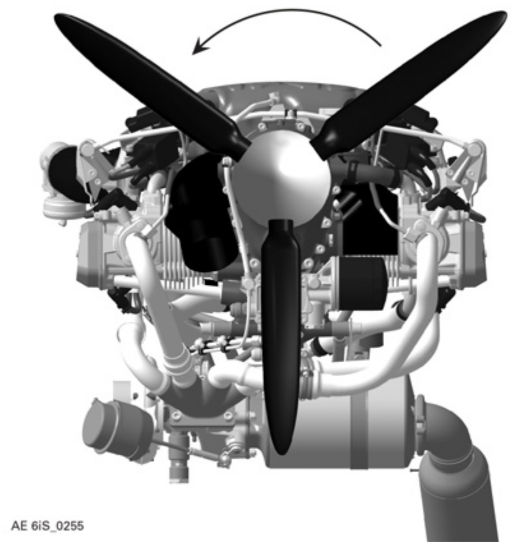

Figure 4.6: Direction of rotation

HYDRAULIC GOVERNOR FOR CONSTANT SPEED PROPELLER

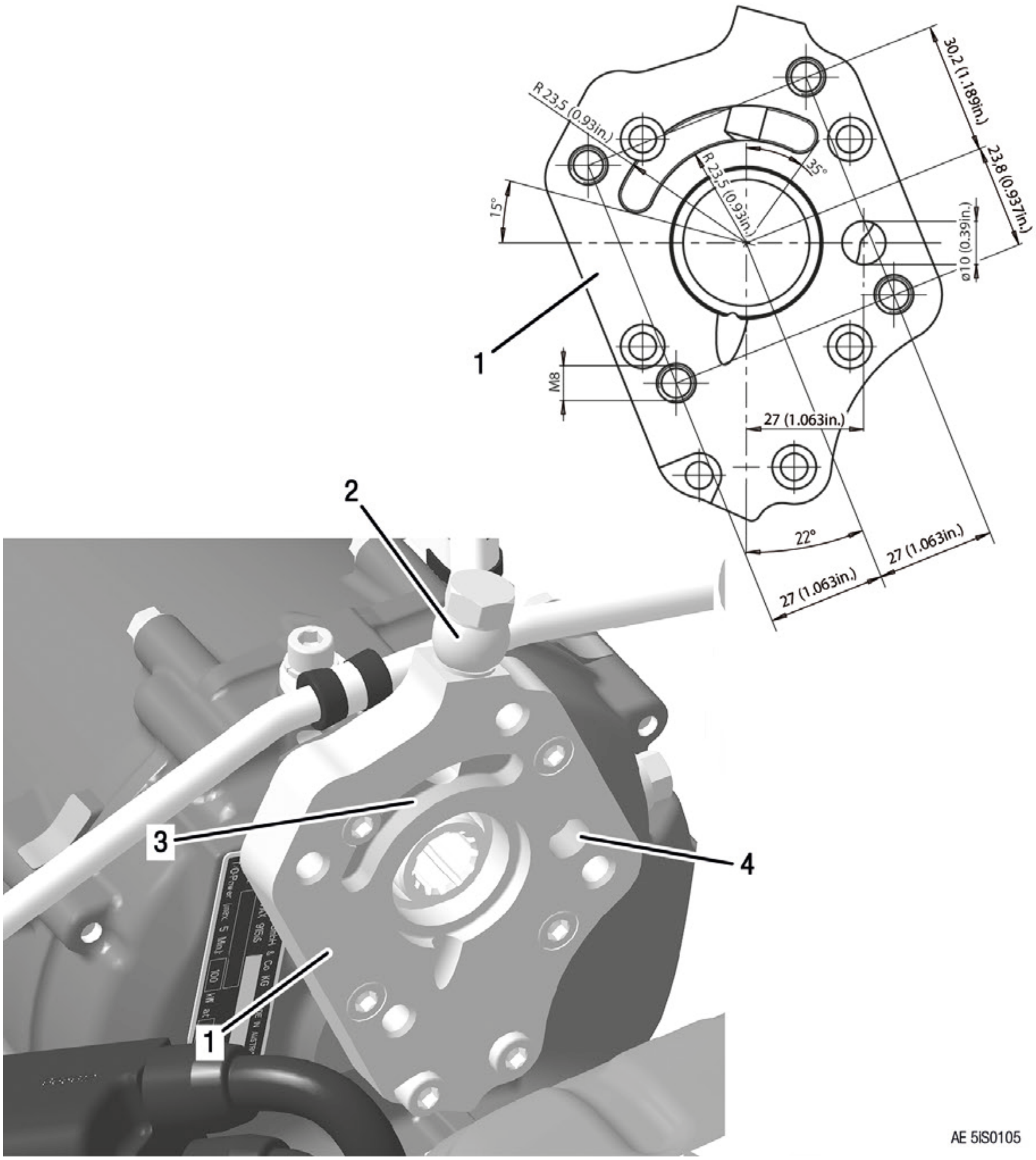

Figure 4.7

1	*Governor flange*	2	*Pressure oil line assy.*
3	*Oil inlet*	4	*Oil outlet*

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

NOTICE

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)

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Chapter: 72–00–00
ENGINE

TOPICS IN THIS CHAPTER

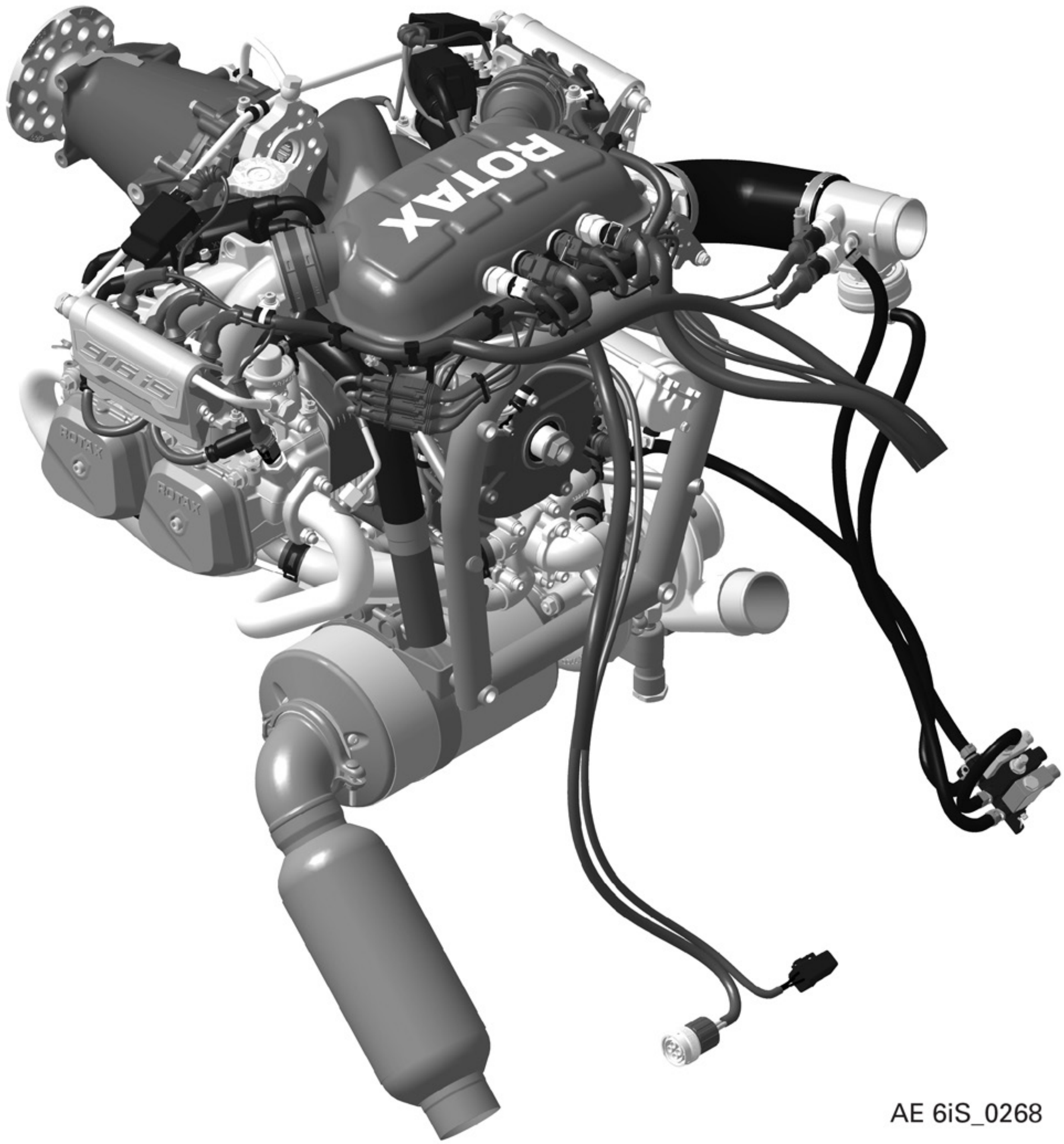

Figure 5.1: Engine, TYPICAL

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

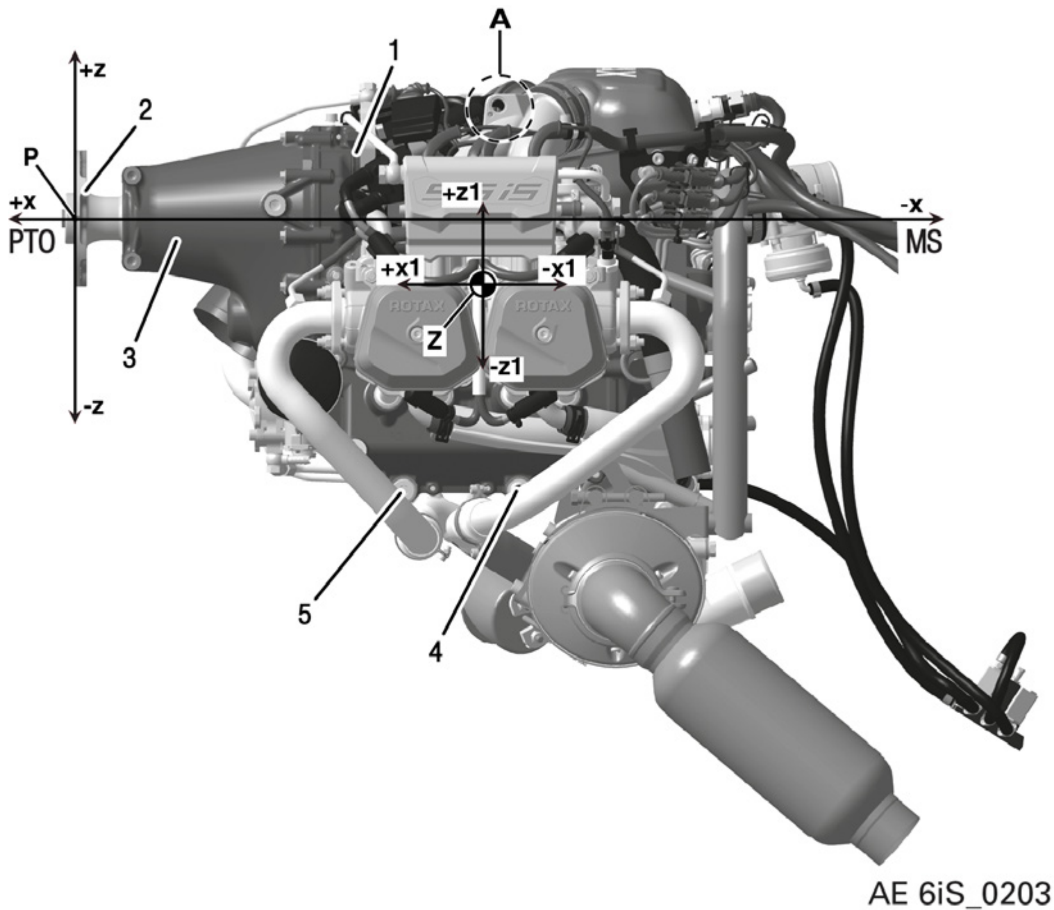

Figure 5.2: Engine side view

1	*Engine serial number*	*2*	*Propeller flange*
3	*Propeller gearbox*	*4*	*Connection for return line, both sides mandatory*
5	*Connection for return line*	*A*	*Attachment points (for engine transport)*
Z	*Center of gravity (Z)*	*P*	*Reference coordinate system (X, Y, Z)*

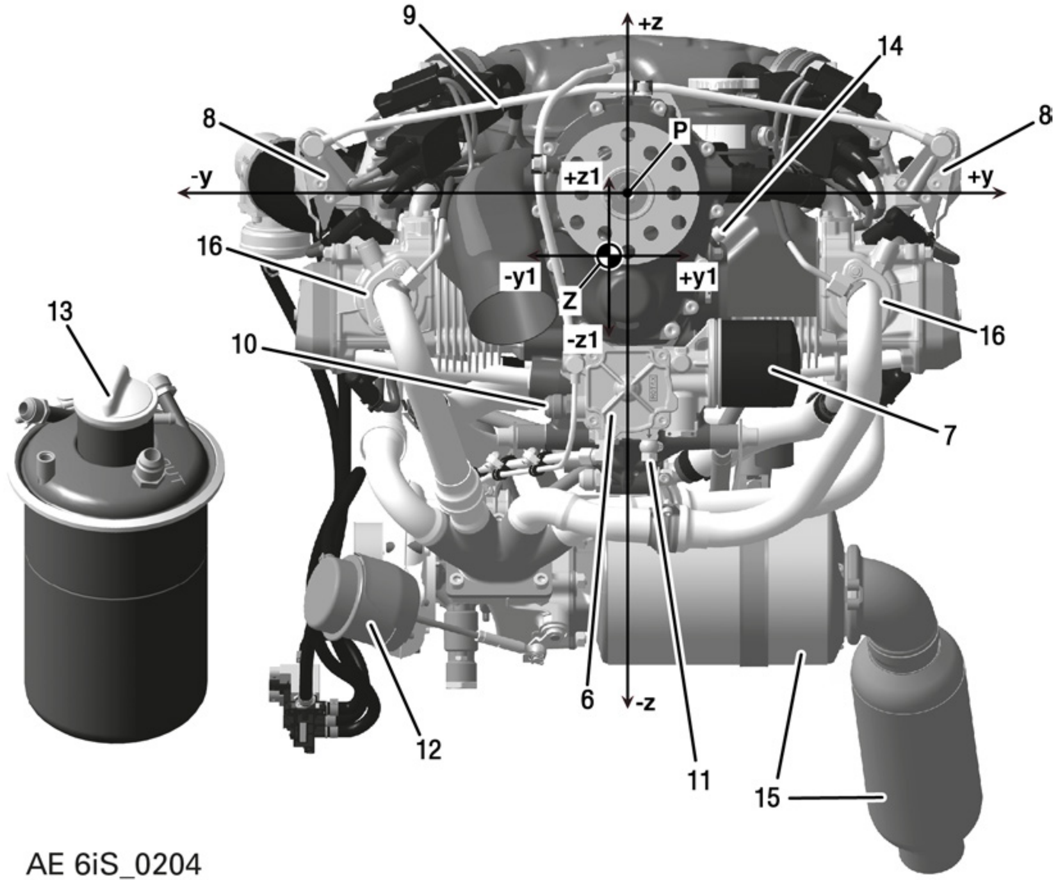

Figure 5.3: Engine Front view

6	*Oil pump housing*	*7*	*Oil filter*
8	*Fuel rail left/right*	*9*	*Fuel line assy.*
10	*Connection for oil feed line*	*11*	*Connection for turbo oil return line to tank*
12	*Wastegate actuator assy.*	*13*	*Oil tank (metric or UNF)*
14	*Crankshaft locking screw position*	*15*	*Muffler assy.*
16	*Exhaust flange*		

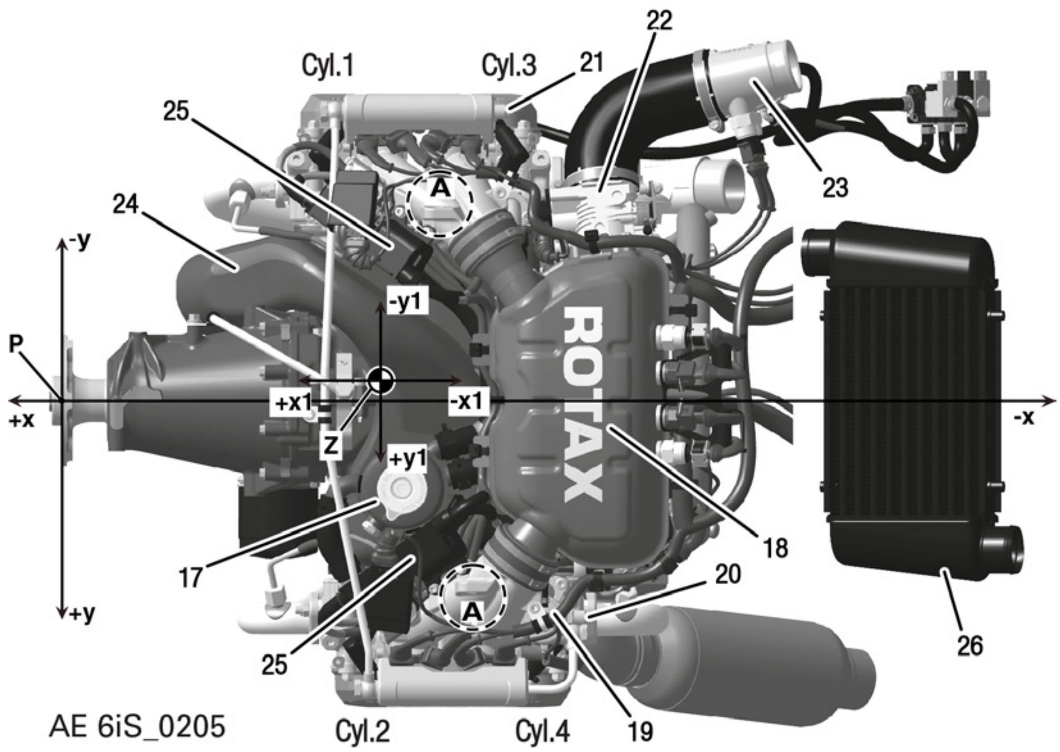

Figure 5.4: Top view

17	*Expansion tank assy.*	18	*Airbox*
19	*Fuel pressure regulator*	20	*Connection for fuel return line*
21	*Connection for fuel feed line*	22	*Throttle body*
23	*Pop off valve*	24	*Cooling air baffle*
25	*Dual ignition coils*	26	*Intercooler*
A	*Attachment points (for engine lifting)*		

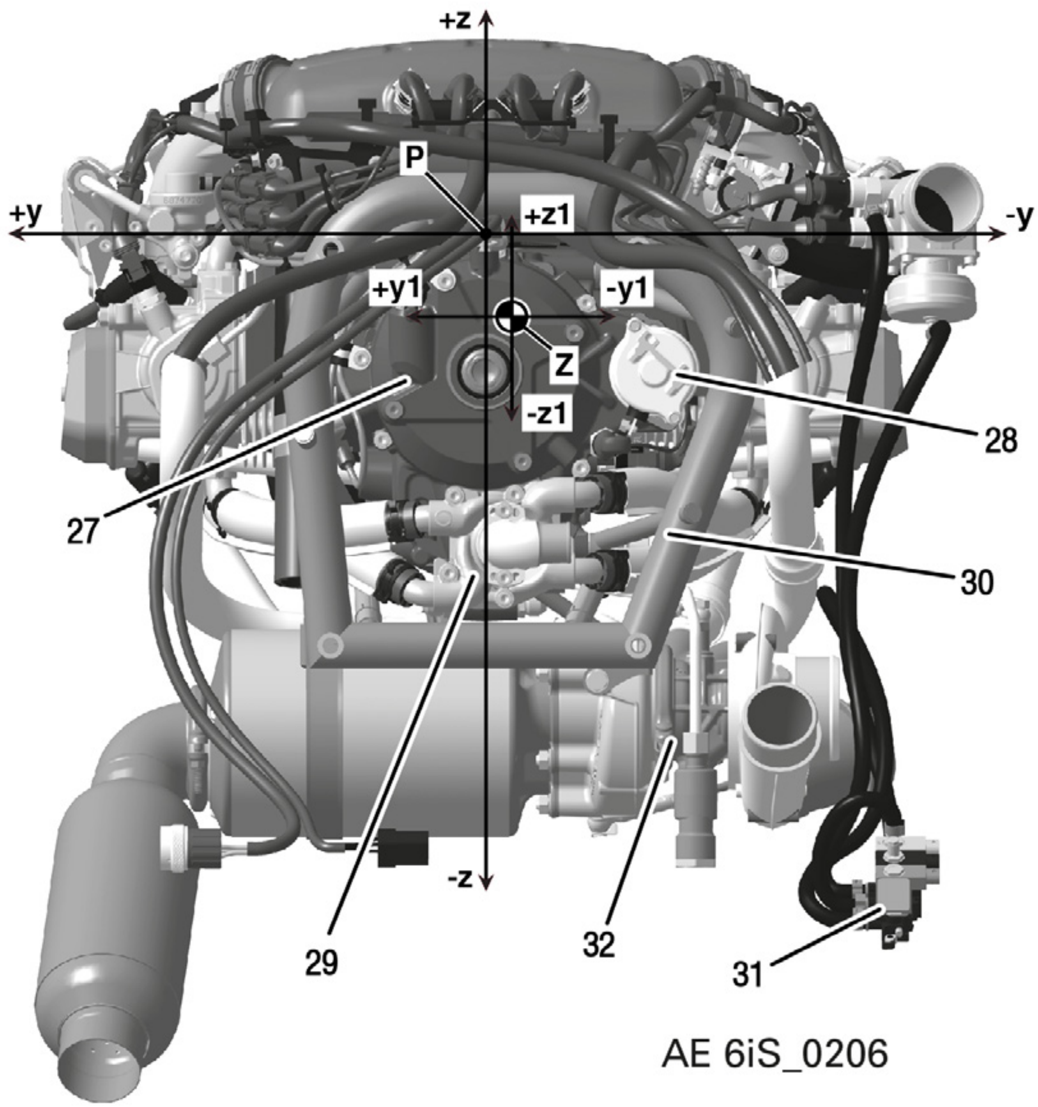

Figure 5.5: Rear view

27	*Ignition housing*	*28*	*Electric starter*
29	*Water pump housing*	*30*	*Engine suspension frame (ring mount)*
31	*Solenoid Valve (PCV)*	*32*	*Turbocharger assy.*

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

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 (OM).

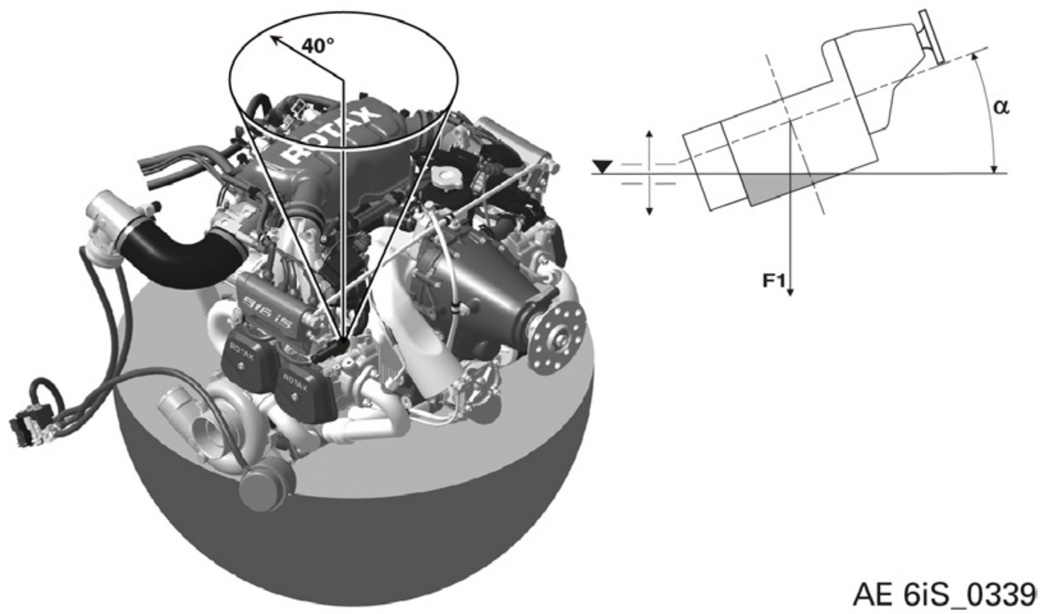

Figure 5.6: Bank angle

Angle/force	Description
α	Bank or rotation
F1	Gravity

Attachment points For mounting the engine on the engine suspension, R2, R3, L3 and L2 of attachment points must be used. All used screws must not be touch engine components.

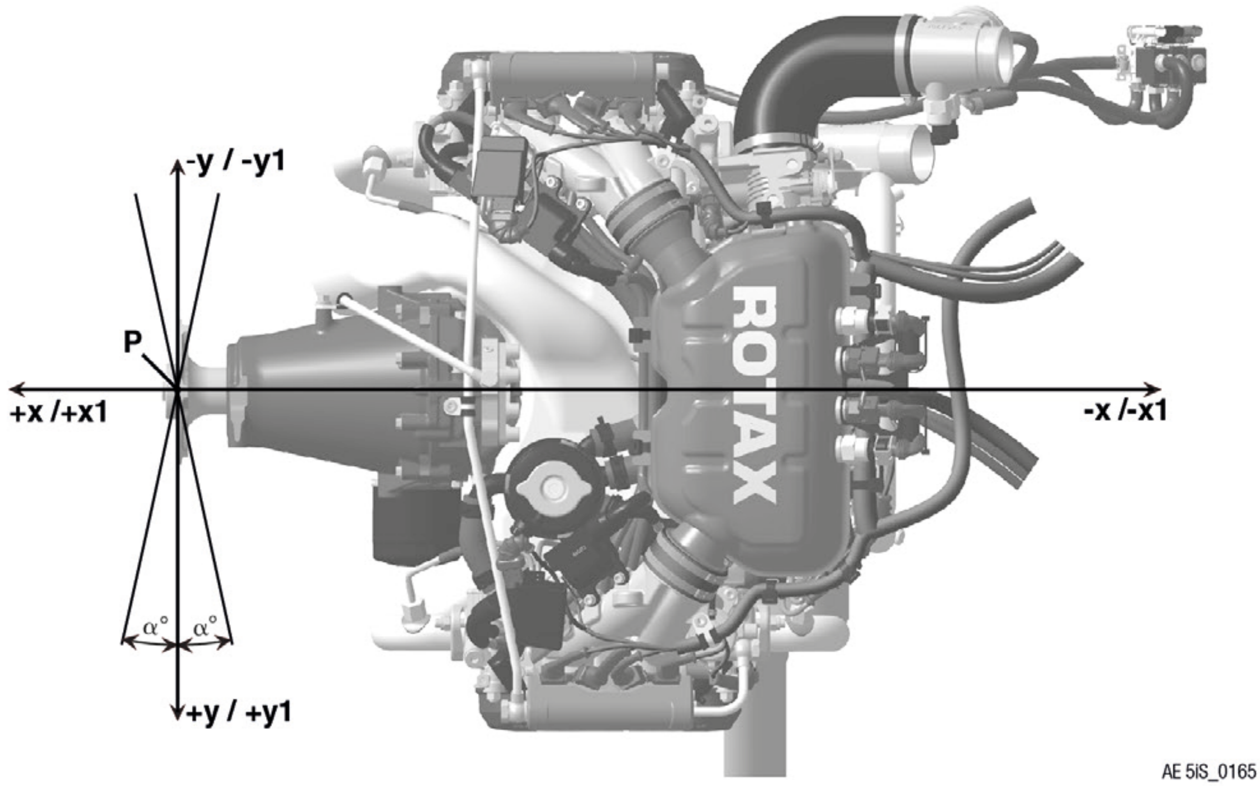

Figure 5.7: Propeller and vertical axis TYPICAL

Propeller axis The y1-axis must be perpendicular to the longitudinal axis of the aircraft.

System Limit	Min.	Max.
Permissible deviation from perpendicular (α)	- 10°	+ 10°

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

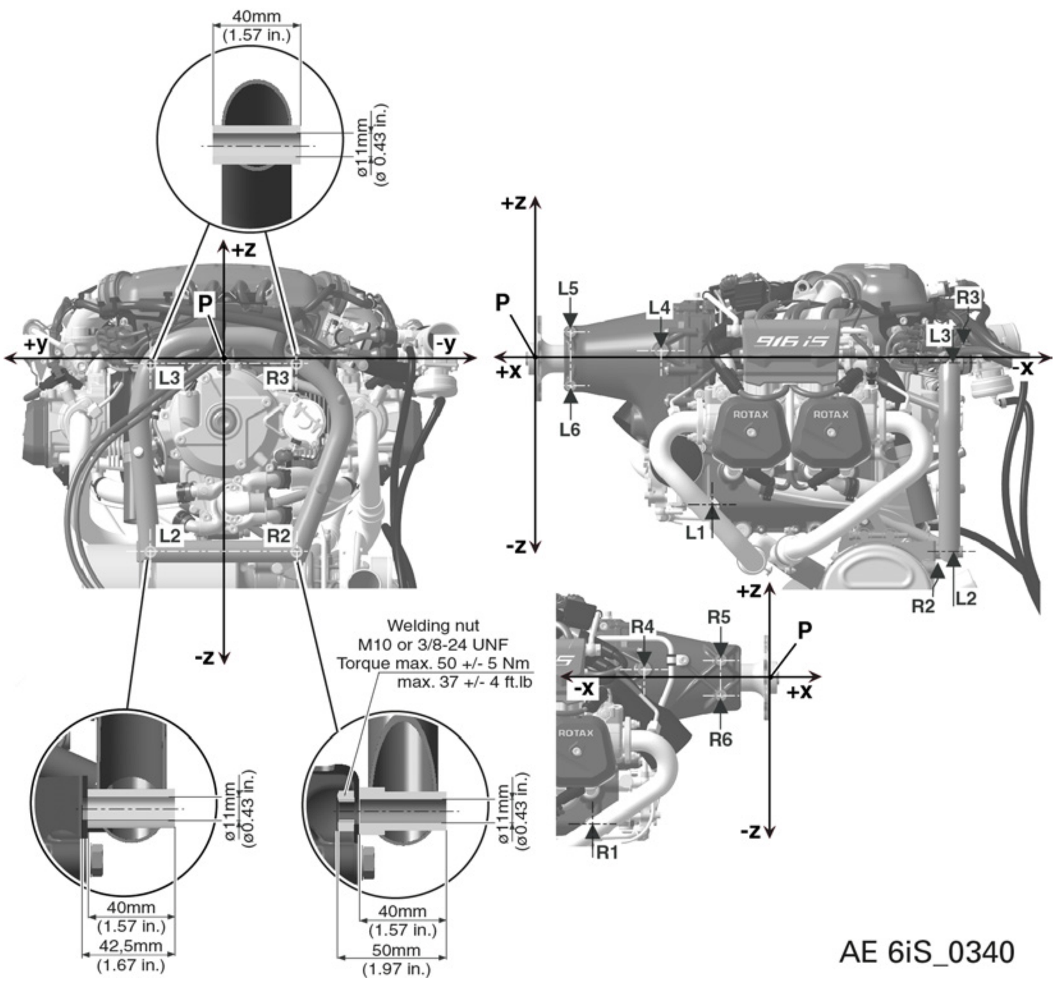

Figure 5.8: Attachment points

MECHANICAL INTERFACES

Attachment points

Interface Parameter	**Value**			
Attachment points	**L1**	**R1**	**L2**	**R2**
x-axis (in)	- 253.5 mm (-99.8 in.)		- 615 mm (-24.21 in.)	
y-axis (in)	-71 mm (-2.8 in.)		105 mm (4.13 in.)	-105 mm (-4.13 in.)
z-axis (in)	-211 mm (-8.31 in.)		–277 mm (-10.91 in.)	

Interface Parameter	Value			
Attachment points	**L1**	**R1**	**L2**	**R2**
Thread	M10		—	
Max. usable Thread length	25 mm (0.98 in.)			

Interface Parameter	Value			
Attachment points	**L3**	**R3**	**L4**	**R4**
x-axis (in)	- 615 mm (-24.21 in.)		- 181 mm (-7.13 in.)	
y-axis (in)	105 mm (4.13 in.)	-105 mm (-4.13 in.)	90 mm (3.54 in.)	-90 mm (-3.54 in.)
z-axis (in)	-7 mm (-0.28 in.)		12.2 mm (0.48 in.)	
Thread	—		M10	
Max. usable Thread length			16 mm (0.63 in.)	

Interface Parameter	Value			
Attachment points	**L5**	**R5**	**L6**	**R6**
x-axis (in)	- 51 mm (-1.97 in.)	- 71 mm (-2.79 in.)	- 51 mm (-1.97 in.)	- 71 mm (-2.79 in.)
y-axis (in)	48 mm (1.89 in.)	-64.5 mm (-2.54 in.)	48 mm (1.89 in.)	-64.5 mm (-2.54 in.)
z-axis (in)	25.4 mm (1.00 in.)	39 mm (1.53 in.)	-25.4 mm (-1.00 in.)	-39 mm (-1.53 in.)
Thread	M8		M8	
Max. usable Thread length	20 mm (0.79 in.)		20 mm (0.79 in.)	

⚠ 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.

Weight

Engine component	Weight
Base engine with gearbox:	75.44 kg (166.3 lb)
Governor drive add on weight version 3	0.60 kg (1.32 lb)
Cooling air baffle	0.38 kg (0.838 lb)
PCV	0.35 kg (0.771 lb)
Oil tank	1.50 kg (3.30 lb)
Intercooler	1.65 kg (3.65 lb)
ECU	1.13 kg (2.49 lb)
Fusebox 916 I A Series	2.02 kg (4.45 lb)
Fusebox 916 I C24 Series	1.84 kg (4.06 lb)
Ambient sensors	0.06 kg (0.132 lb)
Wiring harness 916 I A Series	2.50 kg (5.51 lb)
Wiring harness 916 I C24 Series	1.84 kg (4.06 lb)
Intermediate flange with overboost valve, air hose and clamps	0.78 kg (1.72 lb)
AD-DC Converter assy.	1.68 kg (3.70 lb)
Starter Relay	0.14 kg (0.308 lb)

Centre of gravity of engine

Center of gravity (COG) position information only considers the engine itself. Parts without a specific installation position relative to the reference coordinate system are not considered.

NOTE

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

NOTE

The COG will slightly change when adjusting the orientation of the resonator.

Axis	Center of gravity
X-axis	- 377 mm (-14.84 in.)
Y-axis	- 9.4 mm (-0.35 in.)
Z-axis	- 115 mm (-4.52 in.)

Moments of inertia (relative to COG)

NOTE

The MOI will slightly change when adjusting the orientation of the resonator.

Axis	Moment of intertia
X-axis	2467496 $kg*mm^2$
Y-axis	2600923 $kg*mm^2$
Z-axis	2752637 $kg*mm^2$

Dimensions

NOTE

The Overall length and height may vary by adjusting the orientation of the resonator.

Description	Dimension
Overall length (w/o intercooler and hoses)	657 mm (25.87 in.)
Overall length with suspension frame	657 mm (25.87 in.)
Overall height (w/o exhaust system and suspension frame)	398 mm (15.67 in.)
Overall height with exhaust system	673 mm (26.50 in.)
Overall height with engine suspension frame	430 mm (16.93 in.)
Overall width (w/o exhaust end pipe, intercooler and hoses)	578 mm (22.76 in.)

INSTALLATION NOTES

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.
The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.
The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

ENGINE SUSPENSION

NOTICE

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

The rubber mounts for neutralizing vibrations and other engine suspension components are not in the scope of delivery. Those components must be designed, selected and tested on vibration behavior during ground runs and flight testing at specified loads.

NOTICE

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

The engine suspension is determined essentially by the aircraft design. Four attachment points are provided on the engine suspension frame assy.
The engine will be supplied with a well tried and certified suspension frame for attachment on the fireproof bulkhead. The exhaust system and the turbo charger are supported on this frame, too. The installation into the aircraft is as generally practised by captive rubber mounts which ensure also to reduce vibrations and sound transmission from engine to aircraft frame.

⚠ WARNING
The hex. screws M10x60 on the attachment points R2 and L2 are only used for transport securing but must never be utilized for engine suspension. See interface overview. Therefore, use the ROTAX engine suspension frame and the 4 stated attachment points R2, L2, R3, L3.

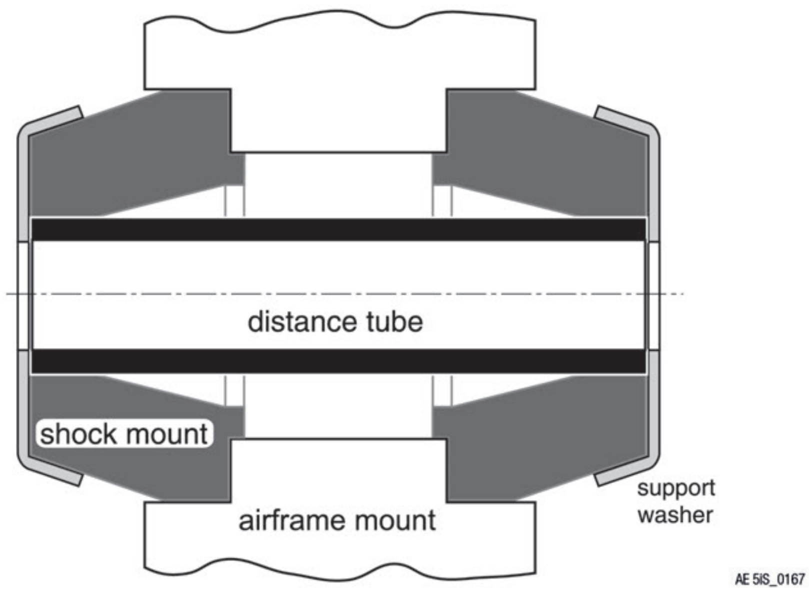

Figure 5.9: Damping element engine suspension

Standard aircraft industry damping elements (e.g. Lord) are suitable and need to be choosen according to the aircraft specific design requirements. Check with the relevant equipment manufacturer.
The vibration and acoustic insulation factor depends on the airframe.

Chapter: 72–60–00
AIR INTAKE SYSTEM

TOPICS IN THIS CHAPTER

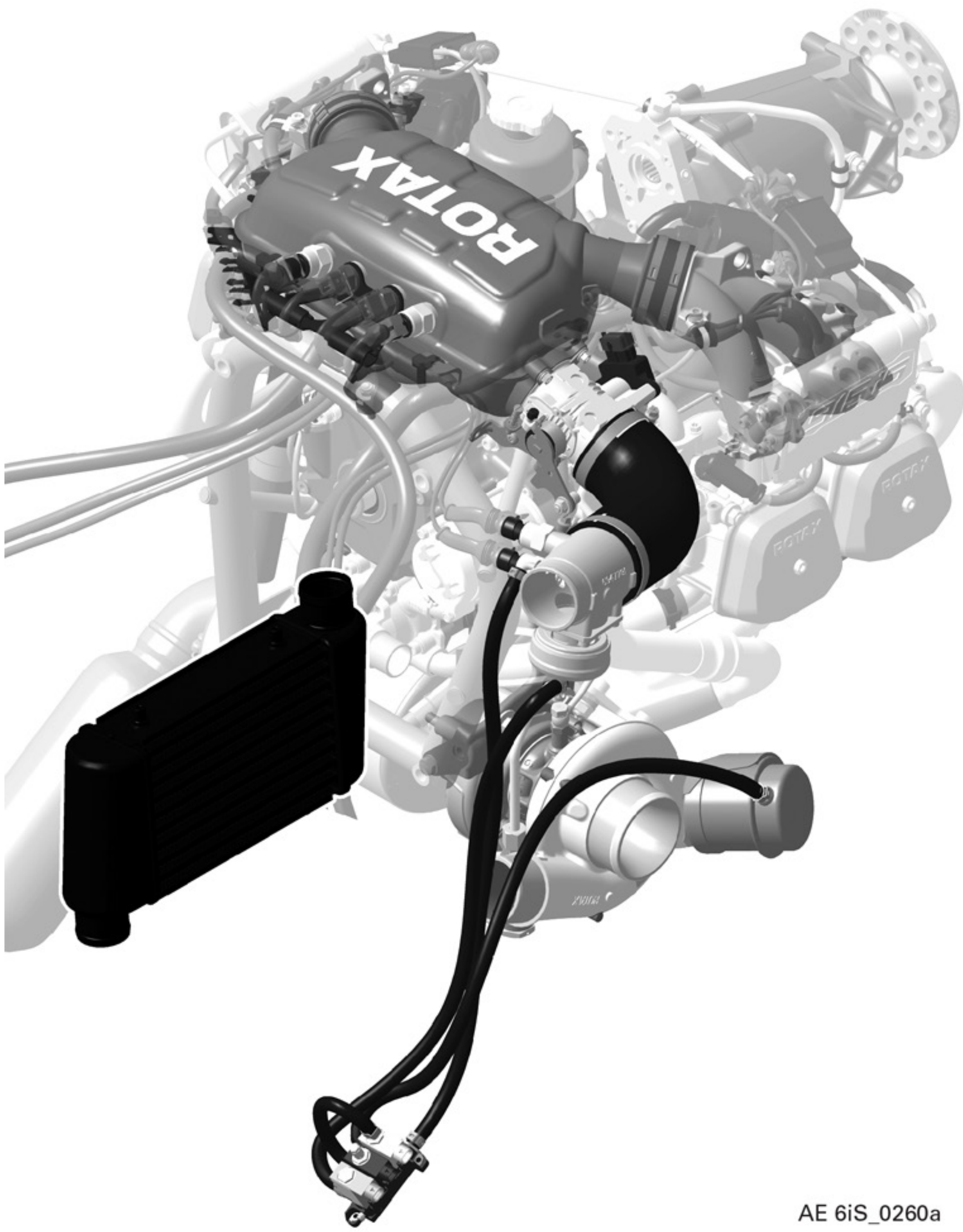

Figure 6.1: Air intake system

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Induction air intake

Following requirements may be used:

System Limit	Min.	Max.
Flow rate	400 kg/h	
Pressure loss between ambient pressure and compressor in pressure, caused by the airfilter.		10 mbar (0.14 psi)

Icing in the area of the air intake needs to be avoided. The prevention of icing lies within the aircraft manufacturer's responsibility.

Airbox reference pressure

The reference pressure of the fuel system is the airbox pressure.

Induction air intake ducting

System Limit	Min.	Max.
Intake pressure loss (Engine Speed: 5500 ±50 rpm; Airflow: 360-366 kg/min)		85 mbar (1.23 psi)
Intake pressure loss (Engine Speed: 5800 ±50 rpm; Airflow: 384-396 kg/min)		90 mbar (1.30 psi)

PCV ducting

All pneumatic connections leading from and to the Pressure Control Valve (PCV) may not be changed. Changes in length and diameter of the connections will have an significant effect on the wastegate control. Depending on the installation heat protection may be required.

System Limit	Min.	Max.
Bending radius on tube centerline	60 mm (2.36 in.)	

Valid installation positions

The intercooler as well as the PCV must be installed vibration-decoupled from the engine.

Compressor housing

The turbo compression housing must not be rotated. The wastegate functionality can be affected.

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

Step	Procedure
1	Push 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.*
2	Push to "idle". Set the spring-loaded screw that the throttle lever hits the stop screw with the black cap (maximum setting for lowest idle).
3	If the idling speed is too low, then open throttle lever with the spring-loaded screw until the required idling speed is reached
4	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.

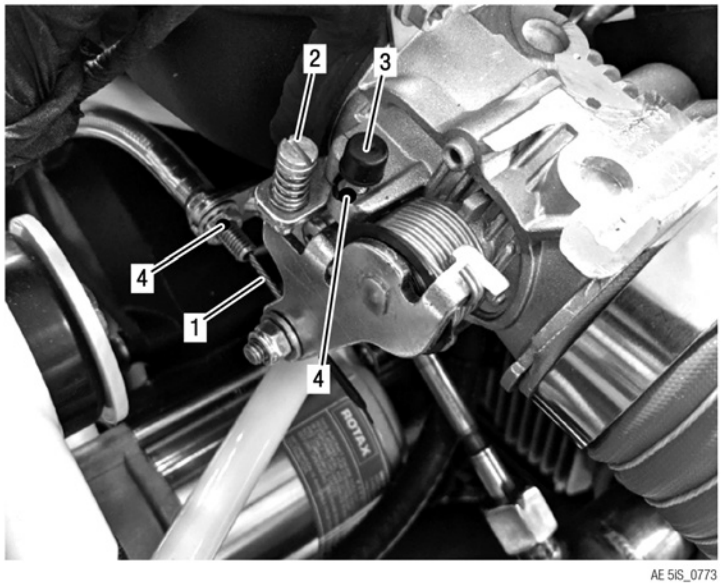

Figure 6.2: Figure shows idle position

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

⚠ 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.

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

Interface overview

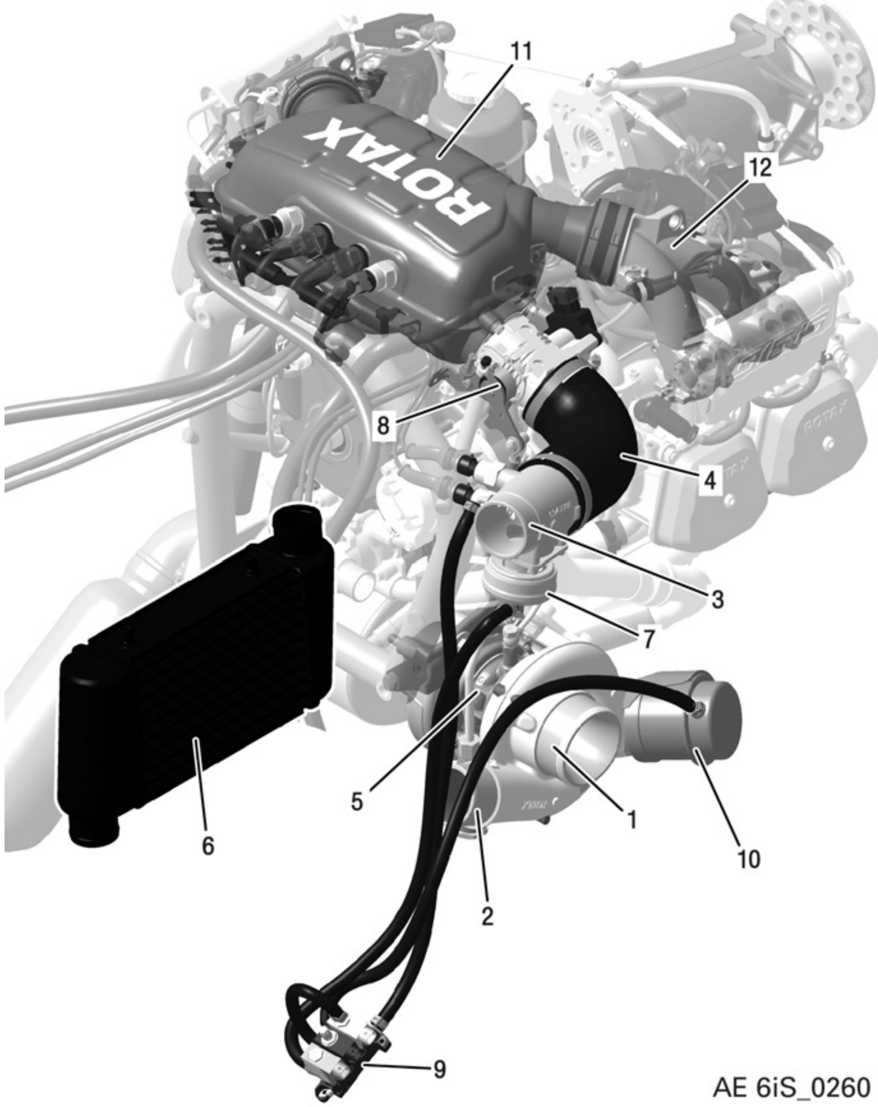

Figure 6.3: Air intake: Interface overview and components

1	*Air filter connection*	2	*Connection turbocharger to intercooler*
3	*Connection intercooler to pop off valve*	4	*Air intake hose (pop off valve to throttle body)*
5	*Turbocharger*	6	*Intercooler*
7	*Pop off valve*	8	*Throttle body*

9	*Pressure control valve (PCV)*	*10*	*Actuator assy. (wastegate)*
11	*Airbox*	*12*	*Intake manifold*

MECHANICAL INTERFACES

Pressure control valve (PCV)

Interface Parameter	Min.	Max.
Tightening torque	–	1 Nm (9 in. lb)

Pressure control valve (PCV)

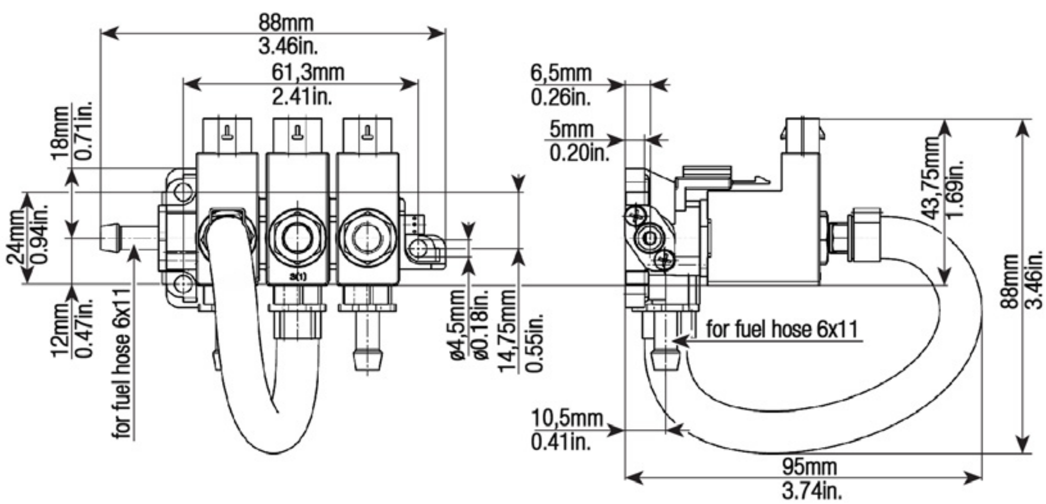

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Figure 6.4: Connection and dimensions

Throttle body

Interface Parameter	Min.	Max.
Tightening torque (Bowden cable to throttle arm)	4 Nm (35 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	7.5 N (1.69 lbs.)	20 N (4.5 lbs)
Max. permissible actuating force	—	20 N (4.5 lbs)

Connection: Set screw M6x12 mm

Intercooler

For details see SI-PAC-005.

PNEUMATIC INTERFACES

Airfilter connection

See figure Connection on turbocharger

Interface Parameter	Min.	Max.
Slip-on length	30 mm (1.18 in.)	-

NOTE

Use only filter elements which will not tend to restrict the flow when in contact with water.

Turbocharger to intercooler

Connection on turbocharger:

Interface Parameter	Min.	Max.
Slip-on length	30 mm (1.18 in.)	-

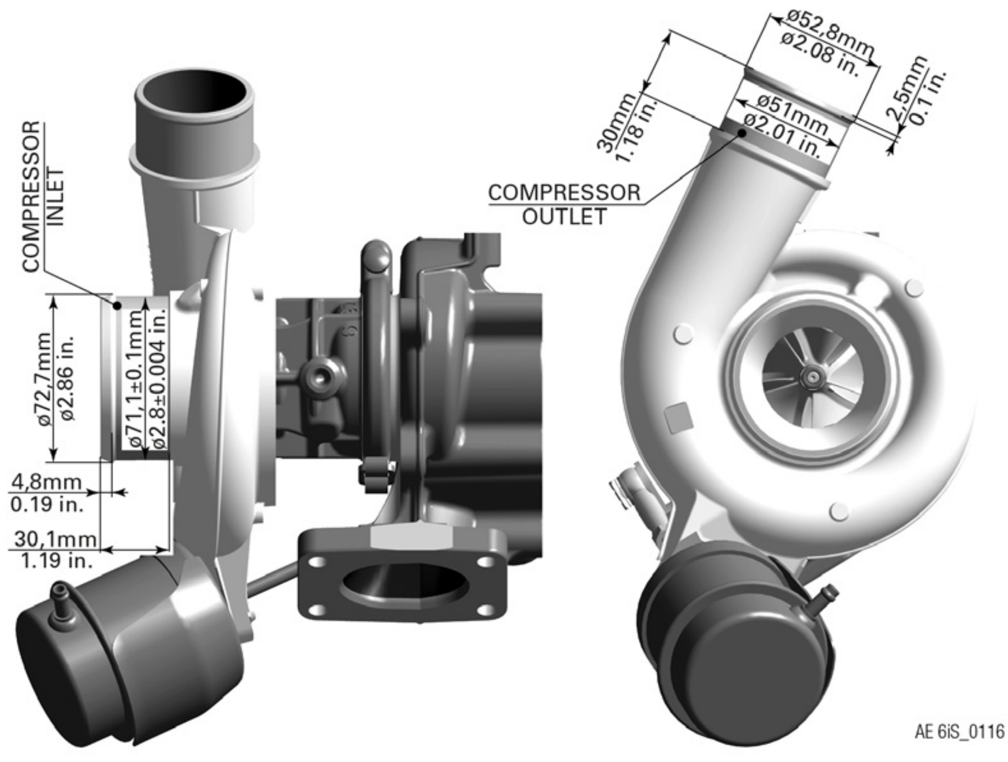

Figure 6.5: Connection on turbocharger

Connection on intercooler:

Interface Parameter	Min.	Max.
Slip-on length	32 mm (1.26 in.)	-

Intercooler to overboost valve

Interface Parameter	Min.	Max.
Slip-on length	18 mm (0.71 in.)	

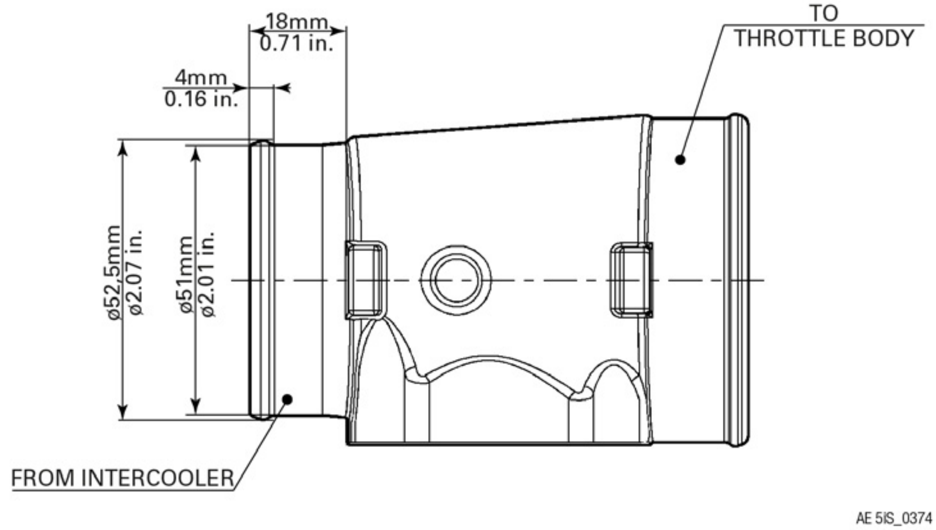

Figure 6.6: Overboost valve

Connection on throttle body: Install the delivered hose (scope of supply) to the correct side of the overboost valve, recheck if it fits.

ELECTRICAL INTERFACES

PCV sockets The appropriate connectors on the wiring harness as well as the corresponding sockets on the PCV are color coded.
To avoid inappropriate behavior of the wastegate the correct linkage needs to be ensured.

INSTALLATION NOTES

General

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The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

Pneumatic diagram

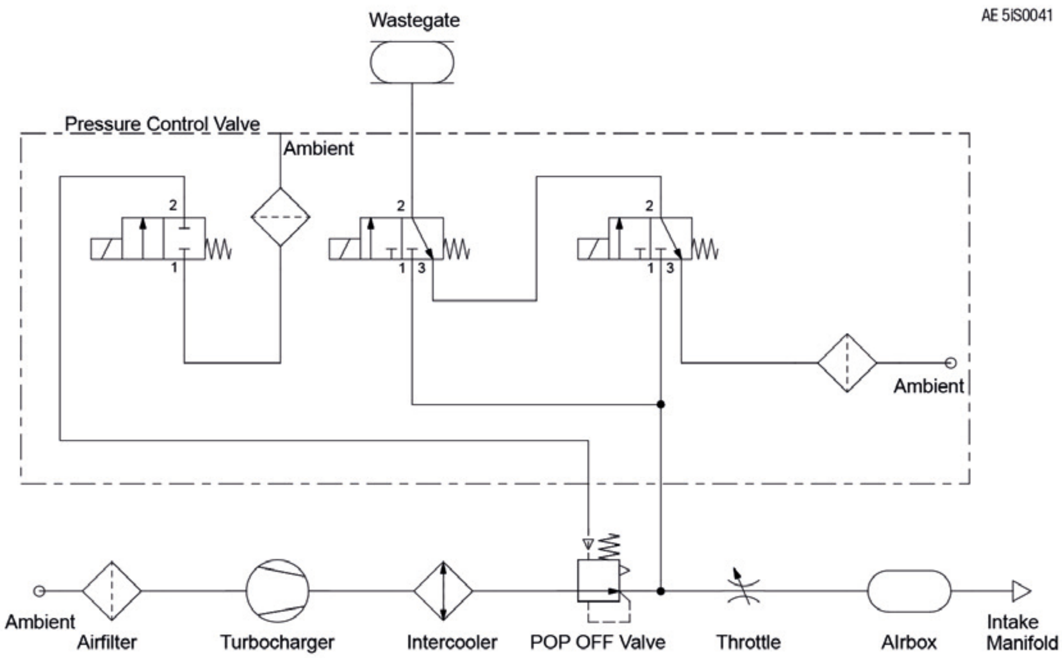

Figure 6.7: Pneumatic diagram

Connection between compressor outlet and intercooler

Temperature-resistant hoses must be used.

Chapter: 73–00–00
<u>ENGINE – FUEL AND CONTROL</u>

<u>TOPICS IN THIS CHAPTER</u>

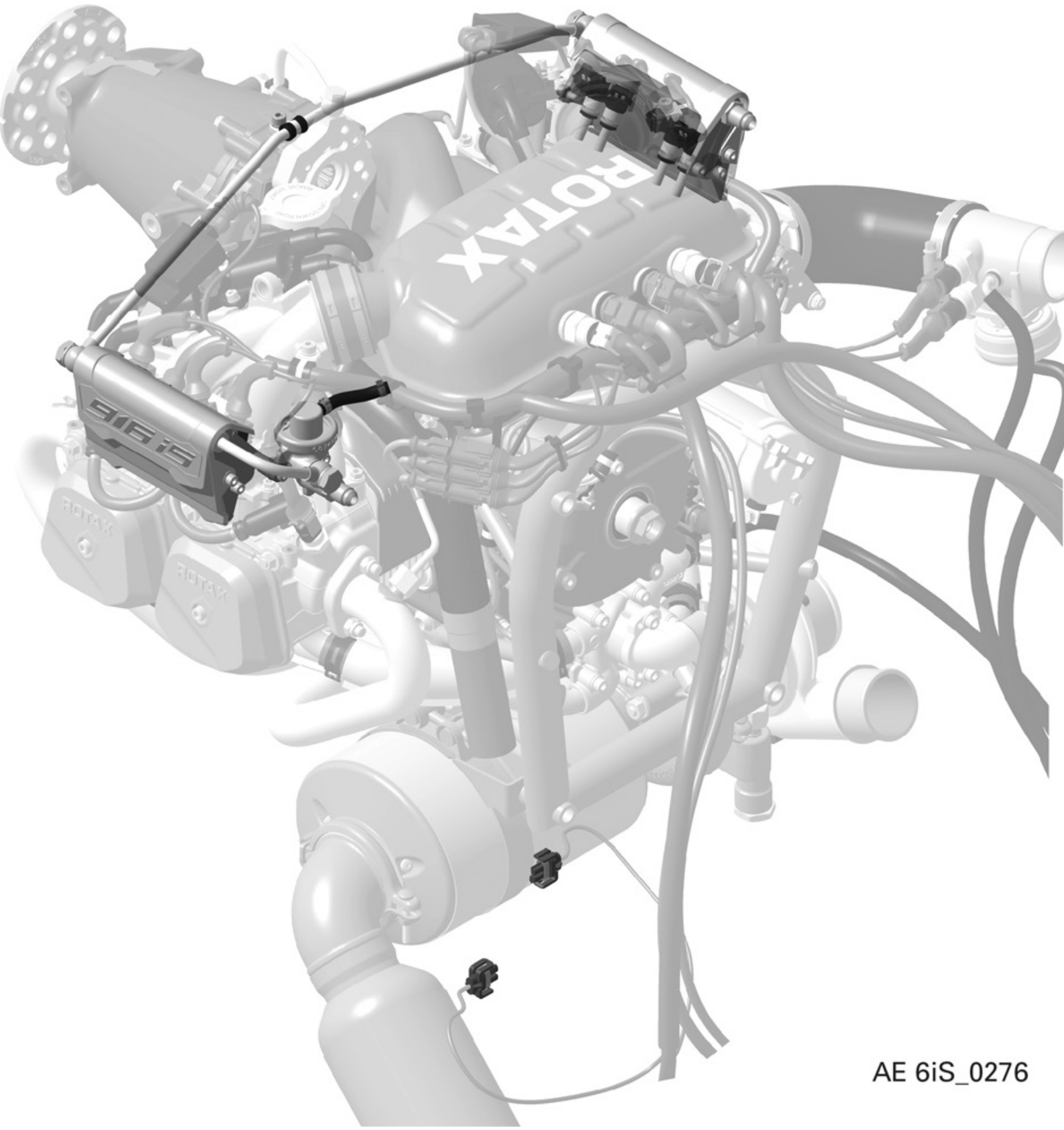

Figure 7.1: Fuel System

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

916 i TYPE A

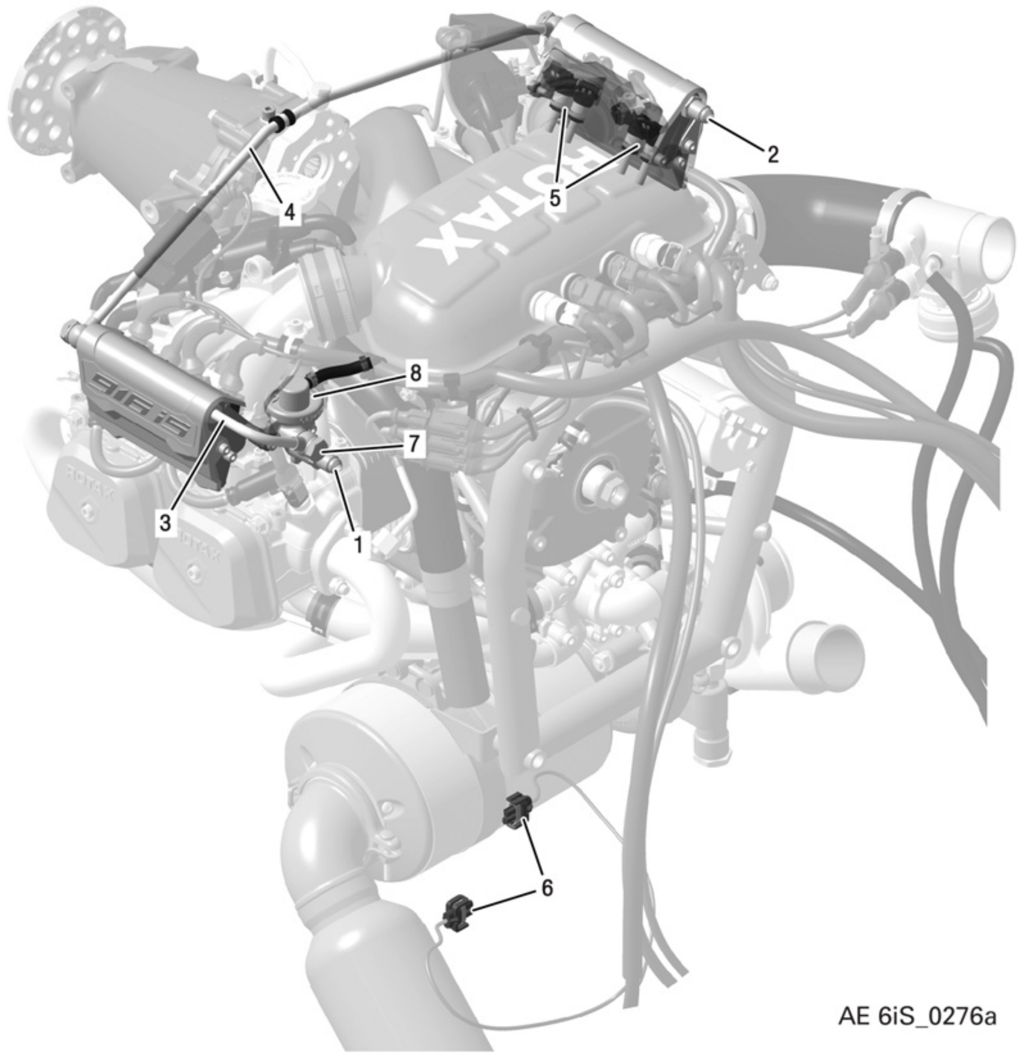

Figure 7.2: Fuel System: Interface overview and components

1	*Fuel rail 2/4 outlet line (hydraulic Interface)*	2	*Fuel rail 1/3 feed line (hydraulic Interface)*
3	*Fuel rail*	4	*Fuel line assy.*
5	*Injection valves*	6	*Fuel pump connectors (electrical interface)*
7	*Banjo bolt adapter (mechanical interface)*	8	*Fuel pressure regulator*

916 i TYPE C24

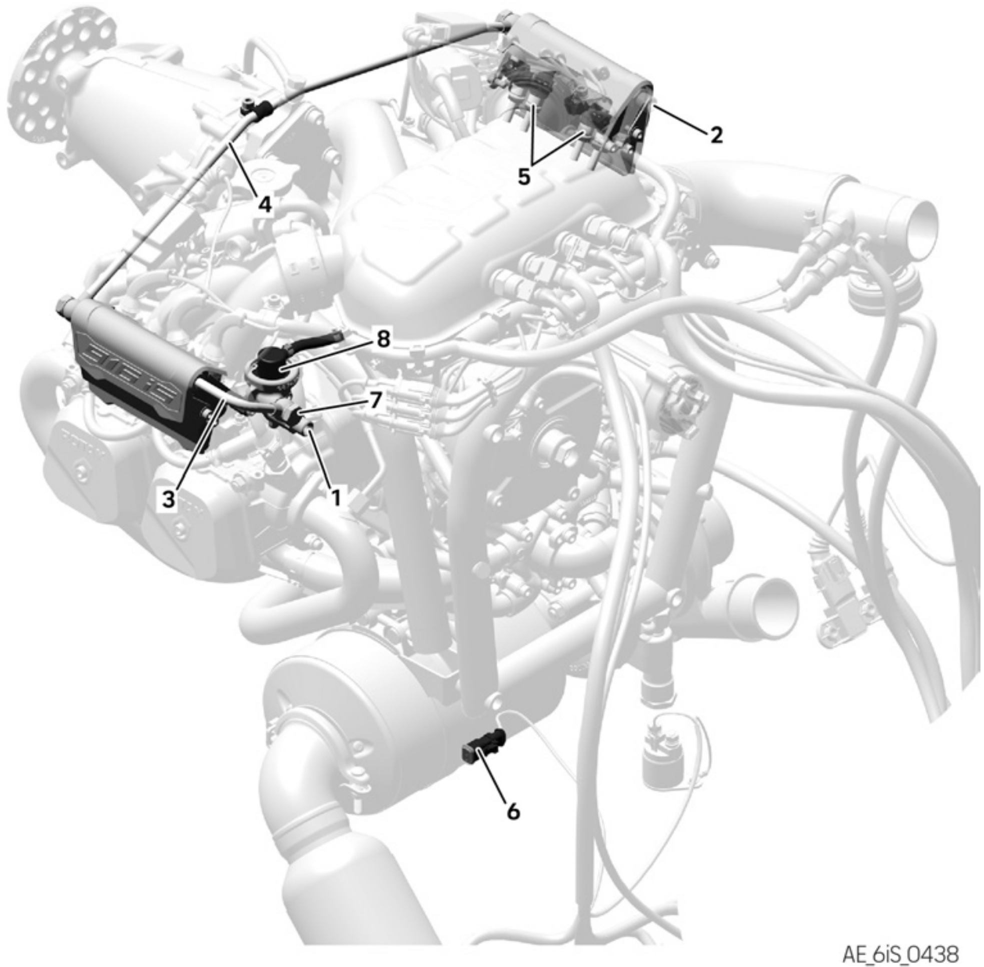

Figure 7.3: Fuel System: Interface overview and components

1	*Fuel rail 2/4 outlet line (hydraulic Interface)*	2	*Fuel rail 1/3 feed line (hydraulic Interface)*
3	*Fuel rail*	4	*Fuel line assy.*
5	*Injection valves*	6	*Fuel pump connectors (electrical interface)*
7	*Banjo bolt adapter (mechanical interface)*	8	*Fuel pressure regulator*

HYDRAULIC INTERFACES

NOTICE

Independent from the ambient conditions (e.g. fuel pressure and temperature) and independent from the used fuel the design of the fuel system must prevent from vapour lock conditions. Vapour lock may result in engine stoppage.

Fuel inlet

Interface Parameter	Min.	Max.
Fuel pressure (relative to MAP)	2.9 bar (42 psi)	3.2 bar (46 psi)
Acceptable Fuel pressure exceedance (max. 3 sec.)	2.5 bar (36 psi)	3.5 bar (51 psi)
NOTE *Fuel pressure exceedance only allowed after power setting change*		
Fuel pressure oscillation (min. sample rate 20 kHz)	-	1.0 bar (14.5 psi), peak-to-peak
Fuel flow	56 l/h (14.8 gal/h)	150 l/h (39.6 gal/h)
Fuel quality	EN 228	-

Fine filter quality

NOTE

Nominal rating 8 – 12 µm, minimum 82 % capture efficiency according to ISO 19438 (edition 11/2003), dirt particles > 35 µm are not permissible.

Connection: M14x1.5 or AN-6 (9/16-18 UNF).

Fuel outlet

Interface Parameter	Min.	Max.
Fuel pressure (relative to Fuel Tank pressure)	-	0.5 bar (7.3 psi)

Connection: M14x1.5 or AN-6 (9/16-18 UNF).

ELECTRICAL INTERFACES – 916 I TYPE A

Fuel pump connectors

Interface Parameter	Min.	Max.	Nominal
Output Voltage (V)	12 V	14.5 V	13.8 V
Output Current (A)	Fuel pump assy. (both pumps):		
	7 A	10.5 A	–
Output Current (A)	Single pump:		
	4.5 A	7.5 A	–

ELECTRICAL INTERFACES – 916 I TYPE C24

Fuel pump connectors

916 i TYPE C 24

Interface Parameter	Min.	Max.	Nominal
Output Voltage (V)	12 V	14.5 V	13.8 V
Output Current (A)	Fuel pump assy. (both pumps): @ 12 V = 9.1 A [+/- 2 A]		
	Single pump: @ 12 V = 5 A [+ 2.5 A / - 0.5 A]		

Cockpit Air-frame side

Connector	PIN	Function	Type
X4	A	14 V (for EMS, Battery Backup)	Output
	B	14 V GND (for EMS, Battery Backup)	Output
	C	14 V (for Fuel Pump 2 / Aux.)	Output
	D	14 V GND (for Fuel Pump 2 / Aux)	Output

MECHANICAL INTERFACES

Adapter for fuel pressure

Standard banjo bolt can be replaced by an optional Sensor adapter for connectivity directly on the fuel inlet of the fuel pressure regulator. See SI-PAC–024.

Interface Parameter	Min.	Max.
Tightening torque	23 Nm (17 ft. lb)	27 Nm (20 ft.lb)
Component mass (adapter with sensor)	-	80 g

Connection: M12 x 1.5

INSTALLATION NOTES

General

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The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

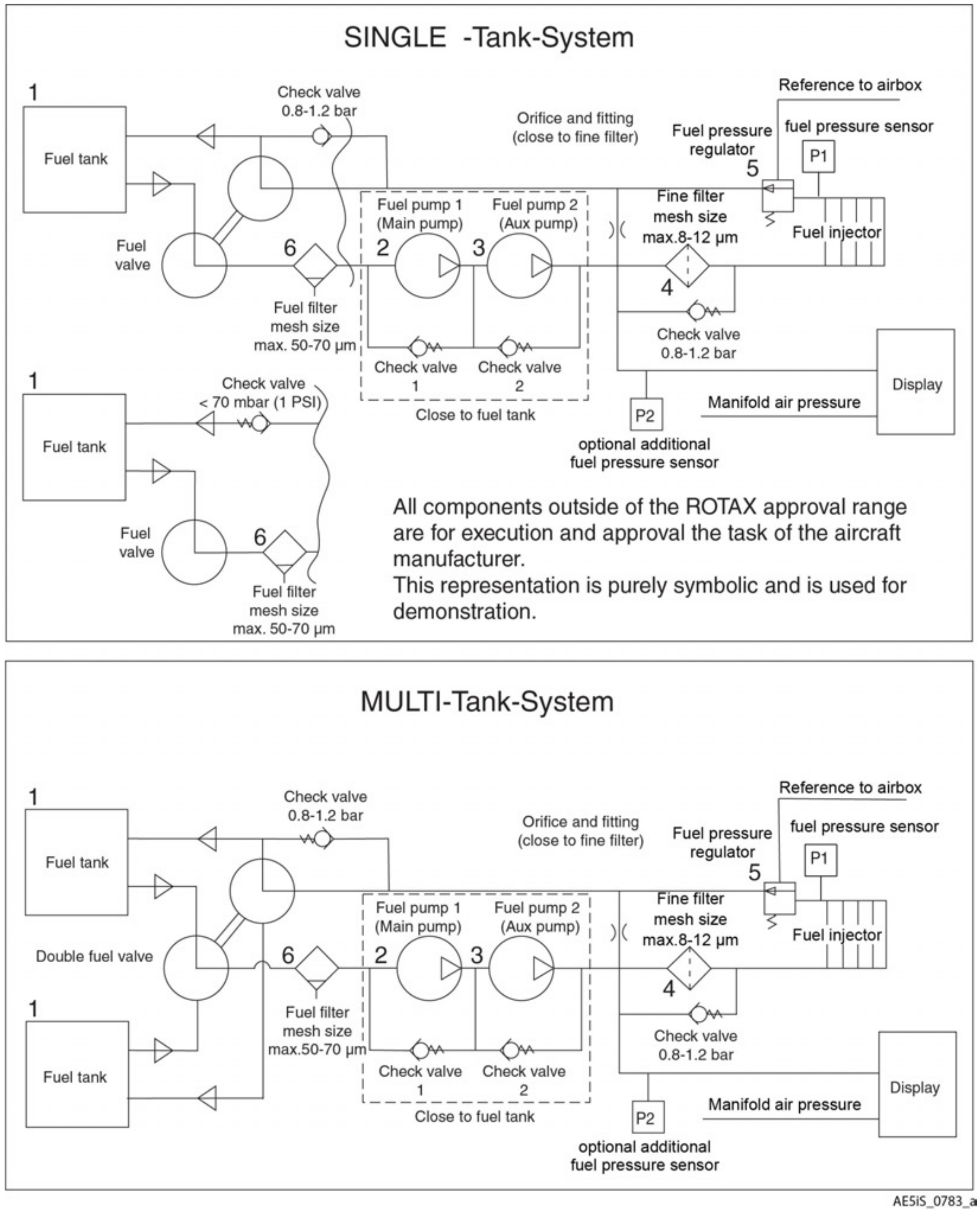

Figure 7.4: Fuel system

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

FUEL LINES

To prevent problems with vapour lock, all the fuel lines should be insulated against heat in the engine compartment. It is recommended to route the fuel lines in an appropriate distance from hot engine components and avoid sharp bends.
For a better heat dissipation it is recommended to use fuel lines made of metal whenever practicable (except for flex hoses to/ from engine).
Fuel lines should be installed by using suitable screw clamps or by ferrules.
Non drainable low points in feed, return and vent lines should be avoided. Any low points should allow for drainage of water and other contaminants.

⚠ WARNING

Non-compliance can result in serious injuries or death!
At the low points, accumulations of water can freeze and cut of the fuel flow.

INLET LINE

The inlet line should have an inner diameter of at least 7.5 mm (0.3 in). (AN-6 or 3/8’’).

NOTICE

Fuel lines smaller than this diameter may have a significant impact on the proper functionality of this engine.

RETURN LINE

The return line should have a inner diameter of at least 7.5 mm (0.3 in). (AN-6 or 3/8’’).

NOTICE

Fuel lines smaller than this diameter may have a significant impact on the proper functionality of this engine.

Vapour locks in the return line should be efficiently vented out of the fuel system to the atmosphere. Adequate fuel tank venting system design is imperative. Large vent lines with (most) direct routing avoiding low points are desired.

BYPASS LINE

To allow venting of the fuel system and better fuel pump engagement after a potential inclusion of air, there could be installed a restricted bypass line between the inlet (pressure side of the fuel pump module) and the return line. In this bypass line a restricted jet should be installed so that there is an ideal balance between short venting time and minimum fuel flow rate. The positioning and dimensioning of the jet is up to the aircraft manufacturer.
If no bypass line is installed, the pressure release in the fuel lines is very slow. This should be noted accordingly in the manuals of the aircraft manufacturer (fuel lines are possibly under full operating pressure even after engine stop).

NOTE

The switching between several fuel tanks at power loss due to fuel shortage should 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.

COARSE FILTER

The course filter should be installed at an easy accessible position to allow a periodic inspection.
Following fuel filter could be used to ensure that the engine is supplied with fuel of an adequate quality:

Interface Parameter	Min.	Max.
Filter mesh size	50 micron (0.0019 in.)	70 micron (0.0028 in.)
Filter surface (total)	64.4 cm² (10 in²)	-
Passing area	18.4 cm² (2.85 in²)	-

The filter should be installed in the supply line between the tank and the fuel pumps and should be of sufficient capacity to prevent complete blockage between maintenance intervals.

NOTICE

An installation without coarse filter may have an significant impact on the proper functionality of this engine.

WATER TRAP, GASCOLATOR

A suitable water trap must be installed. Certification according to the latest regulations, such as FAR or EASA, must be conducted by the aircraft or fuselage manufacturer.

FINE FILTER

The fine filter should be installed at an easy accessible position to allow a periodic inspection. To ensure that the engine is supplied with fuel of an adequate quality, a fine filter with following specifications should be installed between the fuel pumps (module) and the injection rail (Cylinder 1/3):

Interface Parameter	Min.	Max.
Filter mesh size	8 micron	12 micron
Fuel flow rate	90 l/h (23.8 gal/h)	-
Differential pressure		0.02 bar (0.29 psi)

NOTICE

An installation without fine filter may have a significant impact on the proper functionality of this engine.

FUEL PUMP

For reducing the risk of vapor lock, the fuel pump should be placed in a well–ventilated area. A recommended installation position would be near the fuel tank in order to ensure a safe fuel supply.

FUEL PRESSURE SENSOR

The operating limit of the fuel pressure should be observed at the inlet of the fuel pressure regulator.

An additional fuel pressure sensor could be placed before the fine filter, so the filter load can be checked. An increase of fuel pressure over the allowed limit could mean that the fine filter is becoming contaminated. The fine filter should be checked and replaced if necessary.

FUEL PRESSURE REGULATOR

Fuel pressure regulators have very precise tolerances and are generally reliable. Mostly pressure fluctuations are not caused by the pressure regulator, they might be found in other sections (filter clogged, pulsation of lines, kinks in the hoses etc.) of the fuel system.

FUEL TANK

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 vapour locks when using MOGAS (or auto fuel).
Following points may have a positive impact on the proper functionality of this engine:

- Single tank (large volume of fuel in the tank, just a few fuel lines)
- Catch tanks in the wing tanks. This provides the fuel supply in every flight situation/ position
- Header tank (the following reference values should be considered):

Interface Parameter	Specification
Venting line	The venting line from header tank to wring 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).
Feed lines	Fuel feed lines from the wing tanks to the header tank should be on a steady decline.

Following points may have a negative impact on the proper functionality of the engine:

- A header tank design that enables the re-entry of vapour locks in the suction line
- Multi tank system without catch-, header tank

FUEL SHUT OFF VALVE

The fuel shut off valve position on the pressure side of the fuel system (after the fuel pump module) can have an unfavorable impact on the installation of the engine.

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Chapter: 75–00–00
COOLING SYSTEM

TOPICS IN THIS CHAPTER

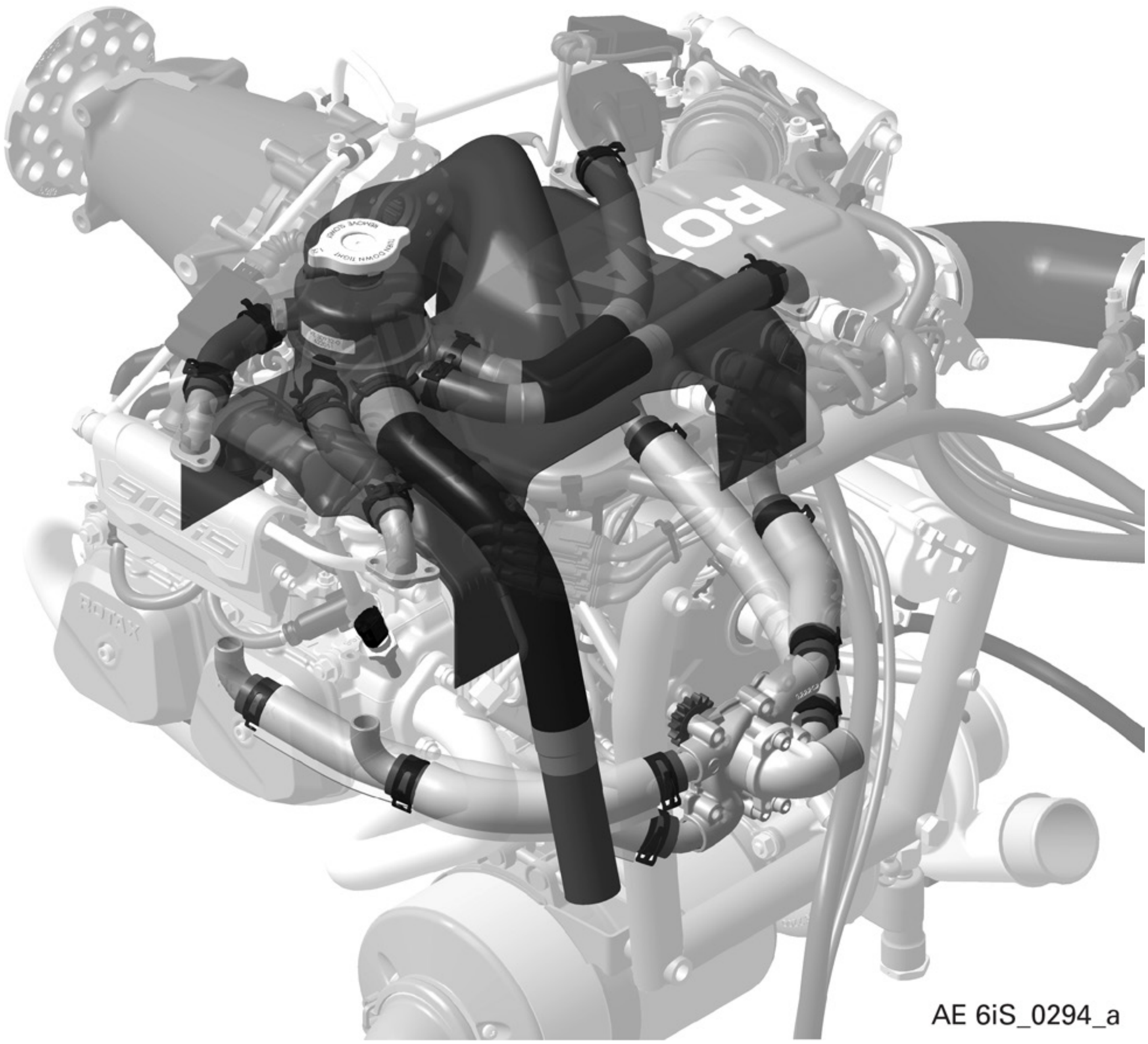

Figure 8.1: Cooling System

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits

Refer to latest issue of the Operators Manual (OM).

> ⚠ **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.

Coolant types

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 loss of coolant.
The boiling point of the coolant is mainly influenced by:

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

For permissible coolant types see SI-916i-001, latest issue.

System pressure

System Limit	Min.	Max.
Coolant system pressure	–	1.2 bar (18 psi)

Hose connecting expansion tank to overflow bottle

System Limit	Min.	Max.
Able to withstand heat and vacuum without collapsing-able	125 °C (257 °F)	–

A soft walled hose is not suitable as it can collapse and cause cooling system failure.

Expansion tank

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.

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

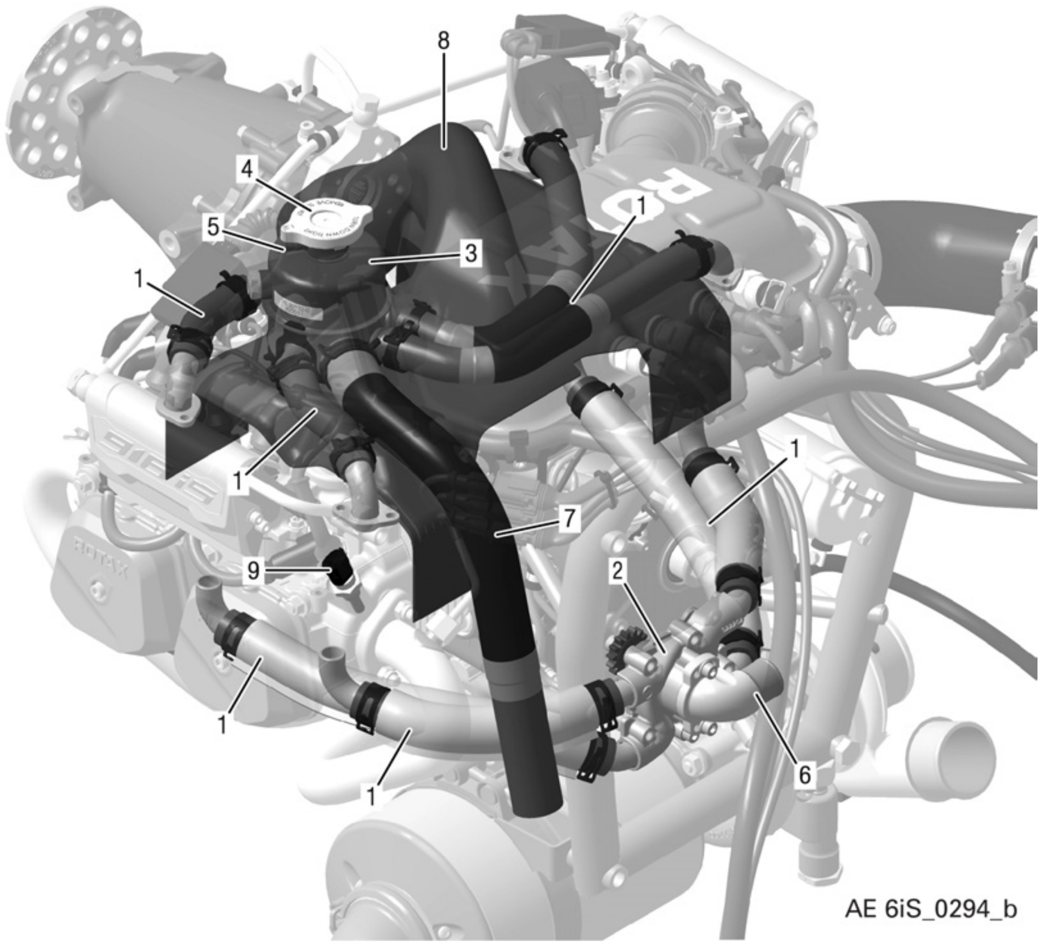

Figure 8.2: Cooling System – Interfaces

1	*Coolant hose*	2	*Water pump housing*
3	*Expansion tank assy.*	4	*Radiator cap*
5	*Expansion tank connection (hydraulic Interface)*	6	*Water inlet elbow (hydraulic Interface)*
7	*Water outlet (hydraulic Interface)*	8	*Coolant Temperature Sensor (CTS)*
9	*Cooling air baffle*		

HYDRAULIC INTERFACES

Water inlet elbow

Interface Parameter	Min.	Max.
Cooling system pressure (relative)	1.6 bar (232 psi)	-
Cooling water temperature	- 20 °C (- 4 °F)	125 °C (257 °F)
Cooling water flow (at 5800 rpm)	70 l/h (18.49 USgal/ min)	-
Slip on length	19 mm (0.75 in)	

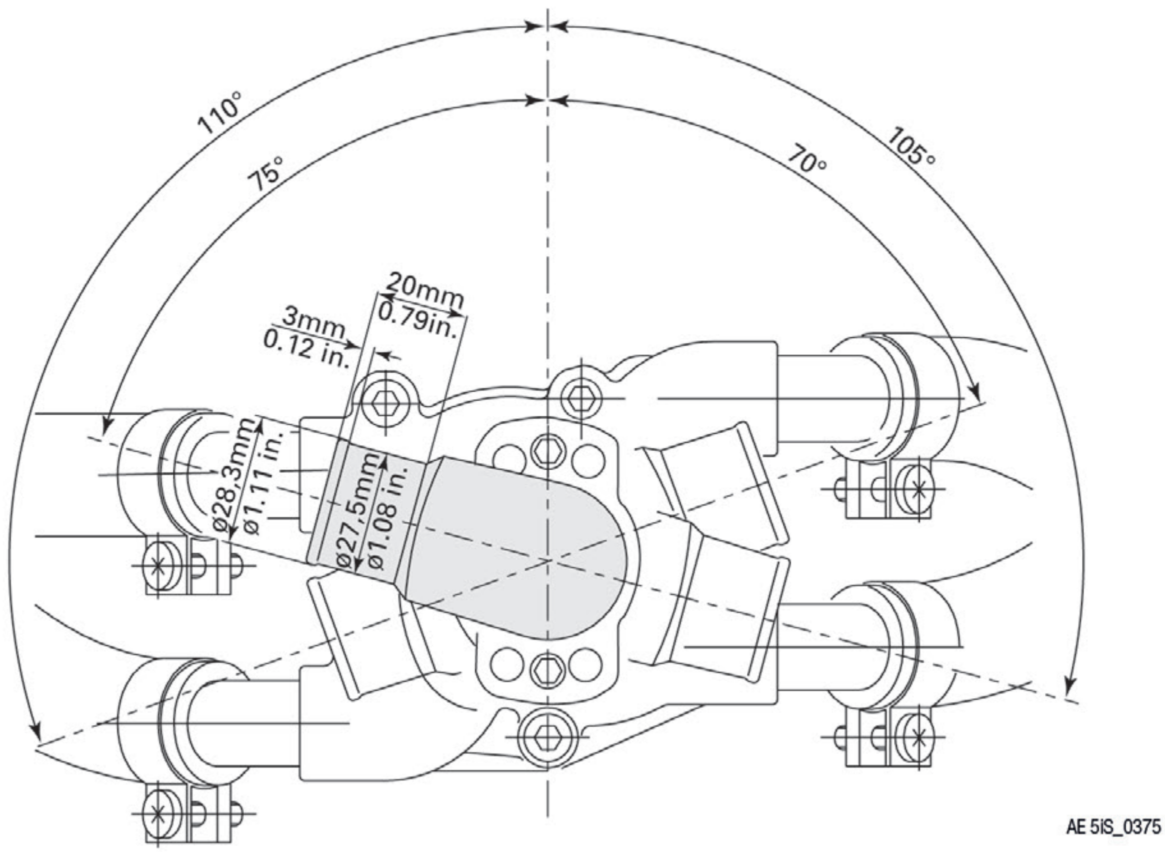

Figure 8.3: Water inlet elbow

Connection: Outer diameter 27 mm (1.07 in).

Water outlet

Interface Parameter	Min.	Max.
Cooling system pressure (relative)	1.6 bar (232 psi)	-
Cooling water temperature	- 20 °C (- 4 °F)	130 °C (266 °F)
Cooling water flow (at 5800 rpm)	70 l/h (18.49 USgal/ min)	-

Connection: Inner diameter 25 mm (0.98 in).

Expansion tank connection

Interface Parameter	Min.	Max.
Slip on length	18 mm (0.71 in.)	

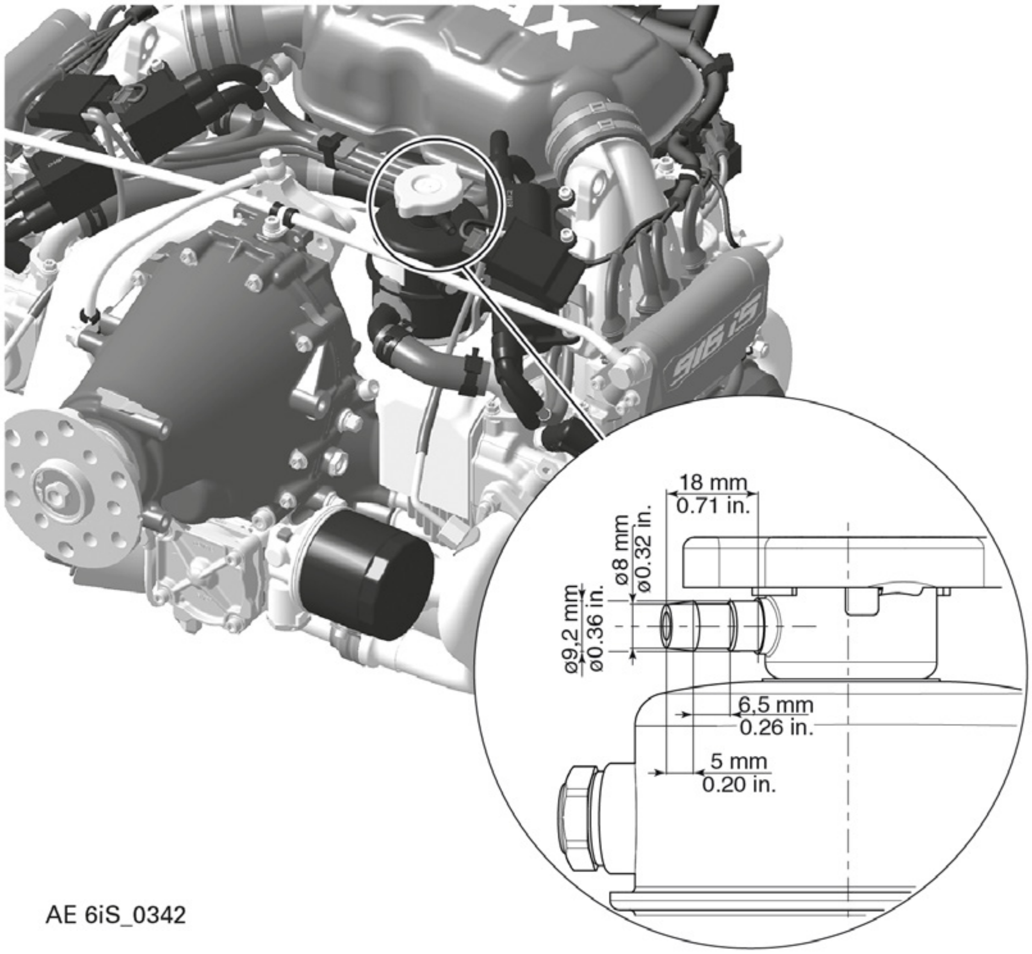

Figure 8.4: Expansion tank connection

AIR COOLING INTERFACES

Cooling air baffle

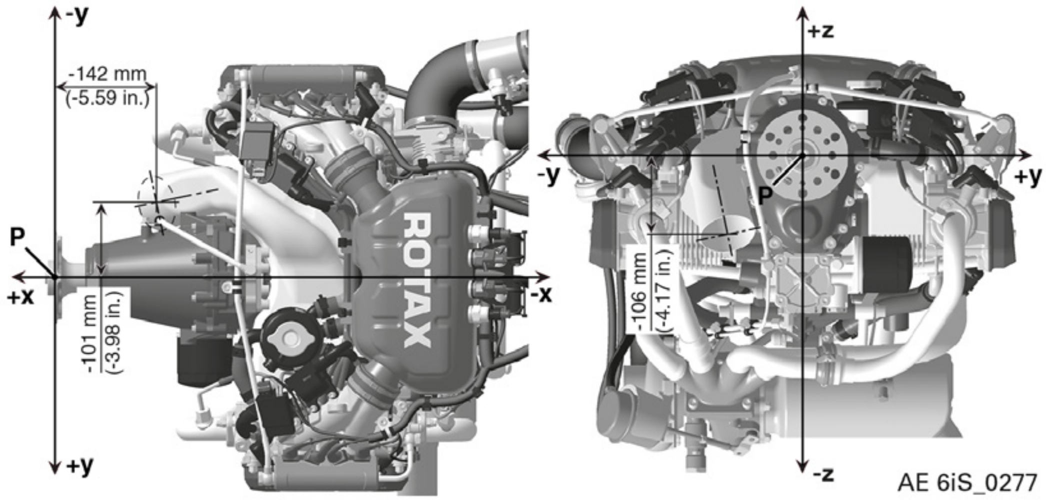

Figure 8.5: Cooling air baffle position, TYPICAL

Position	x-axis	y-axis	z-axis
P1	- 142 mm (- 5.59 in.)	- 101 mm (- 3.98 in.)	- 106 mm (- 4.17 in.)

General information

NOTE

In some special cases a separate cold air supply to the air baffle should be provided.

Cylinder wall temperature

Max. permitted cylinder wall temperature on hottest cylinder is 200 °C (392 °F). See the following figure. The cylinder wall temperature can be measured using a thermocouple.

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.

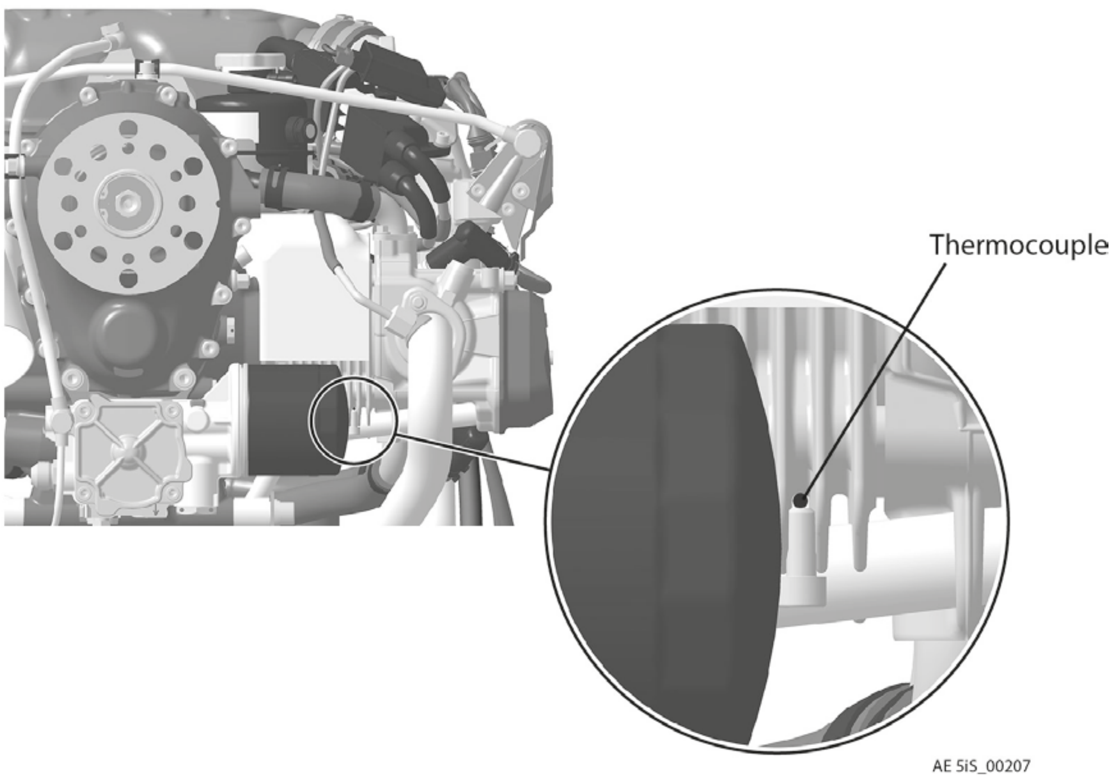

Figure 8.6: Measuring point TYPICAL

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

Specification	Description
Cooling capacity	The cooling air baffle 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 baffle	Cross section of the air baffle min. 100 cm² (15.50 in²).
Material	Glass fibre reinforced plastic or heat and fire resistant material.
Attachment options	Formlocking on engine block and mounting above the cylinder and the crankcase.

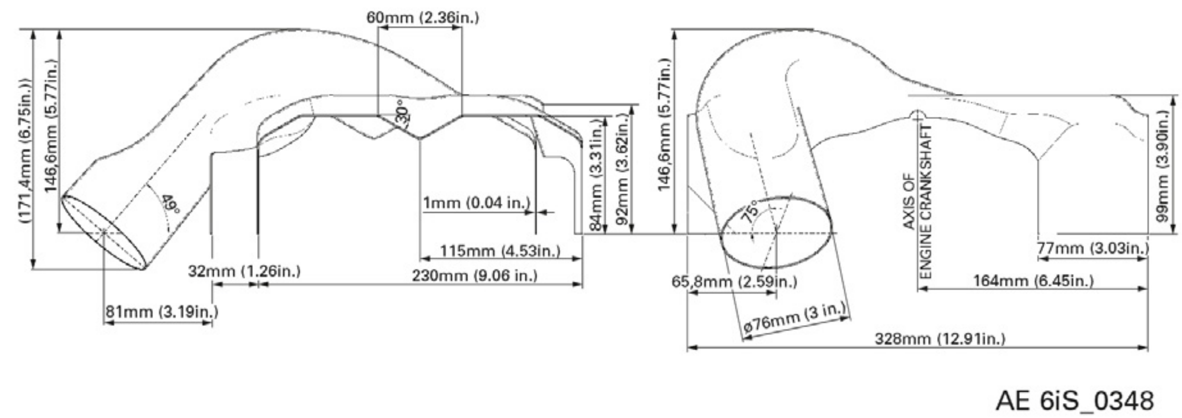

Figure 8.7: Dimensions of cooling air baffle

INSTALLATION NOTES

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INSTALLATION OVERVIEW

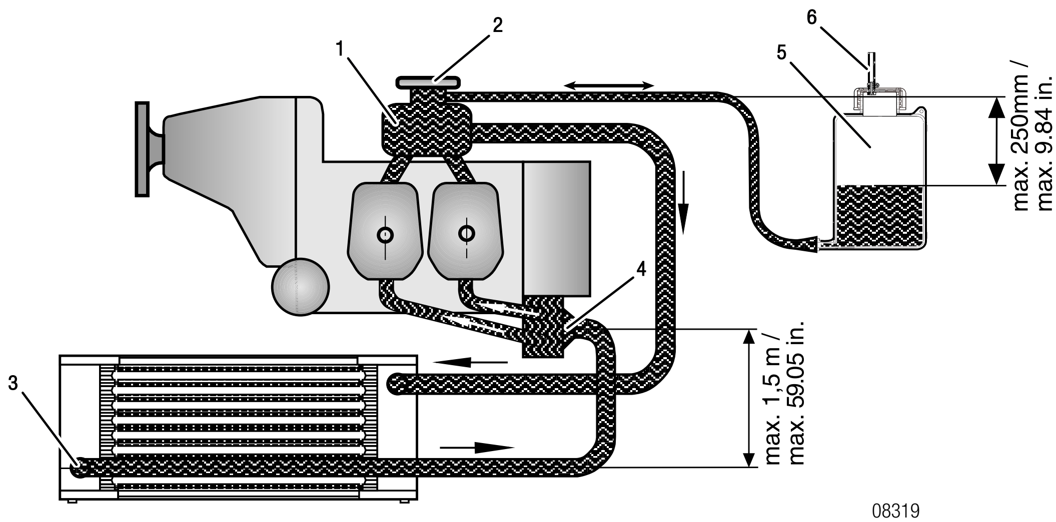

Figure 8.8: Cooling system schematic

1	*Expansion tank*	2	*Pressure cap*
3	*Radiator*	4	*Water pump*
5	*Overflow bottle*	6	*Vent*

Radiator

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

In order to support the deployment of the radiator's full capacity, the radiator should be connected with the upper connection to the suction side in direction to the water pump. Otherwise, air bubbles may accumulate, resulting in reduced cooling capacity (see setup depicted in Cooling system schematic).

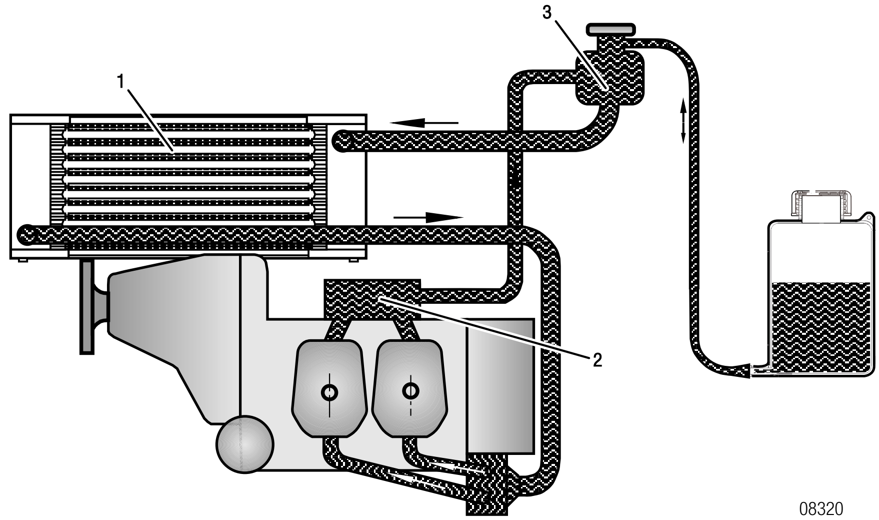

Figure 8.9: Radiator

1 Radiator	*2 Water distributor*
3 Expansion tank	

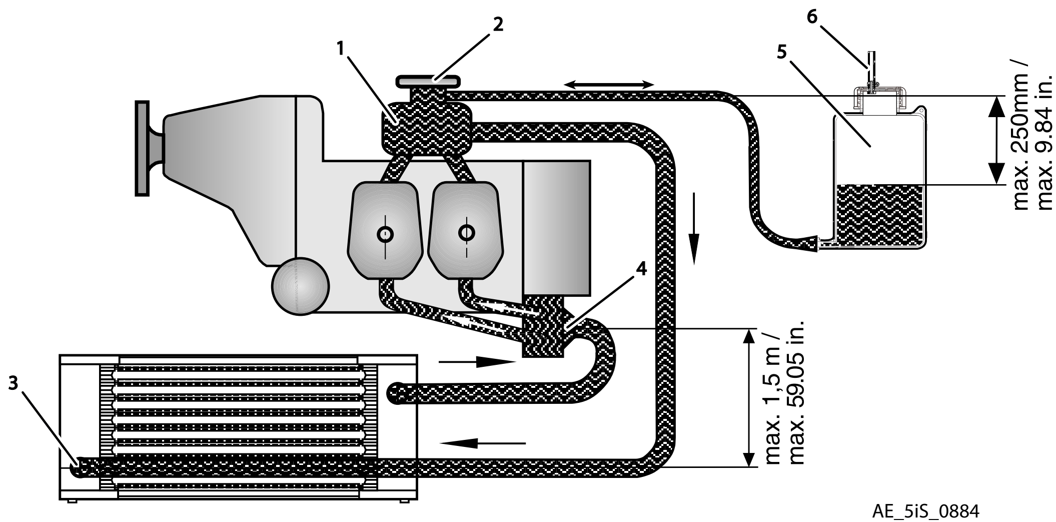

Figure 8.10: Cooling system schematic

1 Expansion tank	*2 Pressure cap*
3 Radiator	*4 Water pump*
5 Overflow bottle	*6 Vent*

WATER INLET ELBOW

NOTICE

The hoses should be fixed with appropriate clips to prevent loss e.g. with spring type hose clips, such as those used for the coolant hoses between the water pump and cylinder.

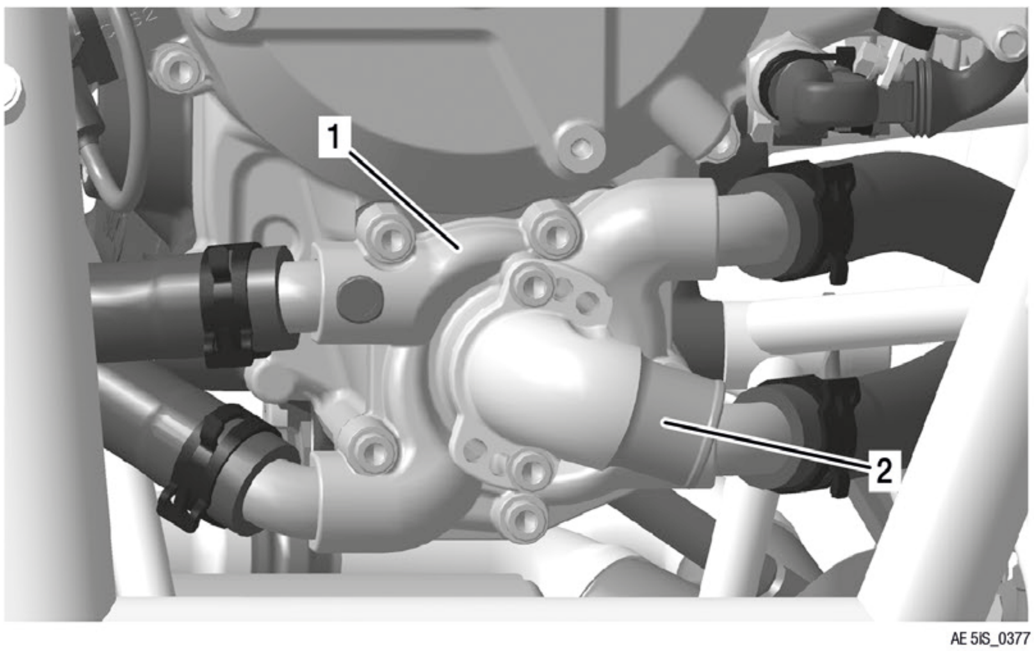

Figure 8.11: Water inlet elbow

1 Water pump housing *2 Water inlet elbow*

Use two M6x20 Allen screws lock washers to attach the water inlet elbow. Tighten screws to 10 Nm (89 in lb.)

NOTICE

The total slip-on length of the water inlet elbow and expansion tank should be used.

EXPANSION TANK

The aircraft manufacturer should give the possibility to the pilots to check the coolant level in the expansion tank. It is also necessary to inform the pilots about the daily inspection of the coolant level in the aircraft manufacturers Operators Manual (OM).
To allow this inspection, e.g. a flap or panel on the cowling or a warning instrument in the cockpit for low coolant level should be installed.

COOLANT HOSES

NOTE

For proper operation short hoses should be used.

Aluminium tubes with an inner diameter of 25 mm (0.98 in) can be used instead of longer hoses. These should have a bulge (1) in order to prevent coolant hoses working loose. Note as well that this will double the number of hose clips required.
The material of the hoses must be resistant against glycol, coolant and ozone.

Interface Parameter	Min.	Max.
Temperature resistance	125 °C (257 °F)	
Pressure durability	5 bar (72 psi)	
Inner diameter	25 mm (1”)	
Bending radius	175 mm (6.89 in)	

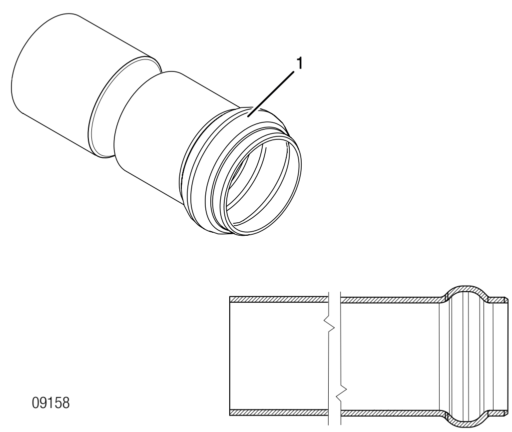

Figure 8.12: Aluminium tube

Hoses Hoses exposed to direct heat radiation from exhaust system must be suitably protected with e.g. heat resistant protection tubes.
The hose between the overflow bottle and the expansion tank should be as short as possible.

COOLANT

NOTICE

Use only coolant as recommended in the current Operators Manual (OM) and SI-916 i-001 “Selection of suitable operation fluids“, 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.

Coolant temperature

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

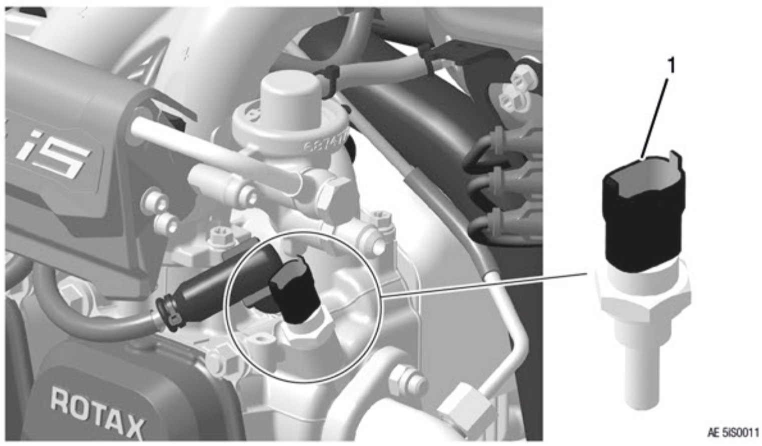

Figure 8.13: Coolant Temperature Sensor (CTS), TYPICAL

1 *Coolant temperature sensor*

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

NOTICE
It is possible to record a false measurement when measuring fluid temperatures. If fluid volume is lost and 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.

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 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 stressfree installation and proper sealing.

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Chapter: 76–00–00
ENGINE CONTROLS

TOPICS IN THIS CHAPTER

916 i TYPE A

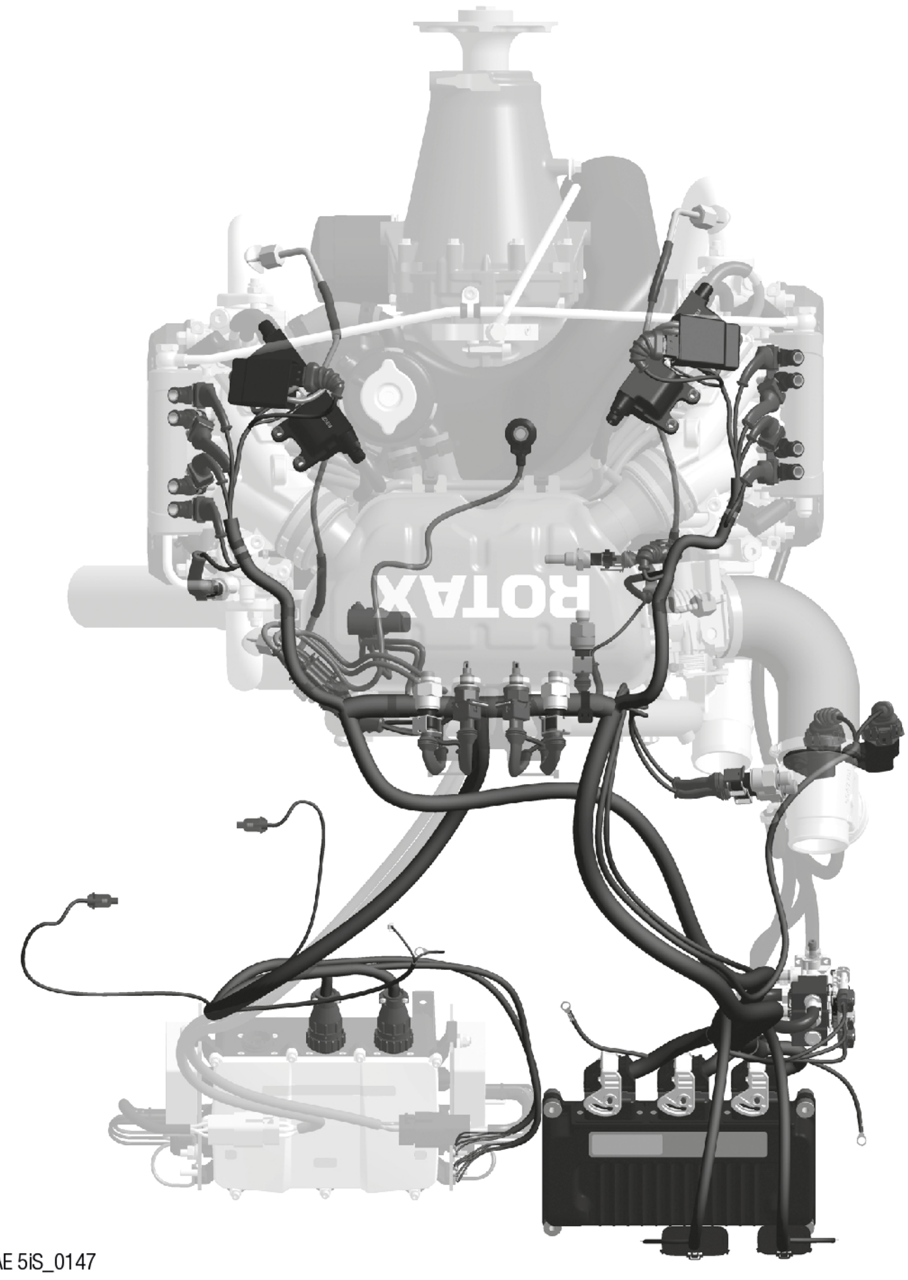

Figure 9.1: Engine management system (EMS), TYPICAL

916 i TYPE C24

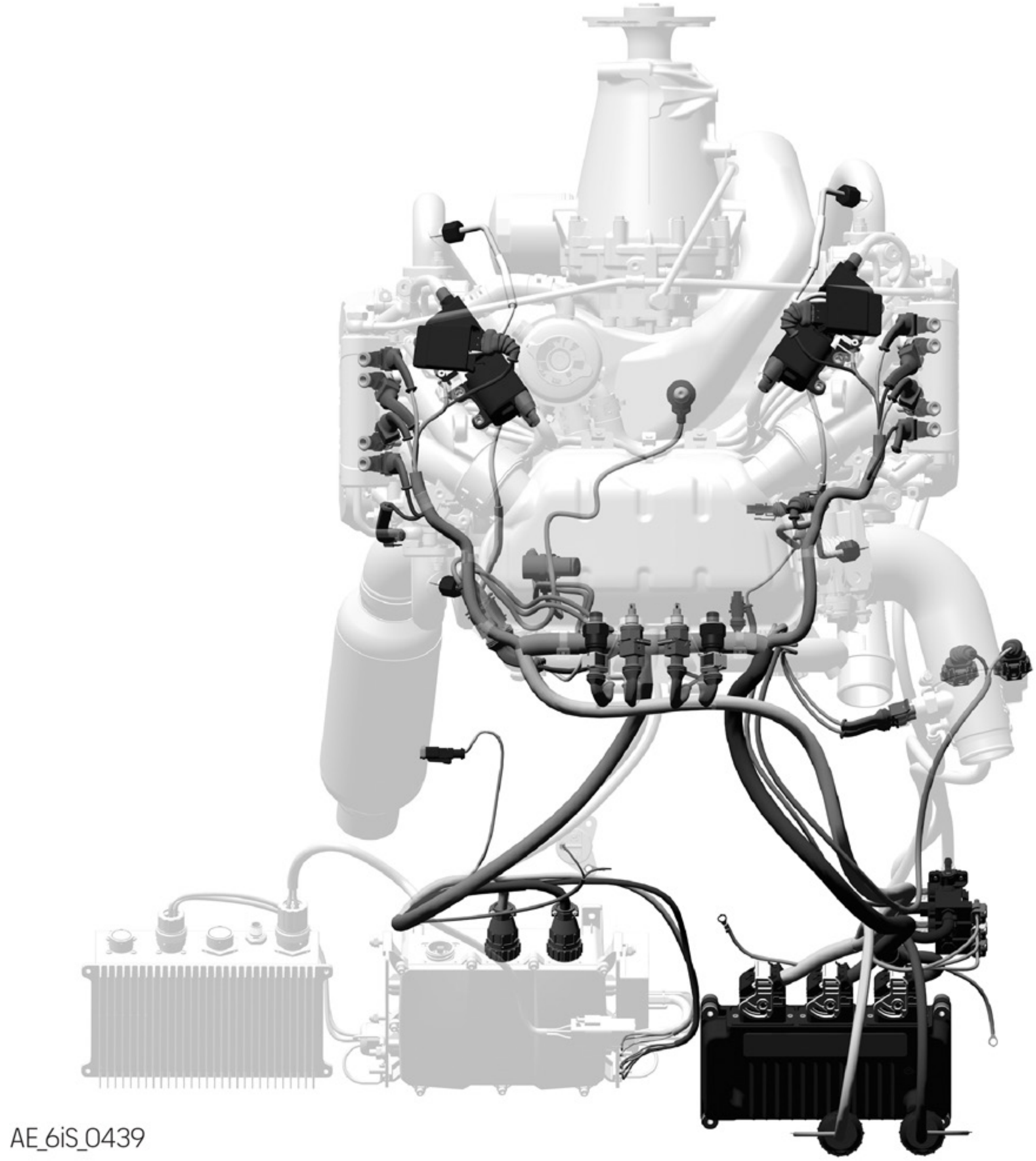

Figure 9.2: Engine management system (EMS), TYPICAL

SPECIAL TOOLS

Description	Part number
Crimping pliers MOLEX 64016-0035/63811-4400	n.a.
Disassembly tool MOLEX 63813-1500	n.a.
Crimp tool ROTAX® ACDC 28 V X1/X2 and 14 V X1 - SKU: 10–306[3]	n.a.
Crimp tool ROTAX® ACDC 28 V X3/X4 - SKU: 10–309[3]	n.a.
Crimp tool ROTAX® ACDC 28 V X5 and 14 V X3 - SKU: 10–311[3]	n.a.

3. can be ordered under www.rs-flightsystems.com

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

Valid installation positions The ECU may be installed either in the engine compartment or in the cockpit. To prevent the ingress of liquids (moisture), the ECU must be mounted in a way that the plugs are facing downward.

The two Ambient Air Pressure and Temperature Sensors (AAPTS) are all-in-one sensors for engine ambient temperature and engine ambient pressure. In cowled engine installations they have to be mounted in the engine compartment in a ram air free area and close to the air inlet. The sensors must measure the correct air inlet temperature and the air pressure right before the air filter. The AAPTS sensors must not be mounted in the air intake system between the air filter and turbocharger inlet. The AAPTS must be mounted isolated from vibrations (e.g. caused by the engine).
The casing of the ECU must not be connected to the airframe ground. 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..

Component temperatures limitation Limitation see Chapter 00-00-00 Approval of electric and electronic components.

Connections When connecting the wiring harness with the ECU take into account the labeling on the wiring harness and the ECU. Although the connectors are mechanically coded (i.e. wiring harness connector A1 can only be connected to ECU A1 socket), excessive force or incorrect positioning can result in bent pins and the ECU would then need to be replaced. Unplug the ECU connector from the wiring harness only if absolutely necessary. Connector plugs (ECU) are suitable for up to 20 plug-in operations. The number of plugging operations must be entered into the logbook. If this limit has been exceeded the ECU needs to be replaced.

Wiring harness In no case the wiring harness must be shortened or modified. Do not bend, kink, pinch or otherwise improperly stress the wiring harness. The bending radius of the wiring harness must not be less than 50 mm (1.97 in). To avoid excessive tension on the ECU connectors, a strain relief must be installed in a distance of ~ 100 mm (3.94 in) from the ECU.

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

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

916 i TYPE A

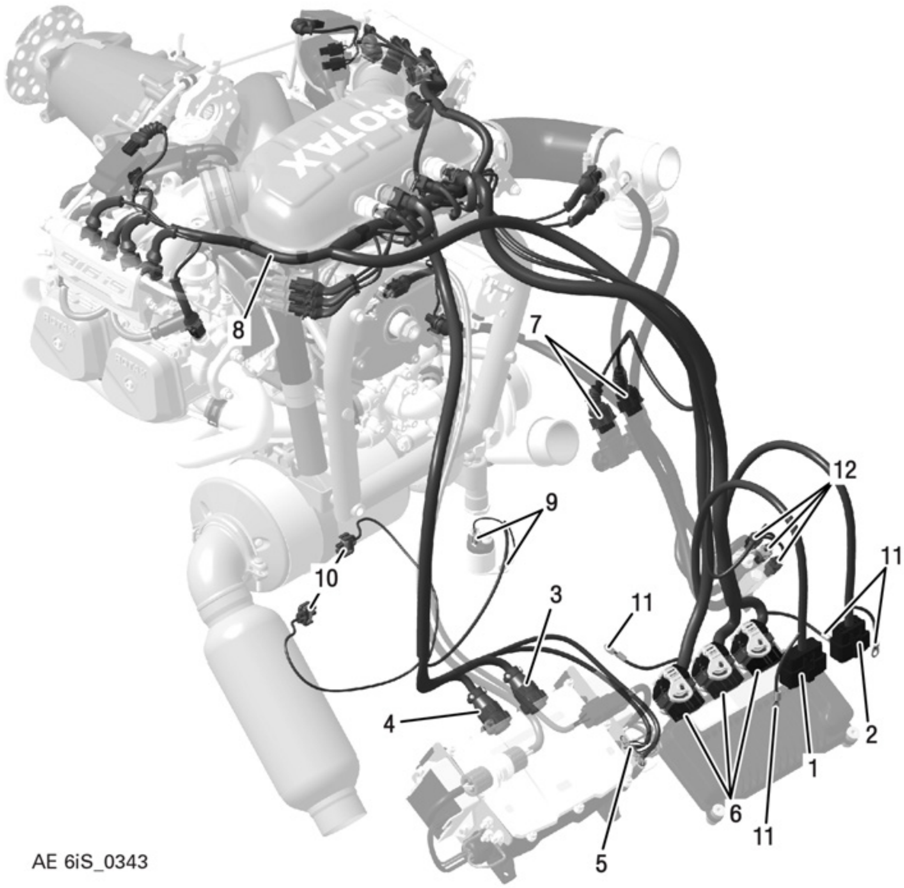

Figure 9.3: Engine Management System (EMS) – Interfaces

1	*Harness Interface Connector A (HIC A) (electrical interface)*	2	*Harness Interface Connector B (HIC B) (electrical interface)*
3	*X1 Connector (electrical interface)*	4	*X2 Connector (electrical interface)*
5	*Regulator A (electrical interface)*	6	*ECU (electrical, mechanical interface)*
7	*AAPTS (electrical, mechanical interface)*	8	*Wiring harness*
9	*Starter relay connectors (electrical interface)*	10	*Fuel pump connectors (electrical interface)*
11	*Wiring harness grounding*	12	*PCV Connector*

ELECTRICAL INTERFACES

Harness interface connector A

The HIC A connector allows powering ECU Lane A and Fuel Pump A. interfaces to Indication elements are described in Chapter 77-00-00.

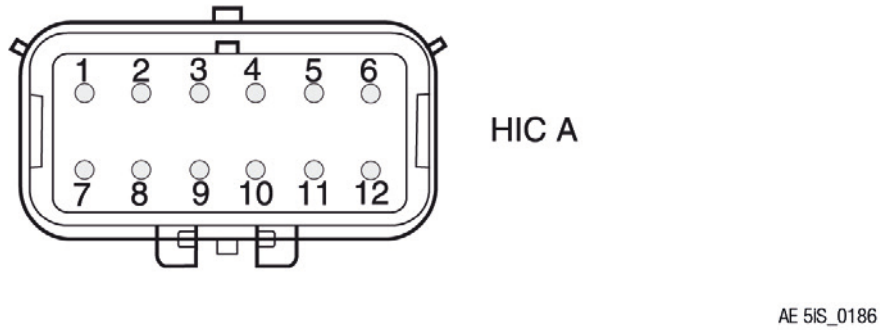

Figure 9.4: HIC A Connector

In case the EMS is powered by an external power source or by one of the internal generators:

- A connection between Terminal 1 and Terminal 7 will power ECU Lane A
- A connection between Terminal 3 and Terminal 9 will power Fuel pump 1

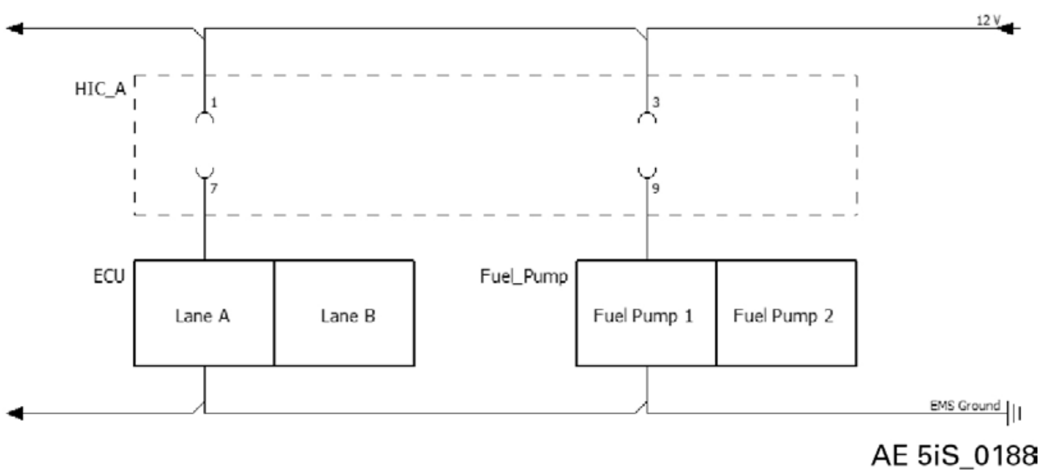

Figure 9.5: HIC A connector –Engine controls

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nomi-nal
1	LANE_SEL_SW_A_1	7	LANE_SEL_SW_A_2	Nominal Voltage			12 V
				Nominal Current		7.5 A	
3	SIG_FUEL_PUMP_1	9	GND_FUEL_PUMP_1	Nominal Voltage			12 V
				Nominal Current		10 A	

Harness Interface Connector B

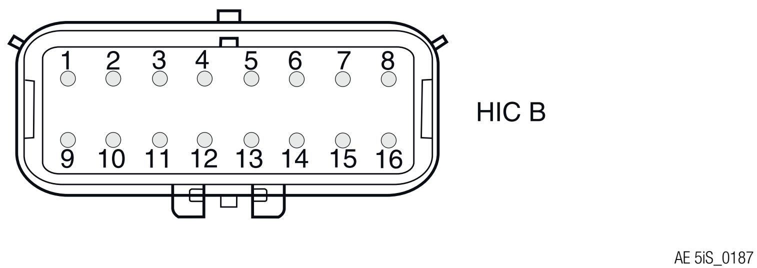

Figure 9.6: HIC B connector

In case the EMS is powered by an external power source or by one of the internal generators:

- A connection between Terminal 1 and Terminal 9 will power ECU Lane B
- A connection between Terminal 3 and Terminal 11 will power Fuel Pump 2
- A connection between Terminal 4 and Terminal 12 will actuate the Starter Relay

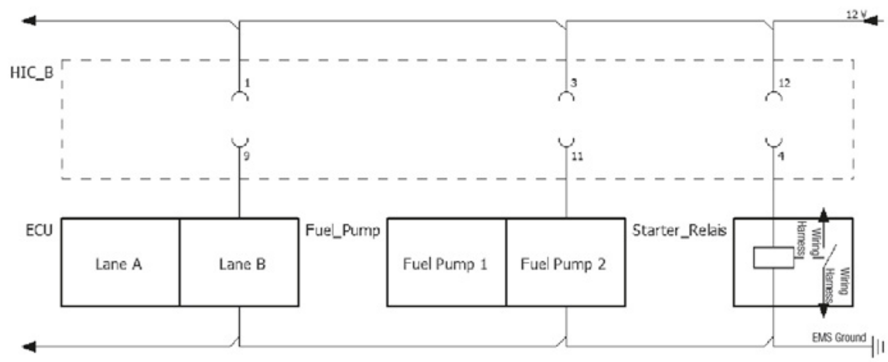

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Figure 9.7: HIC B Connector – Engine controls

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nom-inal
1	LANE_SEL_SW_B_1	9	LANE_SEL_SW_B_2	Nominal Voltage			12 V
				Nominal Current		7.5 A	
3	SIG_FUEL_PUMP_2	11	GND_FUEL_PUMP_2	Nominal Voltage			12 V
				Nominal Current		10 A	
12	SUPP_START_SWITCH	4	CONN_START-ER_REL_SW	Nominal Voltage			12 V
				Nominal Current		5 A	

The HIC B connector allows powering ECU Lane B. Interfaces to indication elements are described in Chapter 77-00-00.

X1, X2 Connector See Chapter 24-00-00 section Interface Description.

Regulator A See Chapter 24-00-00 section 24–00–00 section Interface Description.

Starter Relay See Chapter 80-00-00 section Interface Description

Wiring harness grounding The grounding cable must be attached to Fusebox Regulator A. See Chapter 24-00-00 section Fusebox Regulator A

Fuel pump See Chapter 73–00–00 section Interface Description

INTERFACE OVERVIEW — 916 I TYPE C24

916 i TYPE C24

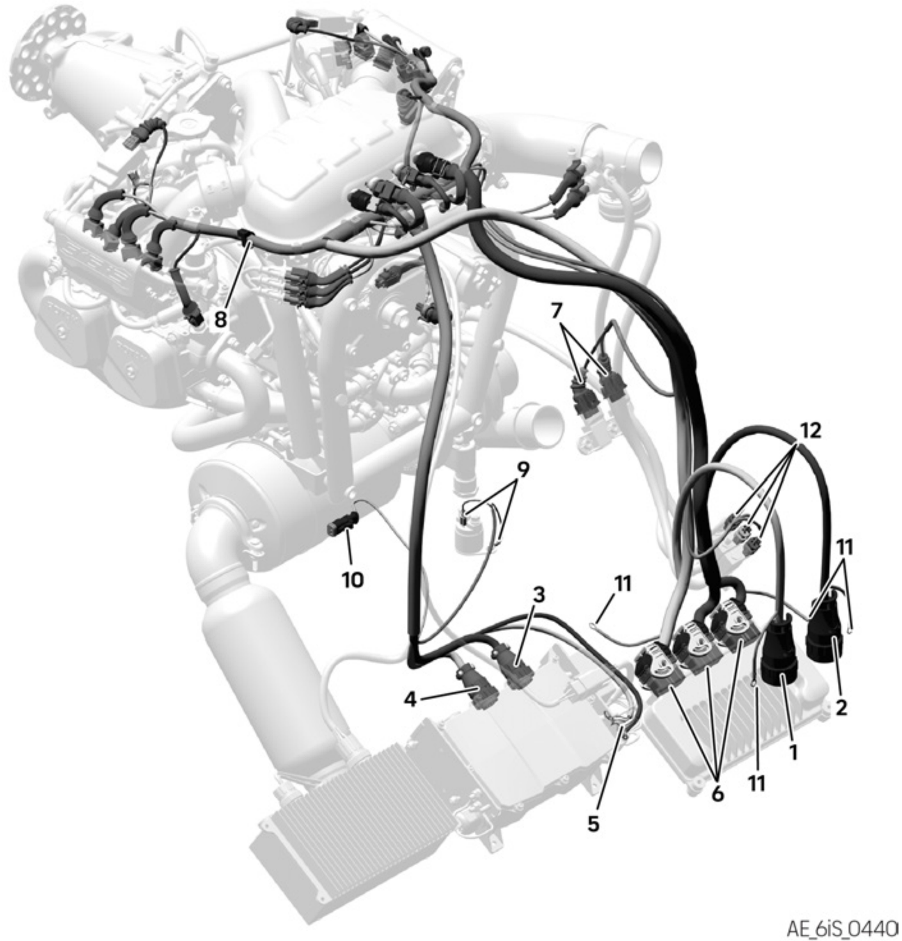

Figure 9.8: Engine Management System (EMS)– Interfaces

1	*Harness Interface Connector A (HIC A) (electrical Interface)*	2	*Harness Interface Connector B (HIC B) (electrical Interface)*
3	*X1 Connector (electrical Interface)*	4	*X2 Connector (electrical Interface)*
5	*Regulator A (electrical Interface)*	6	*ECU (electrical, mechanical Interface)*
7	*AAPTS (electrical, mechanical Interface)*	8	*Wiring harness*
9	*Starter relay connectors (electrical Interface)*	10	*Fuel pump connectors (electrical Interfaces)*
11	*Ring terminal Ground cables*	12	*PCV Connector*

ELECTRICAL INTERFACES – 916 I TYPE C24

Harness interface connector A

916 i TYPE C24

The HIC A connector allows powering ECU Lane A and Fuel Pump A. interfaces to Indication elements are described in Chapter 77-00-00.

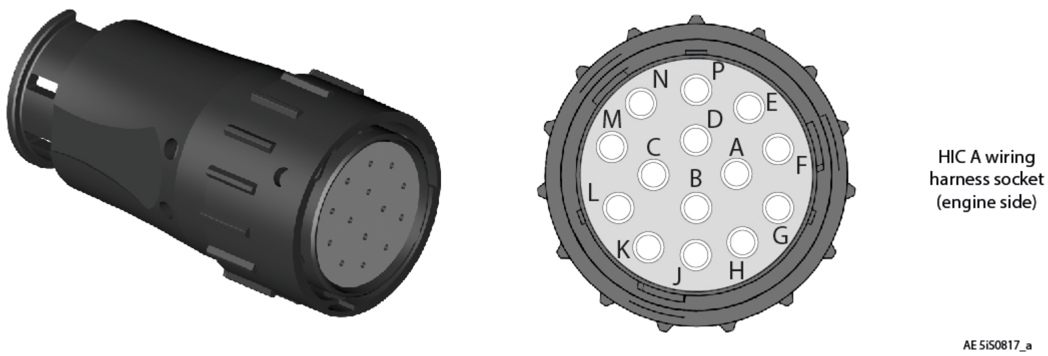

Figure 9.9: HIC A Connector

In case the EMS is powered by an external power source or by one of the internal generators:

- A connection between Terminal N and Terminal P will power ECU Lane A

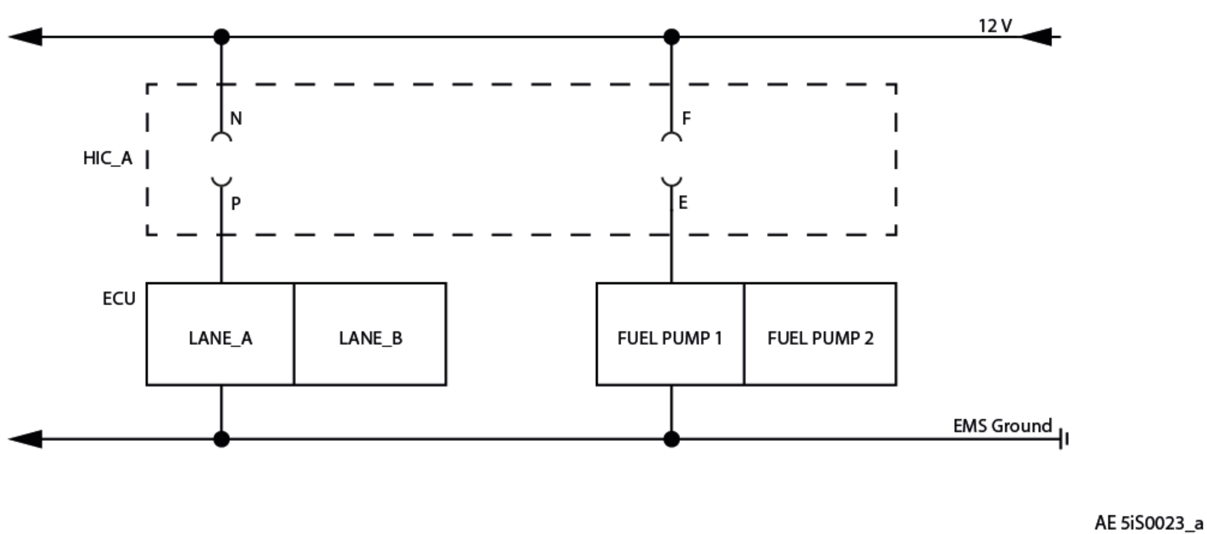

Figure 9.10: HIC A connector –Engine controls

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nomi-nal
N	LANE_SEL_SW_A_1	P	LANE_SEL_SW_A_2	Nominal Voltage			12 V
				Nominal Current		7.5 A	
F	SIG_FUEL_PUMP_1	E	GND_FUEL_PUMP_1	Nominal Voltage			12 V
				Nominal Current		10 A	

Harness Interface Connector B

916 i TYPE C24

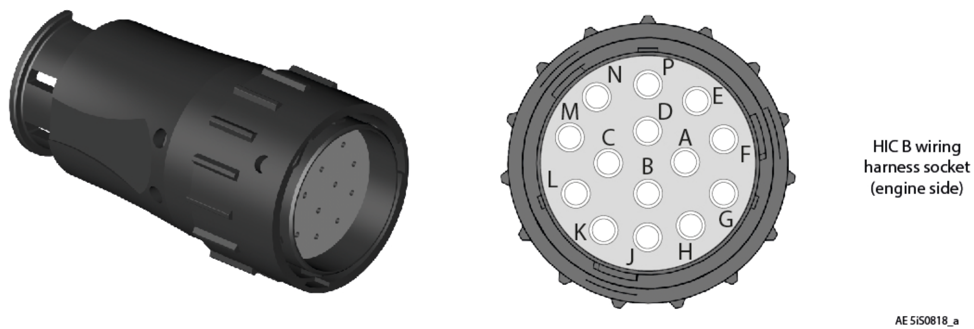

Figure 9.11: HIC B connector

In case the EMS is powered by an external power source or by one of the internal generators:

- A connection between Terminal N and Terminal P will power ECU Lane B

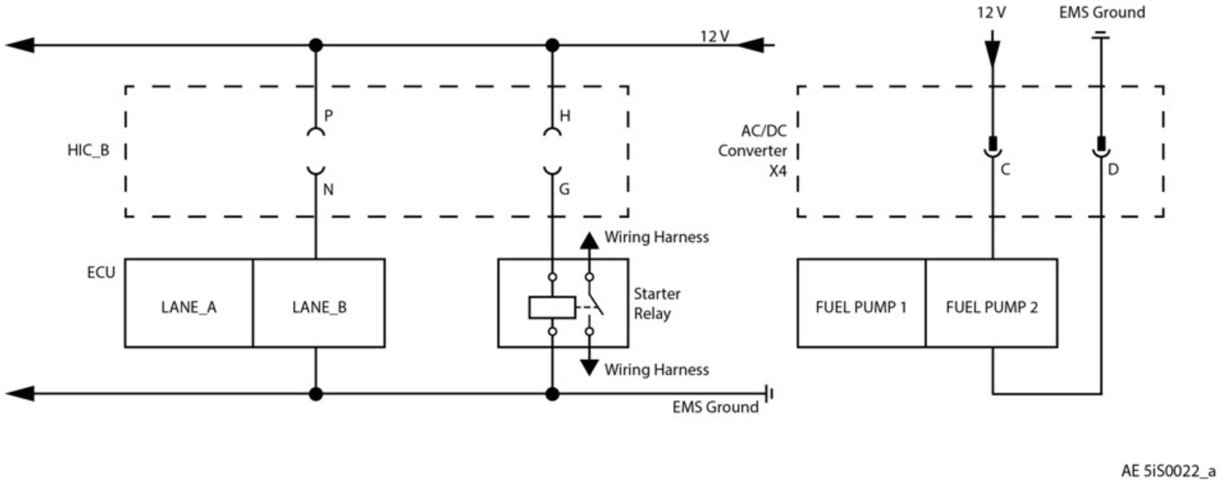

Figure 9.12: HIC B Connector – Engine controls

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nom-inal
P	LANE_SEL_SW_B_1	N	LANE_SEL_SW_B_2	Nominal Voltage			12 V
				Nominal Current		7.5 A	
F	SUPP_START_SWITCH	E	CONN_START-ER_REL_SW	Nominal Voltage			12 V
				Nominal Current		5 A	
C	SIG_FUEL_PUMP_2	D	GND_FUEL_PUMP_2	Nominal Voltage			12 V
				Nominal Current		10 A	

The HIC B connector allows powering ECU Lane B. Interfaces to indication elements are described in Chapter 77-00-00.

X1, X2 Connector See Chapter 24-00-00 section Interface Description.

Regulator A See Chapter 24-00-00 section 24–00–00 section Interface Description.

Wiring harness grounding The grounding cable must be attached to Fusebox Regulator A. See Chapter 24-00-00 section Fusebox Regulator A

MECHANICAL INTERFACES

Engine Control Unit (ECU)

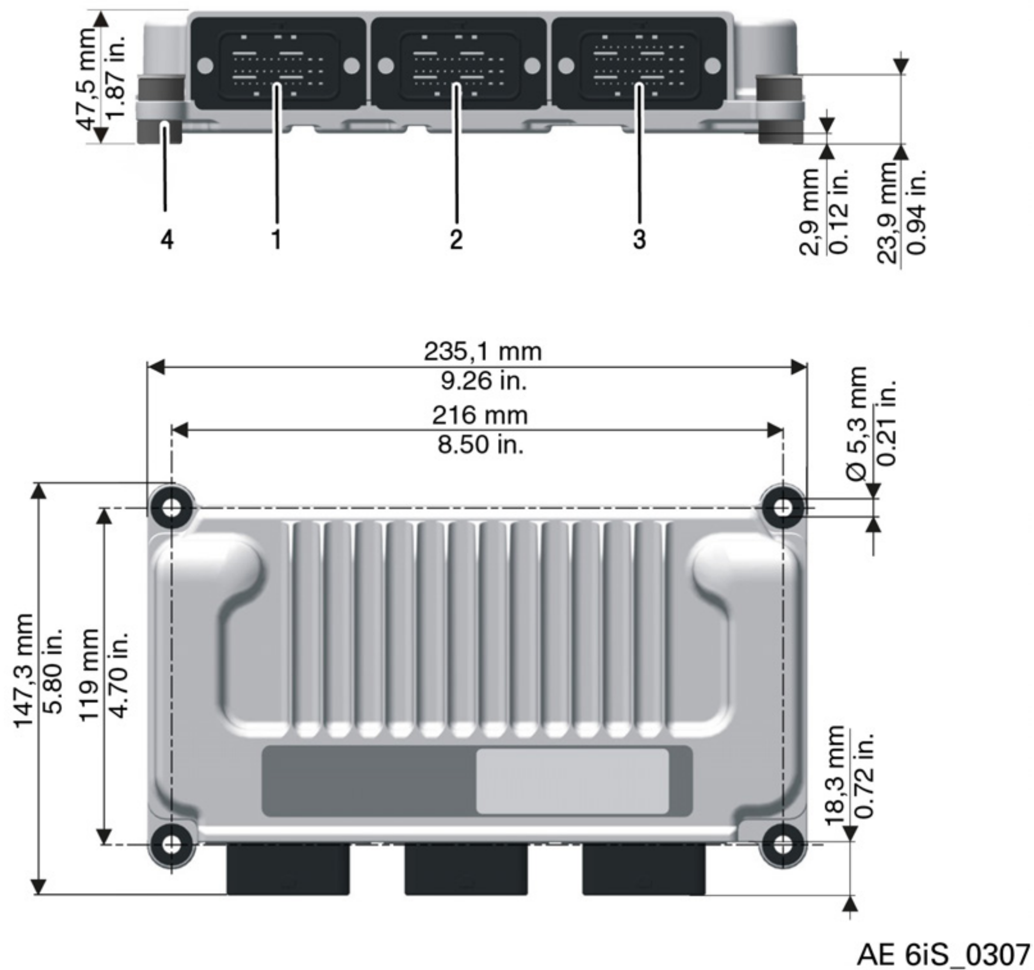

Figure 9.13: ECU –mounting points

1	*Connector socket A1*	*2*	*Connector socket A2*
3	*Connector socket B*	*4*	*Rubber sleeve*

Sensors **Ambient Air Pressure and Temperature Sensors (AAPTS 1, 2)**

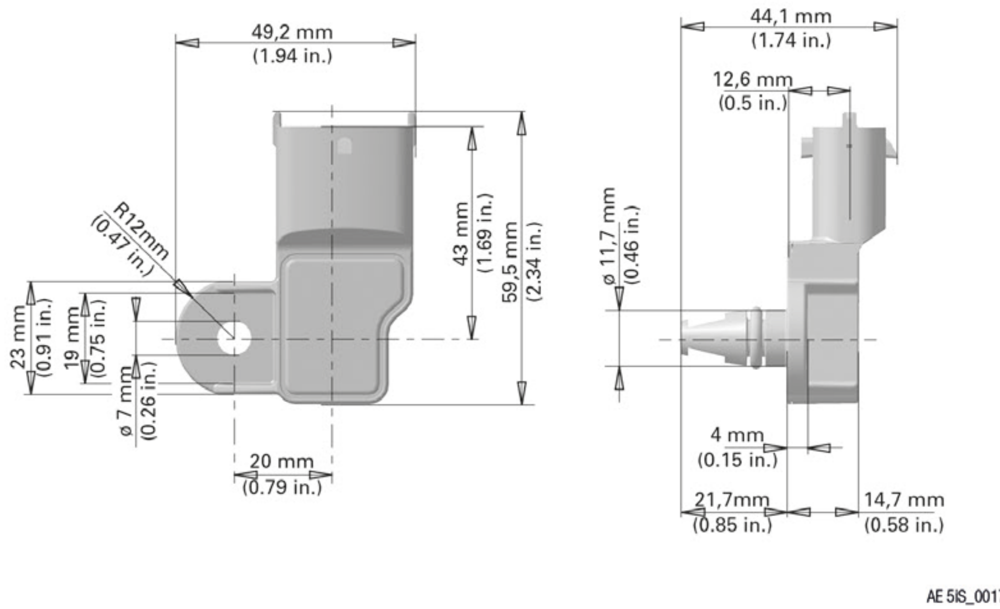

Figure 9.14: AAPTS – mounting points

Maximum diameter of fastener in the interior of the mounting hole: 6 mm (0.24 in). Only mount sensor with a washer (Ø 10 mm (0.39 in) or with an adequate fastener head diameter. The maximum permissible pressure at the mounting flange may not exceed 20 N/mm^2 (0.0029 psi).

INSTALLATION NOTES

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.
The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.
The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

916 i TYPE A

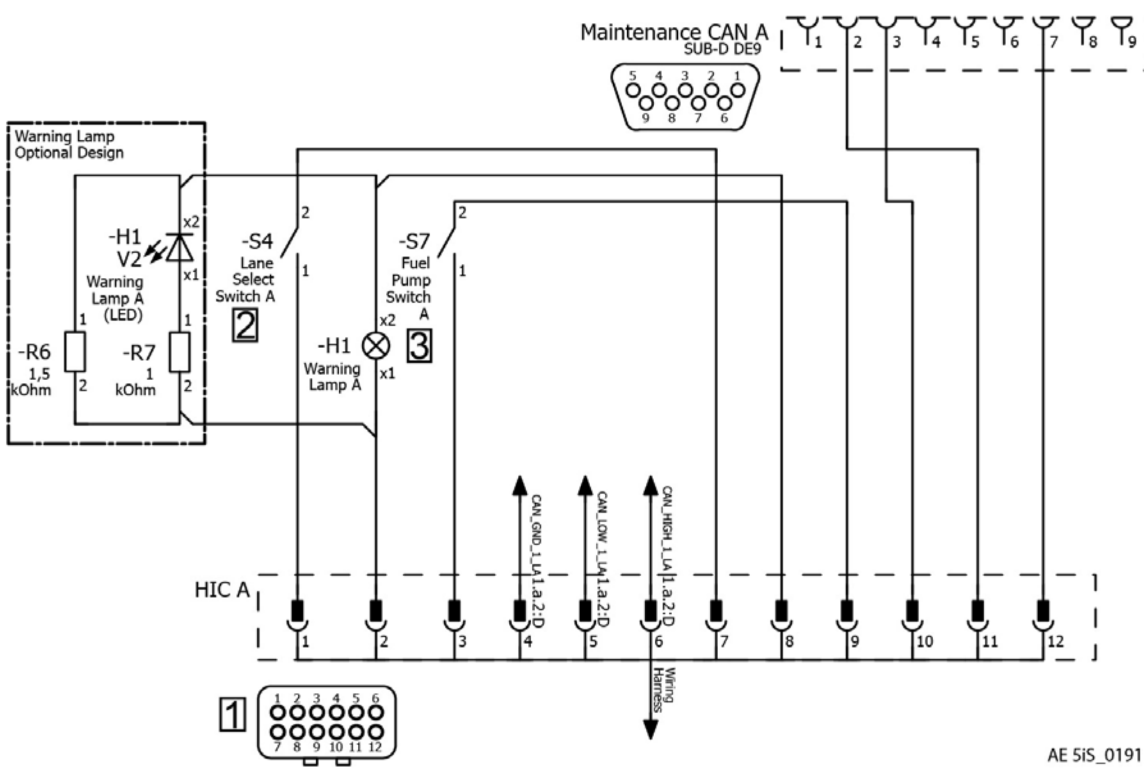

Figure 9.15: Harness Interface Connector A-Schematic

Part	Function
1	Harness Interface Connector A
2	Lane Select Switch A (-S4)
3	Fuel Pump Switch A (-S7)

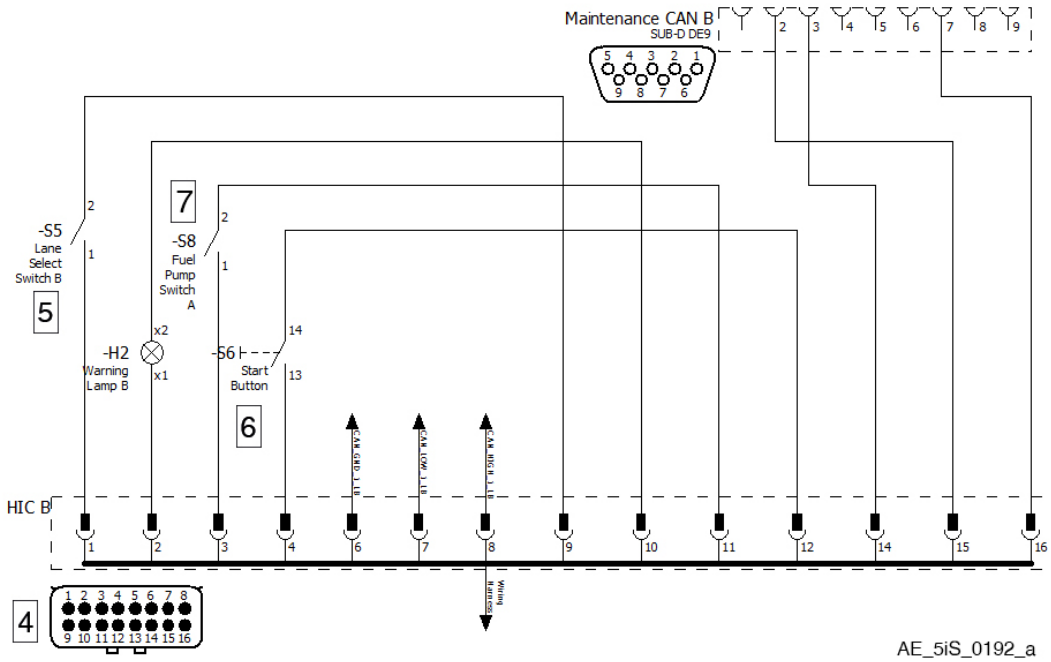

Figure 9.16: Harness Interface Connector B-Schematic

Part	Function
4	Harness Interface Connector B
5	Lane Select Switch B (-S5)
6	Start Switch (-S6)
7	Fuel Pump Switch A (-S8)

INSTALLATION OVERVIEW – 916 I TYPE C24

916 i TYPE C24

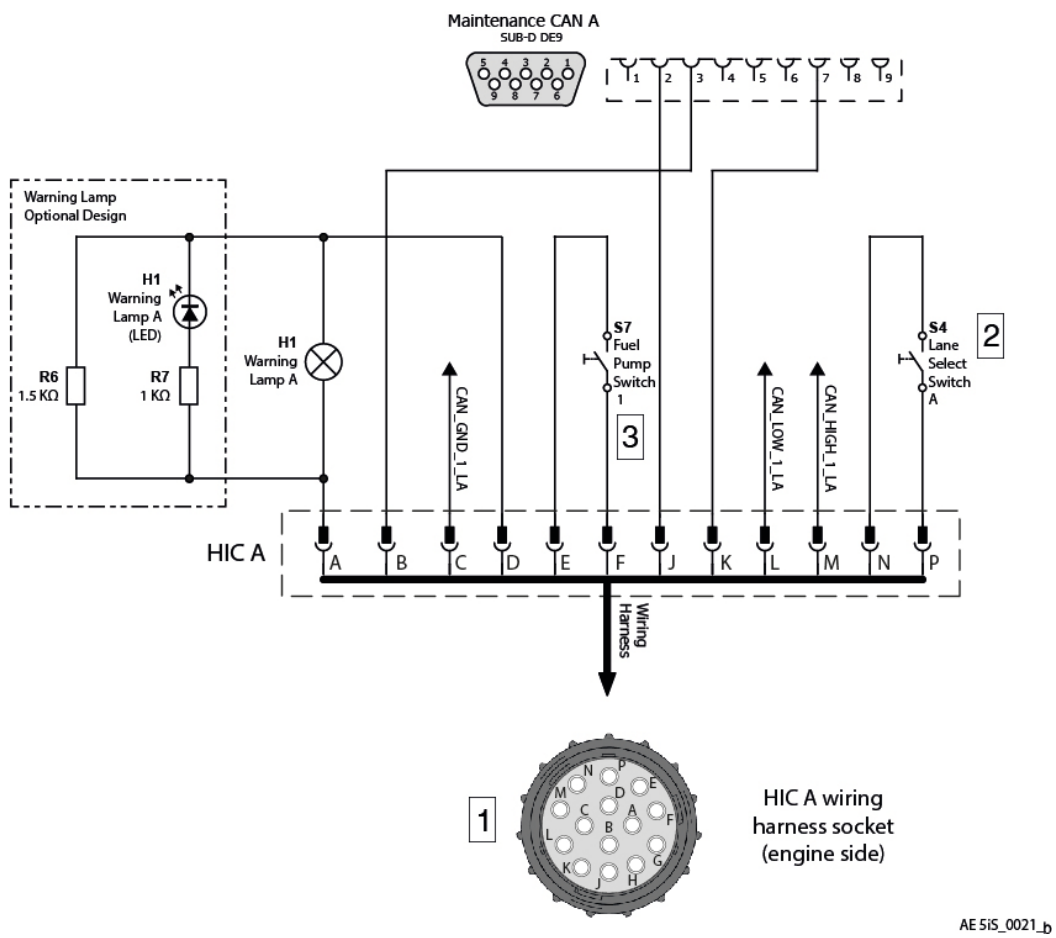

Figure 9.17: Harness Interface Connector A-Schematic

Part	Function
1	Harness Interface Connector A
2	Lane Select Switch A (-S4)
3	Fuel Pump Switch 1 (-S7)

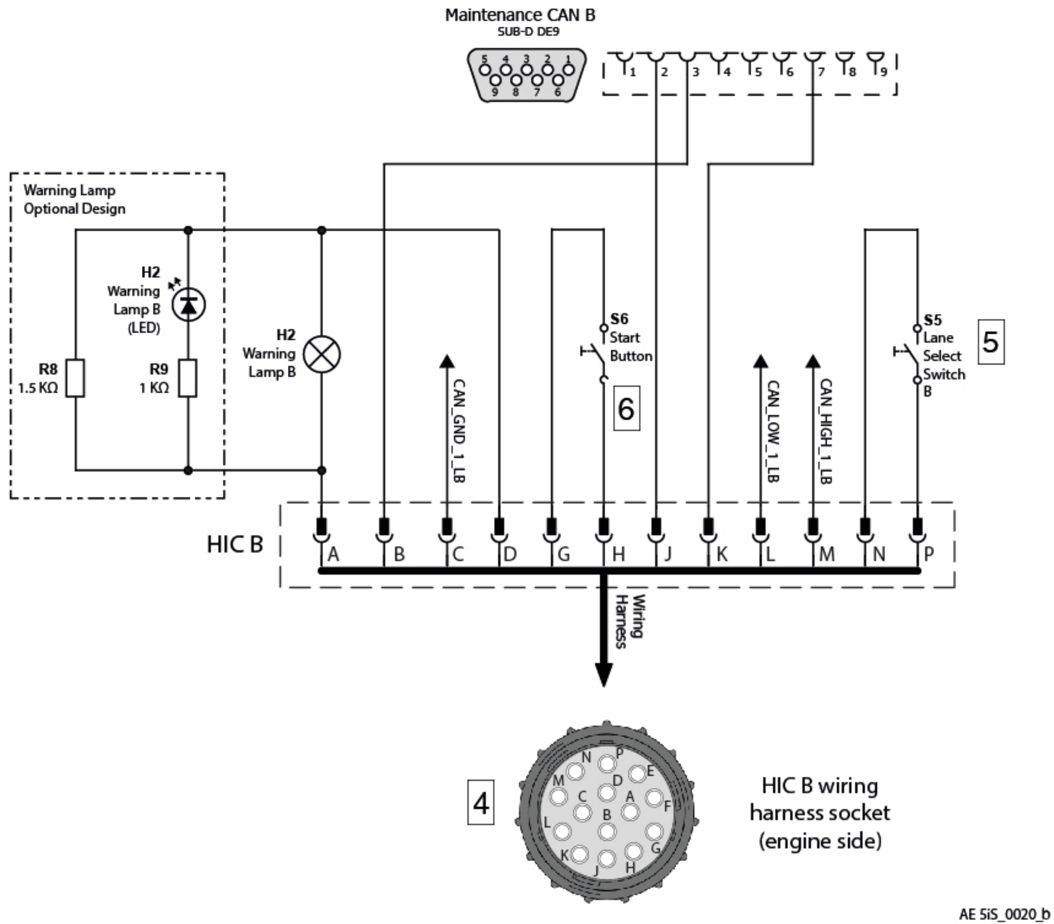

Figure 9.18: Harness Interface Connector B-Schematic

Part	Function
4	Harness Interface Connector B
5	Lane Select Switch B (-S5)
6	Start Switch (-S6)

LANE SELECT SWITCHES

Lane Select Switch A (-S4)

Interface Parameter	Value
Switch type	Toggle (normally open)
Nominal voltage	28 V
Nominal current	7.5 A
Number of poles	1-pole

Lane Select Switch B (-S5)

Interface Parameter	Value
Switch type	Toggle (normally open)
Nominal voltage	28 V
Nominal current	7.5 A
Number of poles	1-pole

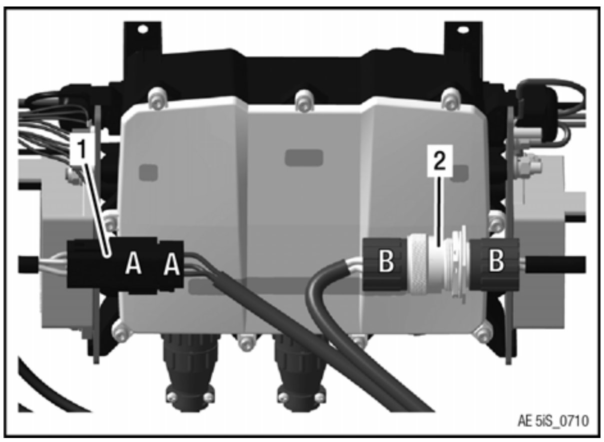

Figure 9.19: Fusebox

1 *Connector Regulator A*

2 *Amphenol connector Regulator B*

START SWITCH

Start Switch (-S6)

Interface Parameter	Value
Switch type	Button (normally open, non-locking)
Nominal voltage	28 V
Nominal current	5 A
Number of poles	1–pole

Chapter: 77–00–00
ENGINE INDICATING

TOPICS IN THIS CHAPTER

916 i TYPE A

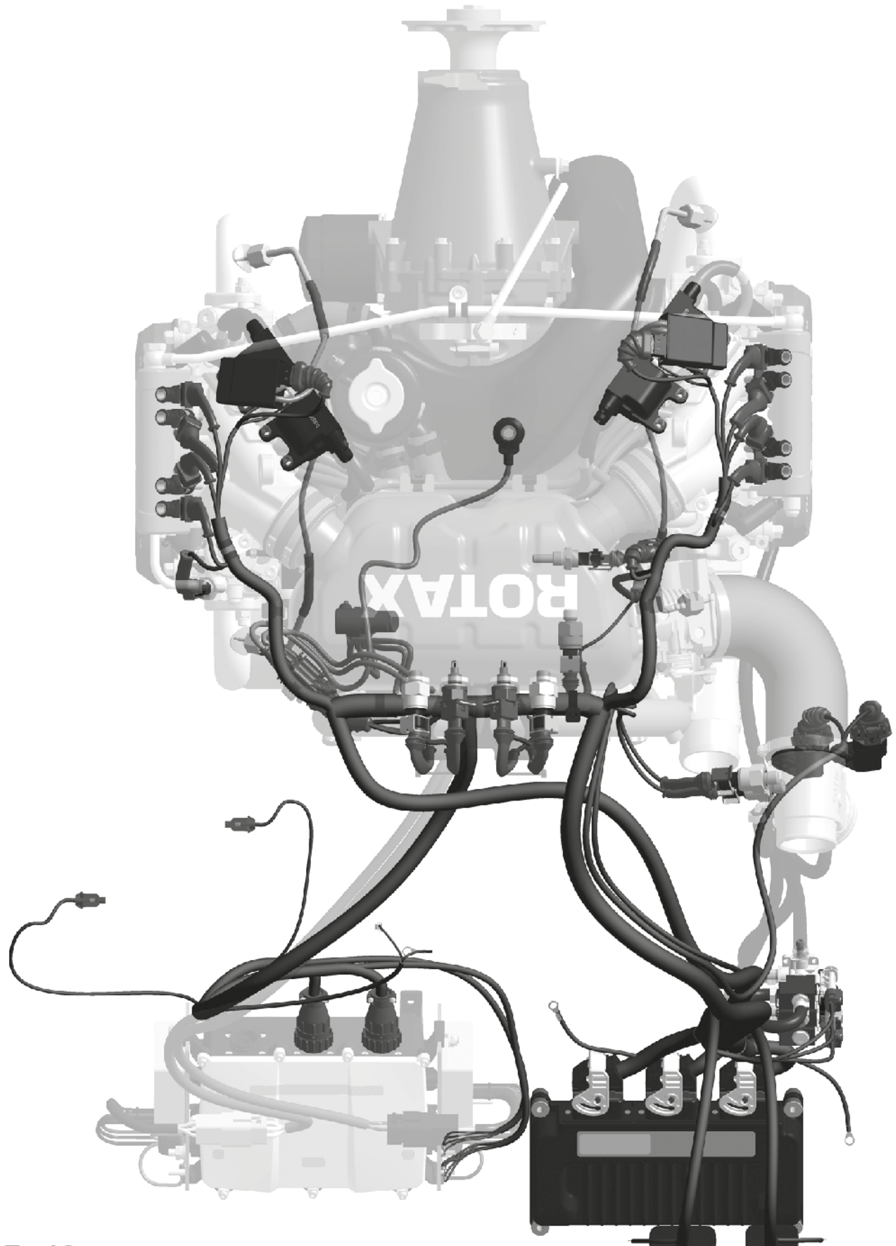

Figure 10.1: Engine indication, TYPICAL

916 i TYPE C 24

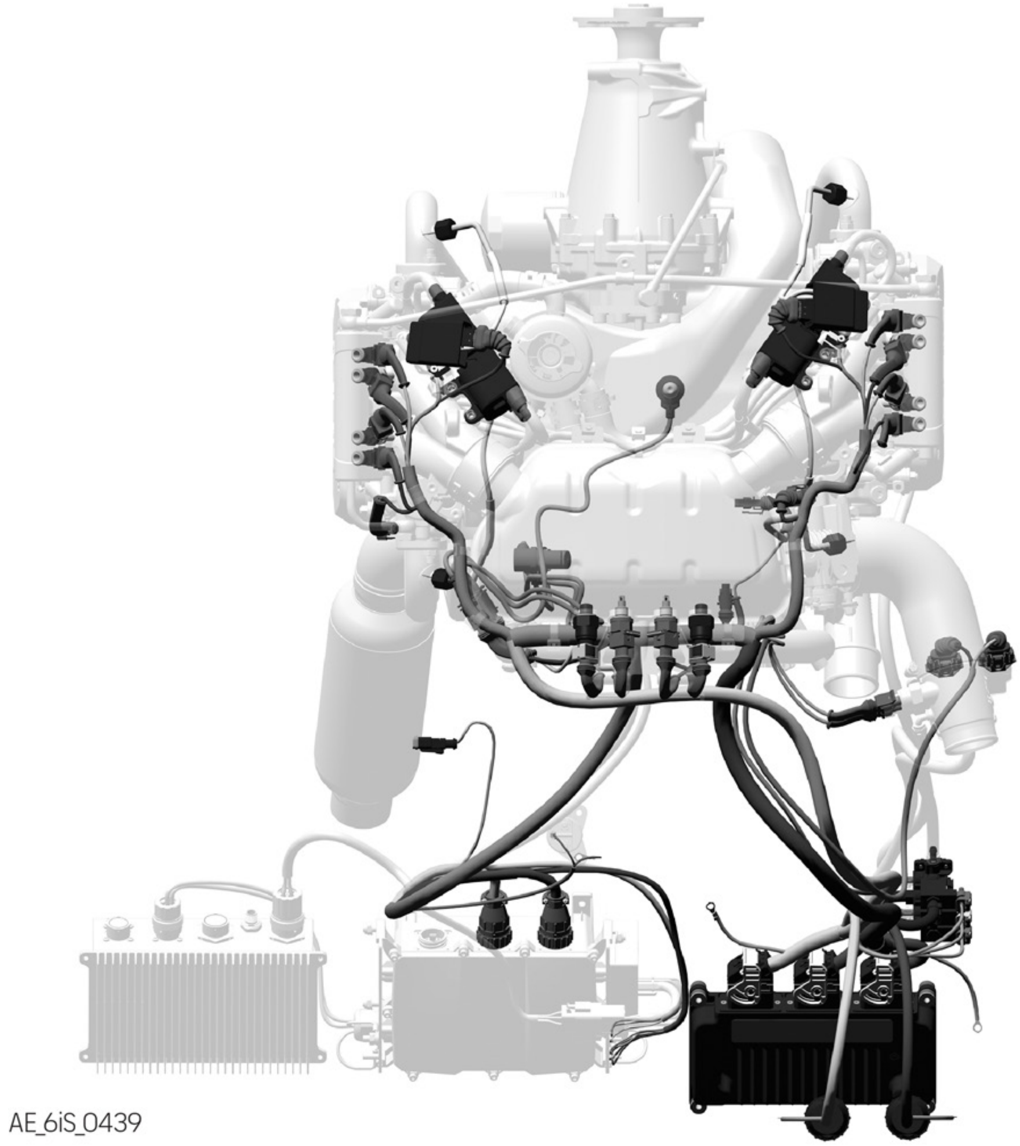

Figure 10.2: Engine indication

SYSTEM DESCRIPTION

The complete system is volume of supply and is certified together with the engine. For a detailed system description refer to latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Maintenance CAN The Maintenance CAN must only be used in combination with a B.U.D.S. Aircraft USB-to-CAN converter and `B.U.D.S. Aircraft Software`. It is not possible to use the Maintenance CAN for other displaying or data logging purposes.

CAN wiring For the Display- and the Maintenance CAN twisted and shielded cables (3 pins: CAN_H, CAN_L, CAN_GND) must be used for the CAN-connections to ensure a high electromagnetic compatibility in data transmission.

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

916 i TYPE A

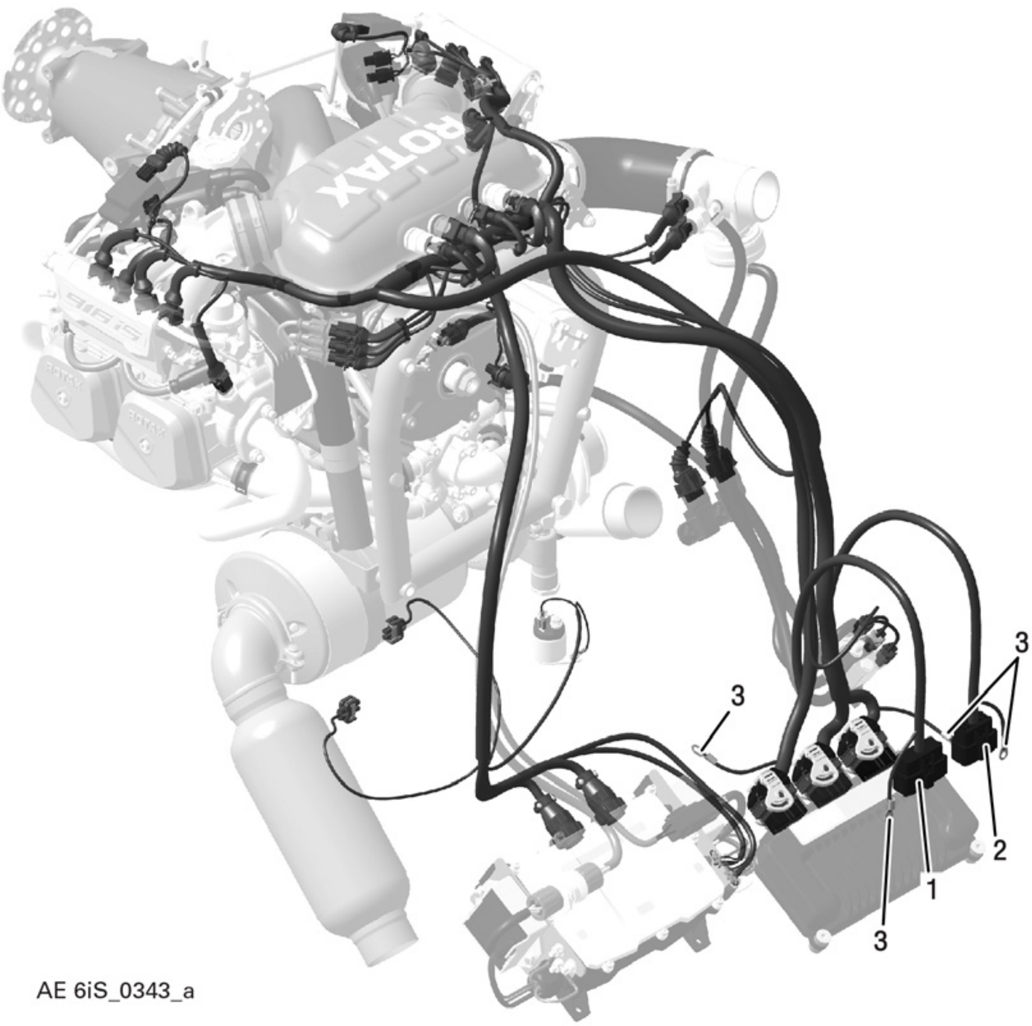

Figure 10.3: Engine Management System (EMS) – Interfaces

1 *Harness Interface Connector A (HIC A)*
2 *Harness Interface Connector B (HIC B)*
3 *Electromagnetic shielding of CAN Bus*

ELECTRICAL INTERFACES

Harness Interface Connector A

The HIC Connector A is equipped with a Maintenance CAN interface, a Display CAN interface and terminals which can be used to actuate a warning lamp indicating the current status of the ECU Lane A. Interfaces to control elements are described in Chapter 76-00-00.

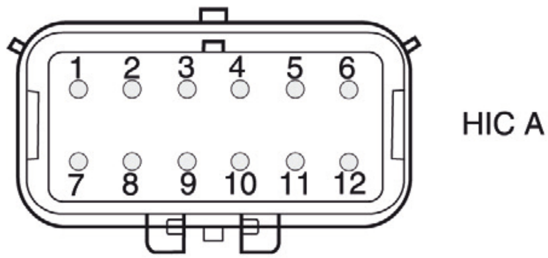

Figure 10.4: HIC A Connector

Warning Lamp

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nominal
2	SUPP_WARN_LAMP_A	8	WARN_LAMP_A	Nominal voltage			12 V
				Nominal current		120 mA	

CAN Interfaces

Terminal		Specification
4	CAN_GND_1_A	Display CAN Lane A
5	CAN_LOW_1_A	
6	CAN_HIGH_1_A	
10	CAN_GND_2_A	Maintenance CAN Lane A
11	CAN_LOW_2_A	
12	CAN_HIGH_2_A	

Connector: HIC Connector A (included in the engines scope of delivery).
The HIC Connectors must be mounted according to the procedure prescribed in Chapter 76-00-00.
The Display CAN is based on the CAN Aerospace protocol. For detailed interface description contact an authorized ROTAX® Distributor or its independent Service Center.

Harness Interface Connector B

The HIC Connector B is equipped with a Maintenance CAN interface, a Display CAN interface and terminals which can be used to actuate a warning lamp indicating the current status of the ECU Lane B. Interfaces to control elements are described in Chapter 76-00-00.

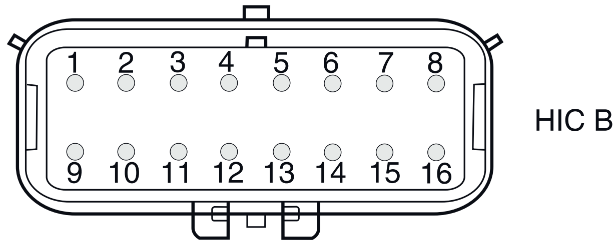

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Figure 10.5: HIC B connector

Warning Lamp

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nominal
2	SUPP_WARN_ LAMP_B	10	WARN_LAMP_B	Nominal voltage			12 V
				Nominal current		120 mA	

CAN Interfaces

Terminal		Specification
6	CAN_GND_1_B	Display CAN Lane B
7	CAN_LOW_1_B	
8	CAN_HIGH_1_B	
14	CAN_GND_2_B	Maintenance CAN Lane B
15	CAN_LOW_2_B	
16	CAN_HIGH_2_B	

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nominal
2	SUPP_WARN_ LAMP_B	10	WARN_LAMP_B	Nominal voltage			12 V
				Nominal current		120 mA	

Connector: HIC Connector B (included in the engine's scope of delivery).
The HIC Connectors must be mounted according to the procedure prescribed in Chapter 76-00-00.
The Display CAN is based on the CAN Aerospace protocol. For detailed interface description contact an authorized ROTAX® Distributor or its independent Service Center.

Electromagnetic shielding of CAN Bus

The electromagnetic CAN Bus shielding ring terminals need to be connected with the Airframe Ground.

Connector: Ring Terminal M6

INTERFACE OVERVIEW – 916 I TYPE C24

916 i TYPE C 24

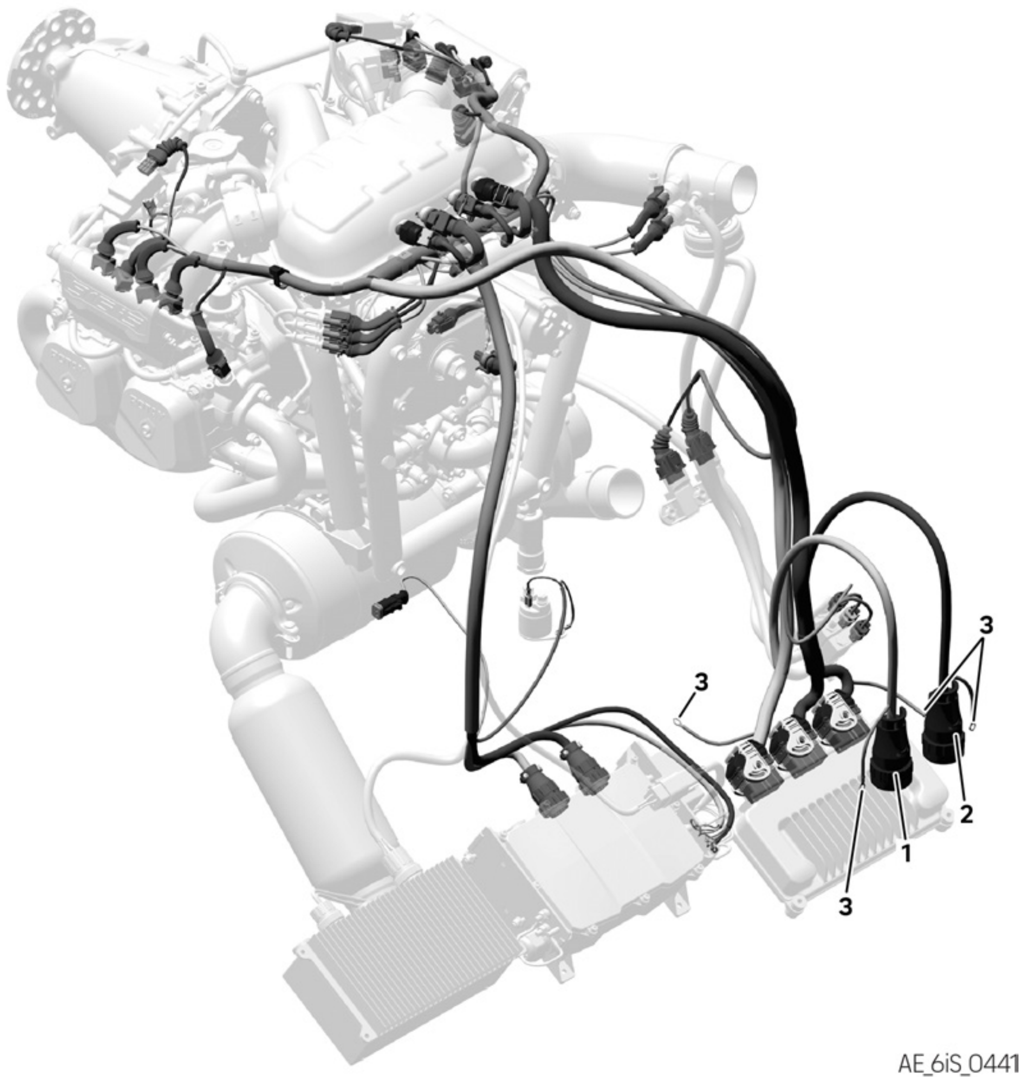

Figure 10.6: Engine Management System (EMS) – Interfaces

1 *Harness Interface Connector A (HIC A)*
2 *Harness Interface Connector B (HIC B)*
3 *Electromagnetic shielding of CAN Bus*

ELECTRICAL INTERFACES – 916 I TYPE C24

Harness Interface Connector A

The HIC Connector A is equipped with a Maintenance CAN interface, a Display CAN interface and terminals which can be used to actuate a warning lamp indicating the current status of the ECU Lane A. Interfaces to control elements are described in Chapter 76-00-00.

916 i TYPE C 24

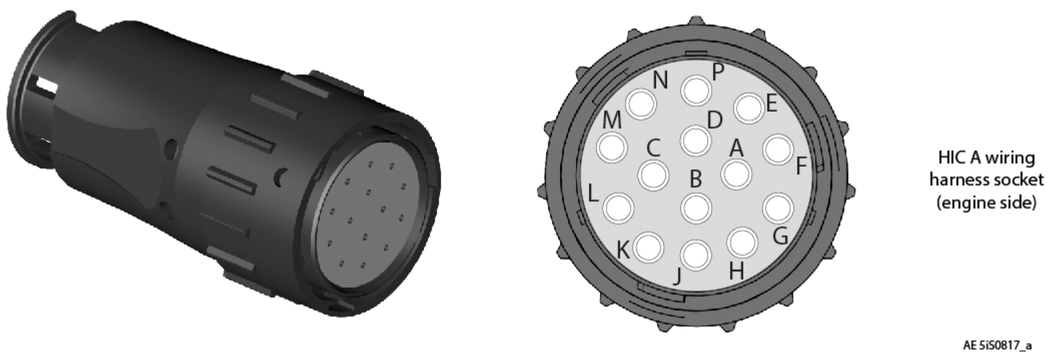

Figure 10.7: HIC A connector

Warning lamp

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nominal
A	SUPP_WARN_LAMP_A	D	WARN_LAMP_A	Nominal voltage			12 V
				Nominal current		120 mA	

CAN Interfaces:

Terminal		Specification
C	CAN_GND_1_A	Display CAN Lane A
L	CAN_LOW_1_A	
M	CAN_HIGH_1_A	
B	CAN_GND_2_A	Maintenance CAN Lane A
J	CAN_LOW_2_A	
K	CAN_HIGH_2_A	

Connector: HIC Connector A (included in the engines scope of delivery).
The HIC Connectors must be mounted according to the procedure prescribed in Chapter 76-00-00.

The Display CAN is based on the CAN Aerospace protocol. For detailed interface description contact an authorized ROTAX® Distributor or its independent Service Center.

Harness Interface Connector B The HIC Connector B is equipped with a Maintenance CAN interface, a Display CAN interface and terminals which can be used to actuate a warning lamp indicating the current status of the ECU Lane B. Interfaces to control elements are described in Chapter 76-00-00.

916 i TYPE C 24

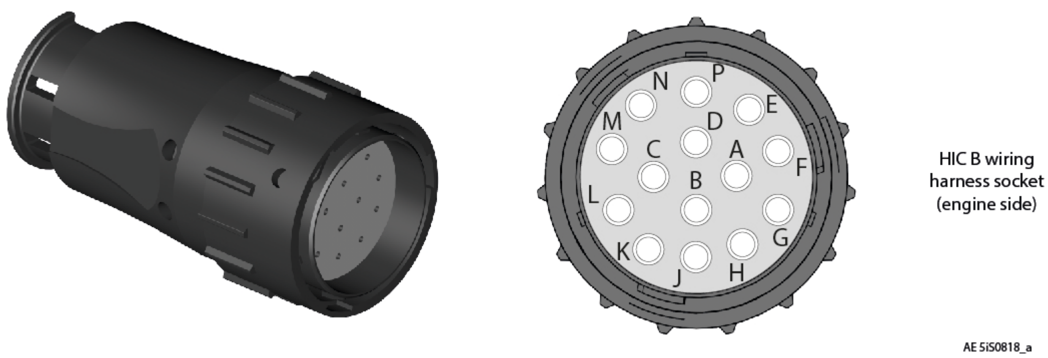

Figure 10.8: HIC B Connector

Warning lamp

Terminal (Supply)		Terminal (Ground)		Interface Parameter	Min.	Max.	Nominal
A	SUPP_WARN_LAMPE_B	D	WARN_LAMP_B	Nominal voltage			12 V
				Nominal current		120 mA	

CAN Interfaces

Terminal		Specification
C	CAN_GND_1_B	Display CAN Lane B
L	CAN_LOW_1_B	
M	CAN_HIGH_1_B	
B	CAN_GND_2_B	Maintenance CAN Lane B
J	CAN_LOW_2_B	
K	CAN_HIGH_2_B	

Connector: HIC Connector B (included in the engine’s scope of delivery).
The HIC Connectors must be mounted according to the procedure prescribed in Chapter 76-00-00.

The Display CAN is based on the CAN Aerospace protocol. For detailed interface description contact an authorized ROTAX® Distributor or its independent Service Center.

Electromagnetic shielding of CAN Bus

The electromagnetic CAN Bus shielding ring terminals need to be connected with the Airframe Ground.

Connector: Ring Terminal M6

INSTALLATION NOTES

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.
The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.
The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

916 i TYPE A

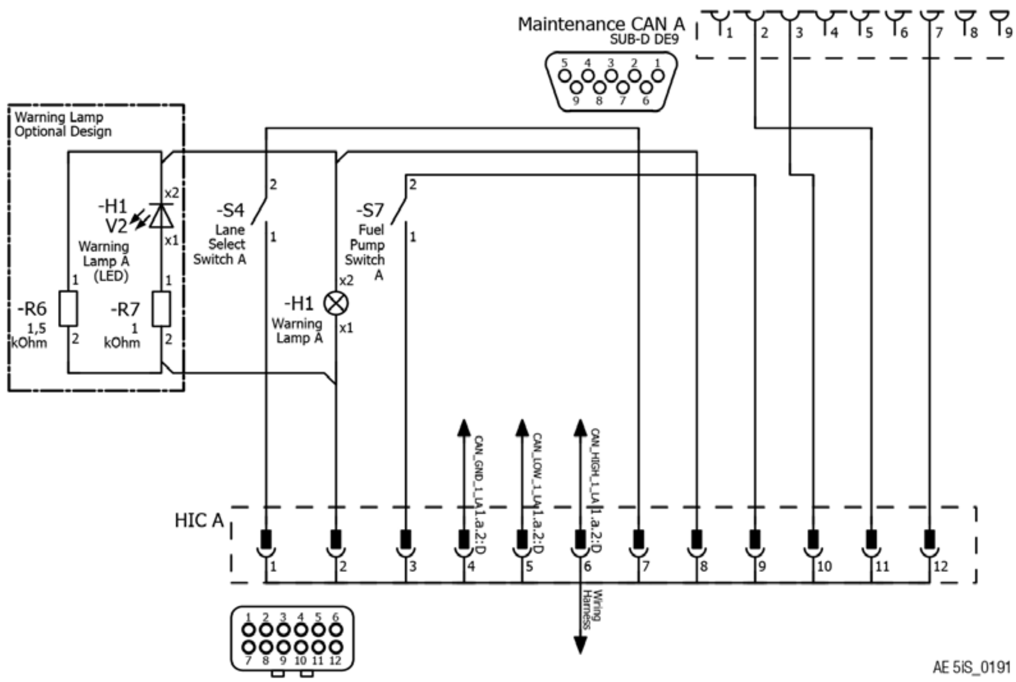

Figure 10.9: Harness Interface Connector A-Schematic

Part	Function
1	Harness Interface Connector A
2	Warning Lamp A (-H1)
3	Warning Lamp A (LED) (-H1 V2)
4	Resistor 1.5 kΩ (-F6)
5	Resistor 1 kΩ (-F7)

6	Display CAN A
7	Maintenance CAN A

916 i TYPE A

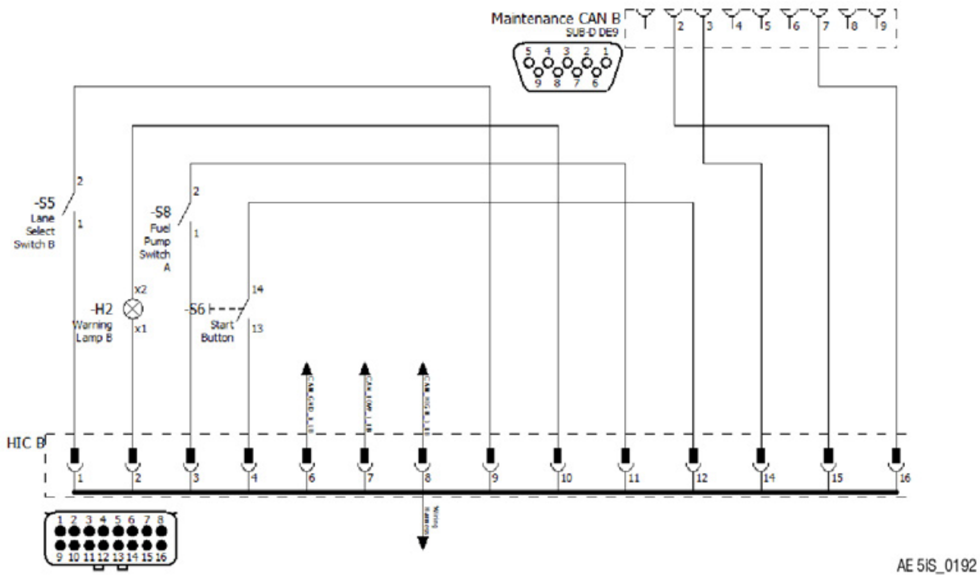

Figure 10.10: Harness Interface Connector B – Schematic

Part	Function
8	Harness Interface Connector B
9	Warning Lamp B (-H2)
10	Warning Lamp B (LED) (-H2 V2)
11	Resistor 1.5 kΩ (-F8)
12	Resistor 1 kΩ (-F9)
13	Display CAN B
14	Maintenance CAN B

WARNING LAMPS

Warning Lamp A, B (-H1, -H2)

Interface Parameter	Value
Nominal voltage	12
Nominal current	max. 120 mA

Instead of common lamps also LED lamps (-H1 V2, -H2 V2) can be used. In this case a appropriate pre-resistor must be conducted serial to the LED. An additional resistor parallel to the LED avoids that the ECU detects an open circuit at this warning lamp.

CAN INTERFACES

Display CAN

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.

Maintenance CAN

To be able to connect the Maintenance CAN A and B with the B.U.D.S Aircraft USB-to-CAN converter the Maintenance CAN A and B should be connected with two separate Sub-D DE9 (9-pin) sockets. It is highly recommended to conduct those connectors due to the fact that the B.U.D.S. Aircraft is a central element when it comes to diagnosis and maintenance of this engine.

CAN Type	Description	HIC Pin	Sub-D DE9 Pin
Maintenance CAN A	CAN_LOW_2_A	11 (HIC A)	2
	CAN_GND_2_A	10 (HIC A)	3
	CAN_HIGH_2_A	12 (HIC A)	7
Maintenance CAN B	CAN_LOW_2_B	15 (HIC B)	2
	CAN_GND_2_B	14 (HIC B)	3
	CAN_HIGH_2_B	16 (HIC B)	7

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

INSTALLATION OVERVIEW – 916 I TYPE C24

916 i TYPE C 24

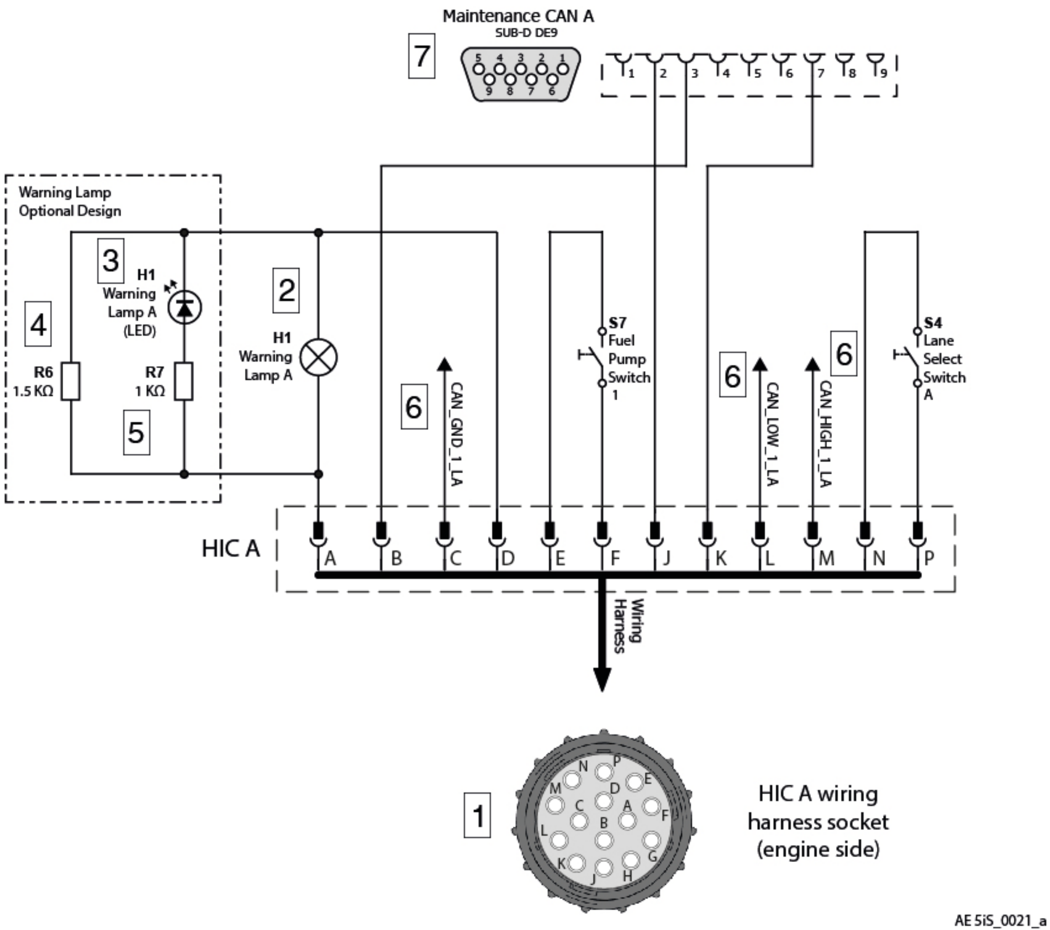

Figure 10.11: Harness Interface Connector A-Schematic

Part	Function
1	Harness Interface Connector A
2	Warning Lamp A (-H1)
3	Warning Lamp A (LED) (-H1 V2)
4	Resistor 1.5 kΩ (-R6)
5	Resistor 1 kΩ (-R7)
6	Display CAN A
7	Maintenance CAN A

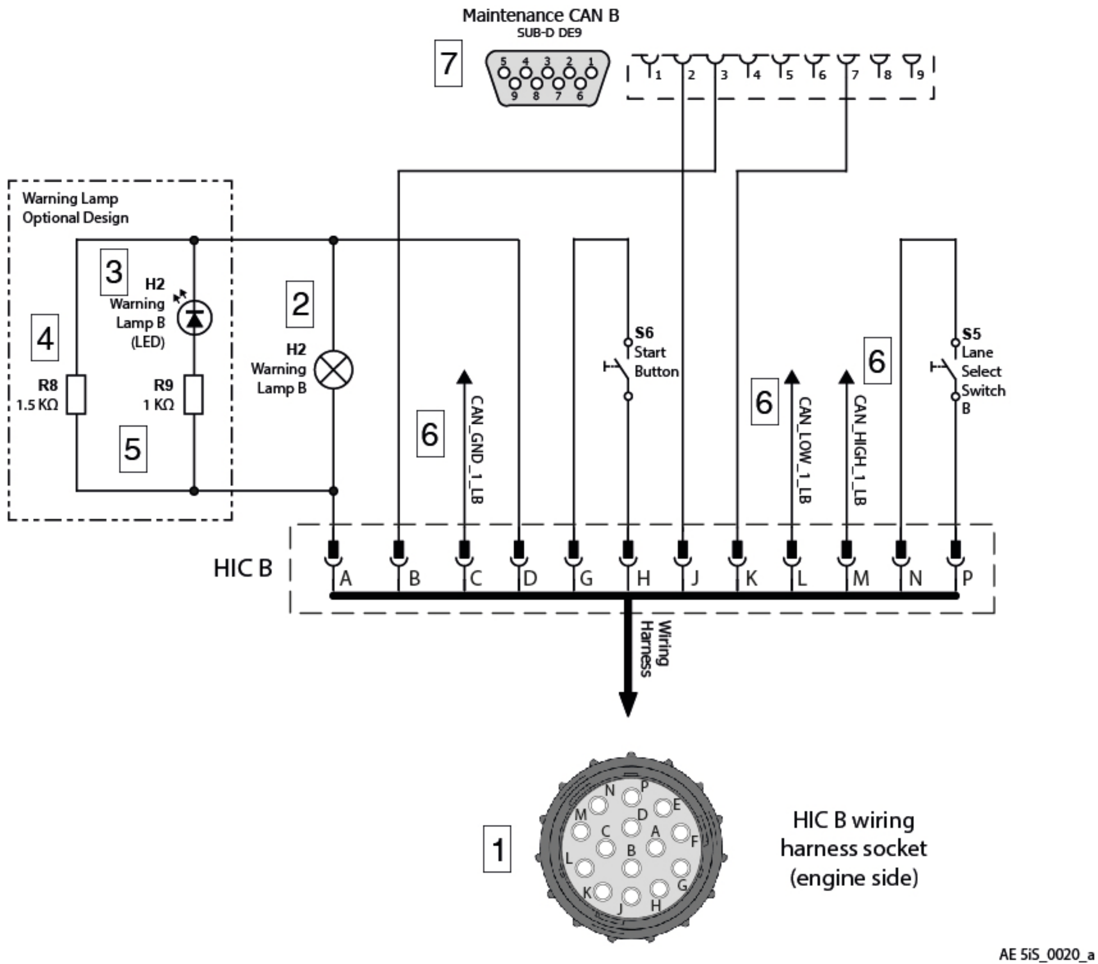

Figure 10.12: Harness Interface Connector B-Schematic

Part	Function
1	Harness Interface Connector B
2	Warning Lamp B (-H2)
3	Warning Lamp B (LED) (-H2 V2)
4	Resistor 1.5 kΩ (-R8)
5	Resistor 1 kΩ (-R9)
6	Display CAN B
7	Maintenance CAN B

Cockpit Airframe side

Connector	PIN	Function	Type
X5	X5.1	Aircraft GND for Warning Lamps	Ground
	X5.2	Warning Lamp 14 V output EMS/Fuel pump	Signal
	X5.3	Warning Lamp Command Input (Start Power / Battery Backup)	Signal
	X5.4	Warning Lamp 28 V output Aircraft	Signal

NOTE

For improved clarity, see diagrams in Chapter 92-00-00 “Wiring diagrams”.

WARNING LAMPS – 916 I TYPE C24

Warning Lamp A, B (-H1, -H2)

916 i TYPE C 24

Interface Parameter	Value
Nominal voltage	12 V
Nominal current	max. 120 mA

Instead of common incandescent lamps also LED lamps (-H1 V2, -H2 V2) can be used. In this case a appropriate pre-resistor must be conducted serial to the LED. An additional resistor parallel to the LED prevents the ECU from detecting an open circuit at this warning lamp.

CAN INTERFACES – 916 I TYPE C24

Display CAN

916 i TYPE C 24

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.

Maintenance CAN

To be able to connect the Maintenance CAN A and B with the B.U.D.S Aircraft USB-to-CAN converter the Maintenance CAN A and B should be connected with two separate Sub-D DE9 (9-pin) sockets. It is highly recommended to conduct those connectors due to the fact that the B.U.D.S. Aircraft is a central element when it comes to diagnosis and maintenance of this engine.

CAN Type	Description	HIC Pin	Sub-D DE9 Pin
Maintenance CAN A	CAN_LOW_2_A	J (HIC A)	2
	CAN_GND_2_A	B (HIC A)	3
	CAN_HIGH_2_A	K (HIC A)	7
Maintenance CAN B	CAN_LOW_2_B	J (HIC B)	2
	CAN_GND_2_B	B (HIC B)	3
	CAN_HIGH_2_B	K (HIC B)	7

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

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Chapter: 78–00–00
EXHAUST SYSTEM

TOPICS IN THIS CHAPTER

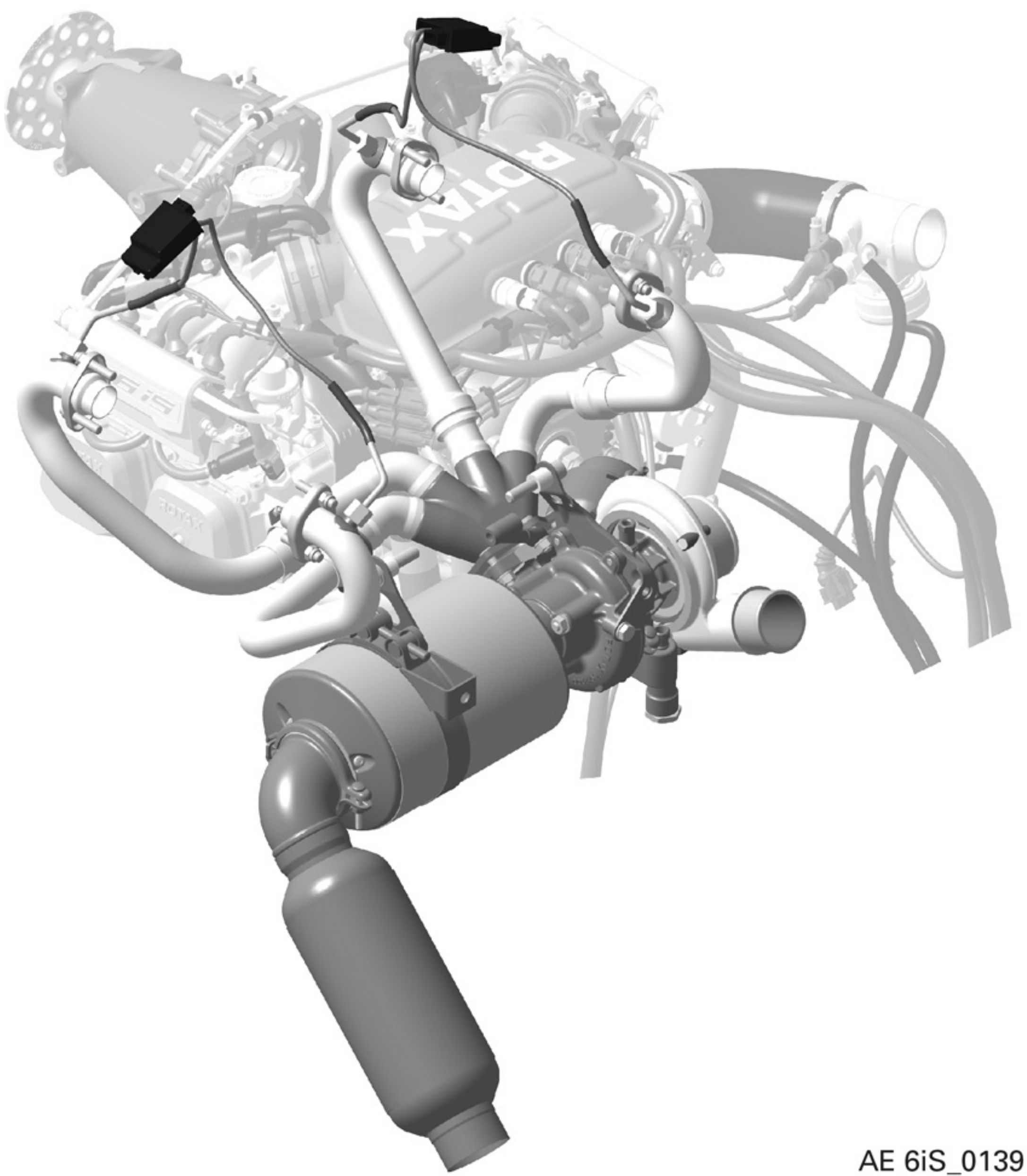

Figure 11.1: Exhaust system, TYPICAL

SYSTEM DESCRIPTION

The complete system is volume of supply and is certified together with the engine. For a detailed system description refer to latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

Modifications Modifications of the system by the OEM (e.g. cut the exhaust) may be done, if following requirements are met:

- All exhaust parts added by the OEMs are decoupled (weight and vibration) from the exhaust provided
- Exhaust back pressure must not exceed following limits:

System Limit	Min.	Max.
Exhaust back pressure (ambient pressure: 1000 mbar (14.50 psi))	90 mbar (1.30 psi)	115 mbar (1.66 psi)
Exhaust back pressure (ambient pressure: 900 mbar (13.05 psi))	115 mbar (1.66 psi)	135 mbar (1.95 psi)
Exhaust back pressure (ambient pressure: 800 mbar (11.60 psi))	135 mbar (1.95 psi)	155 mbar (2.24 psi)
Exhaust back pressure (ambient pressure: 700 mbar (10.15 psi))	155 mbar (2.24 psi)	175 mbar (2.53 psi)

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

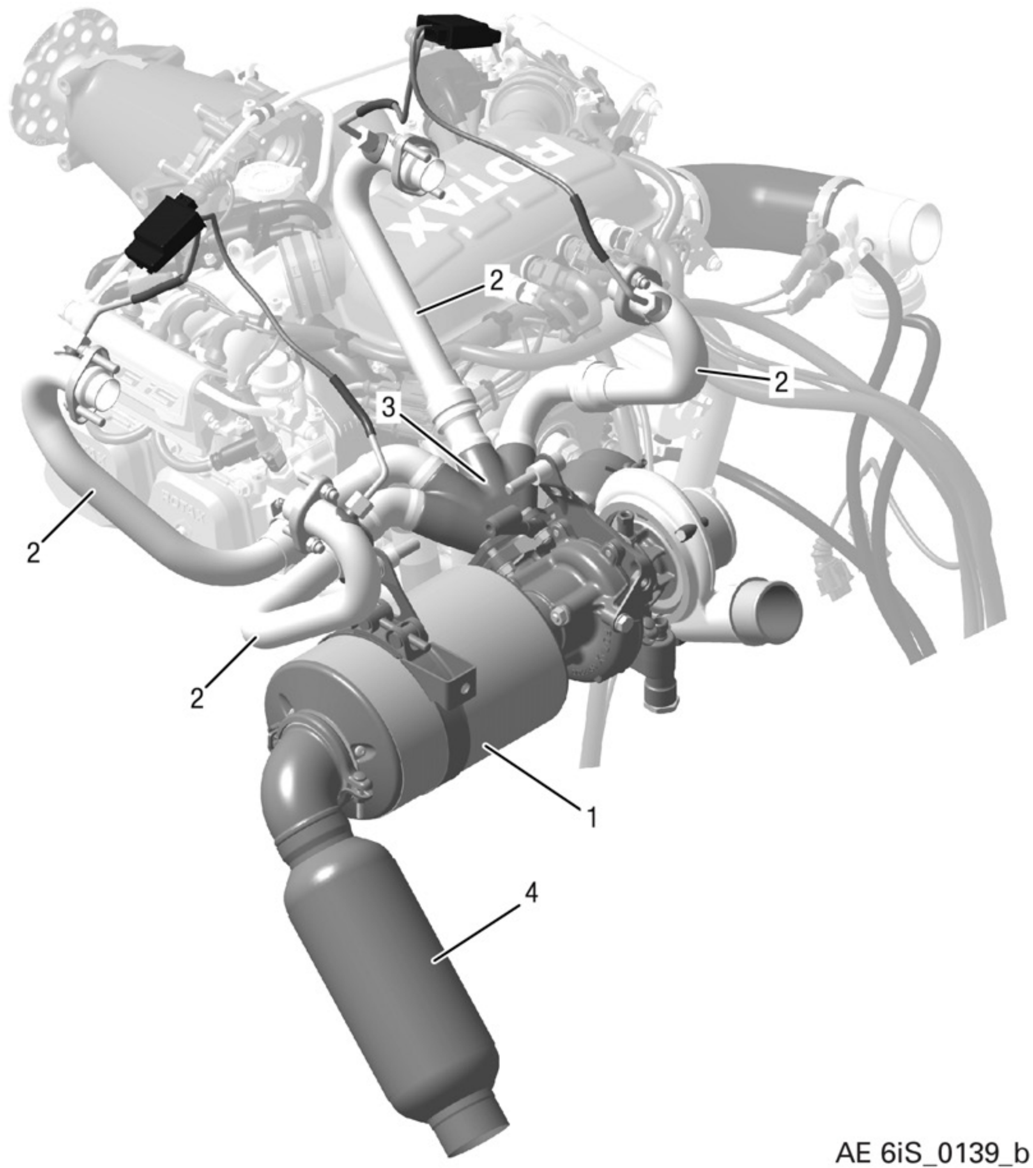

Figure 11.2: Exhaust interfaces

1	*Muffler assy.*	2	*Exhaust pipe*
3	*Exhaust manifold assy.*	4	*Resonator assy.*

MECHANICAL INTERFACES

Exhaust tail pipe

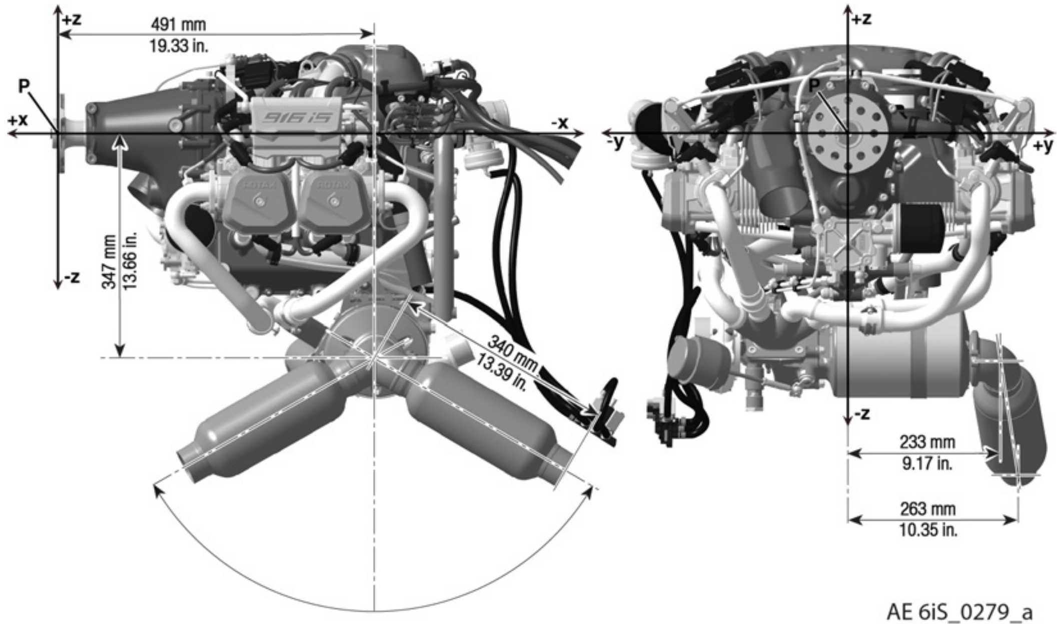

Figure 11.3: Exhaust position

Interface Parameter	Value
Exhaust elbow material	X15CrNiSi20-12

NOTE

The resonator can be rotated as desired, but the orientation can only be changed before initial operation. Afterwards M5x12 screws must not be removed.

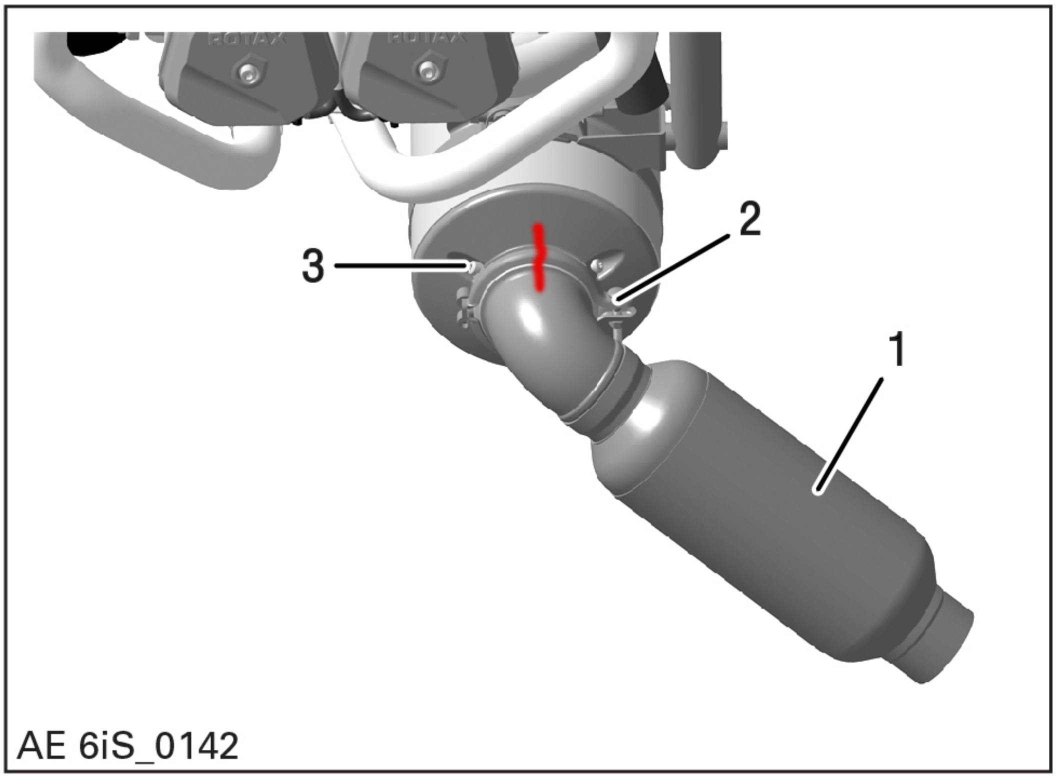

Figure 11.4: Position of the M5x12 screws

1	*Muffler*	2	*V-band clamp assy.*
3	*M5x12 screws*		

Chapter: 79–00–00
LUBRICATION SYSTEM

TOPICS IN THIS CHAPTER

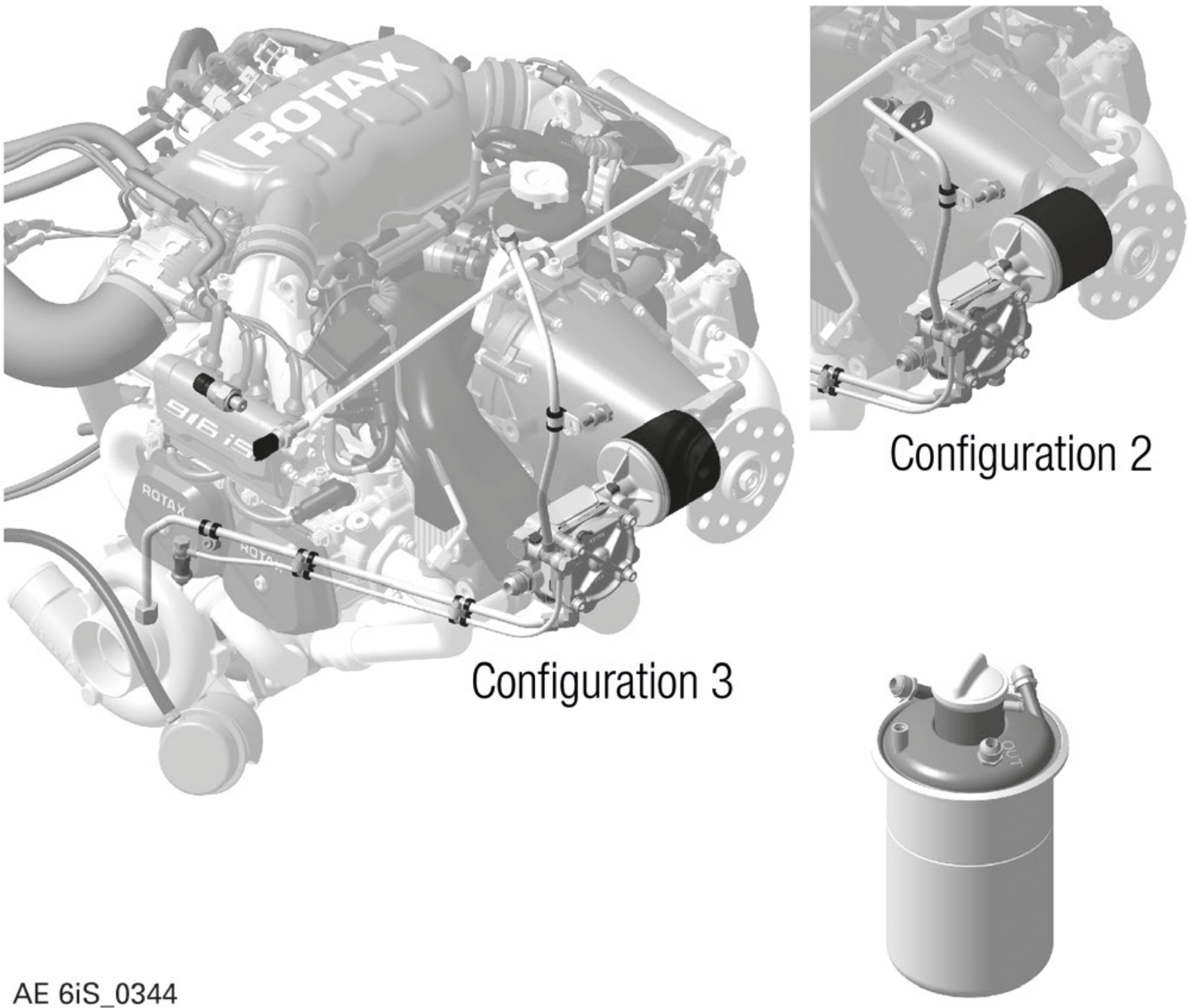

Figure 12.1: Lubrication system, TYPICAL

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

⚠ 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.

CRANKCASE PRESSURE MEASUREMENT

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

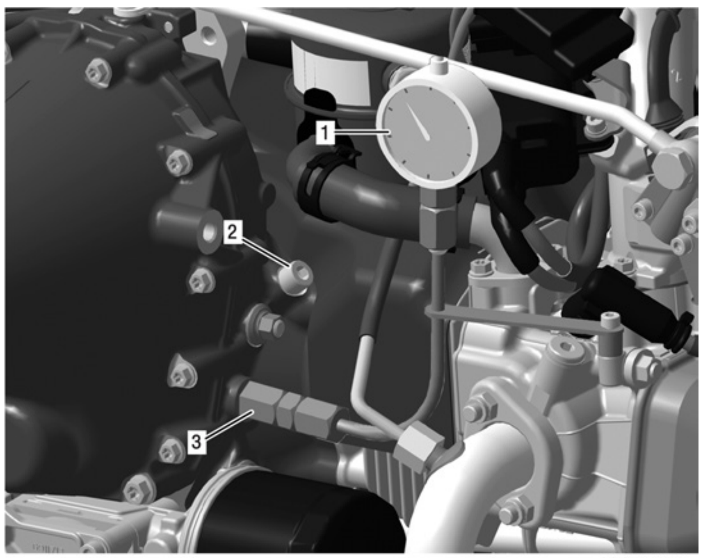

Figure 12.2: Measurement of crankcase pressure

1 *Pressure indicator*

2 *Allen screw M8x20 (position for crankshaft locking screw*

3 *Magnetic plug (position for adapter)*

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

NOTICE
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 0.3 bar (4.35 psi) at 50 °C (122 °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.

MEASURING OF THE VACUUM

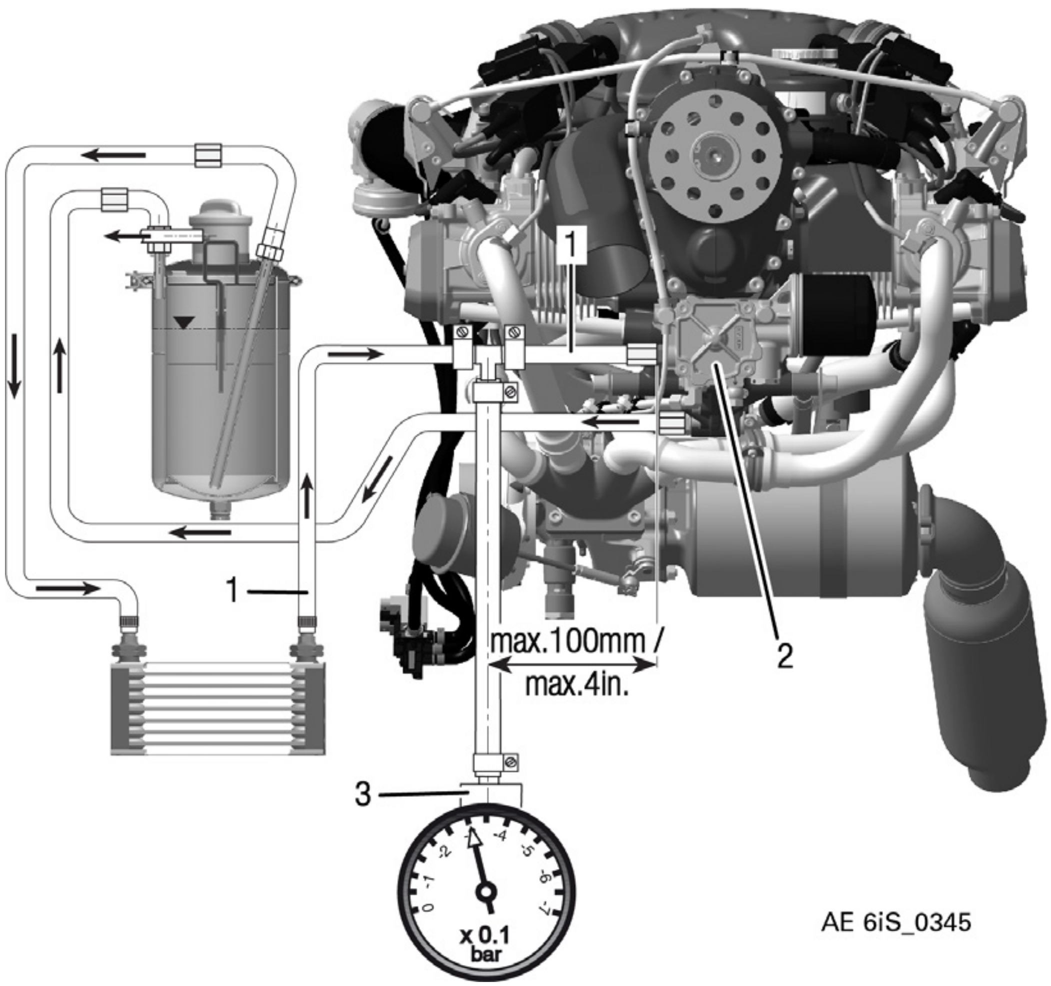

Figure 12.3: Measuring of the vacuum

1 Suction oil hose

2 Oil pump housing

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.

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.

Pressure loss Pressure loss in suction line (p_ambient – p_oil pump inlet) must not exceed 350 mbar (5 psi) between 70 °C – 90 °C (158 °F – 194 °F) oil temperature.

⚠ 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 tank installation positions

Oil tank

System Limit	Min.	Max.
Angular deviation	- 10°	+ 10°
Tank position in relation to engine	+40 mm (+1.57 in.)	–360 mm (-14.17 in.)

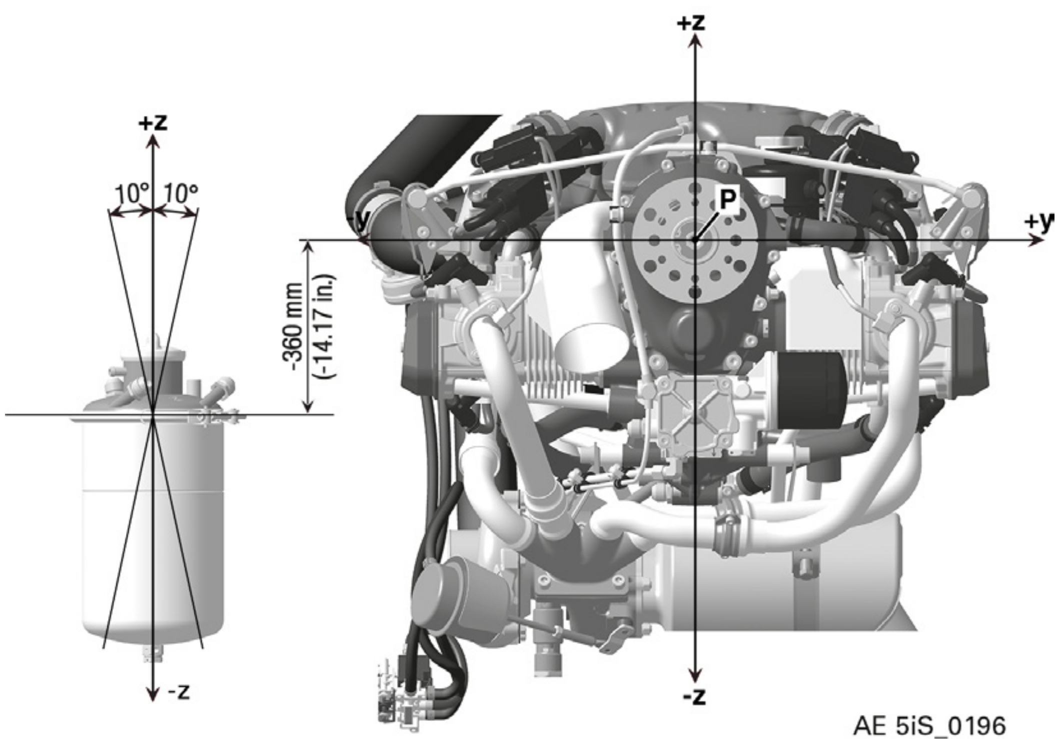

Figure 12.4: Oil tank installation position, TYPICAL

The oil tank must be installed on a low-vibration position and not on the engine directly. The oil tank cover and the oil drain screw must be easily accessible.

NOTE

The oil tank has to positioned on its z-axis such that the normal oil level is always between 0 and –360 mm (-14.17 in.) on the z-axis.

⚠ 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 will be too low for the first seconds after starting the engine.

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.

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

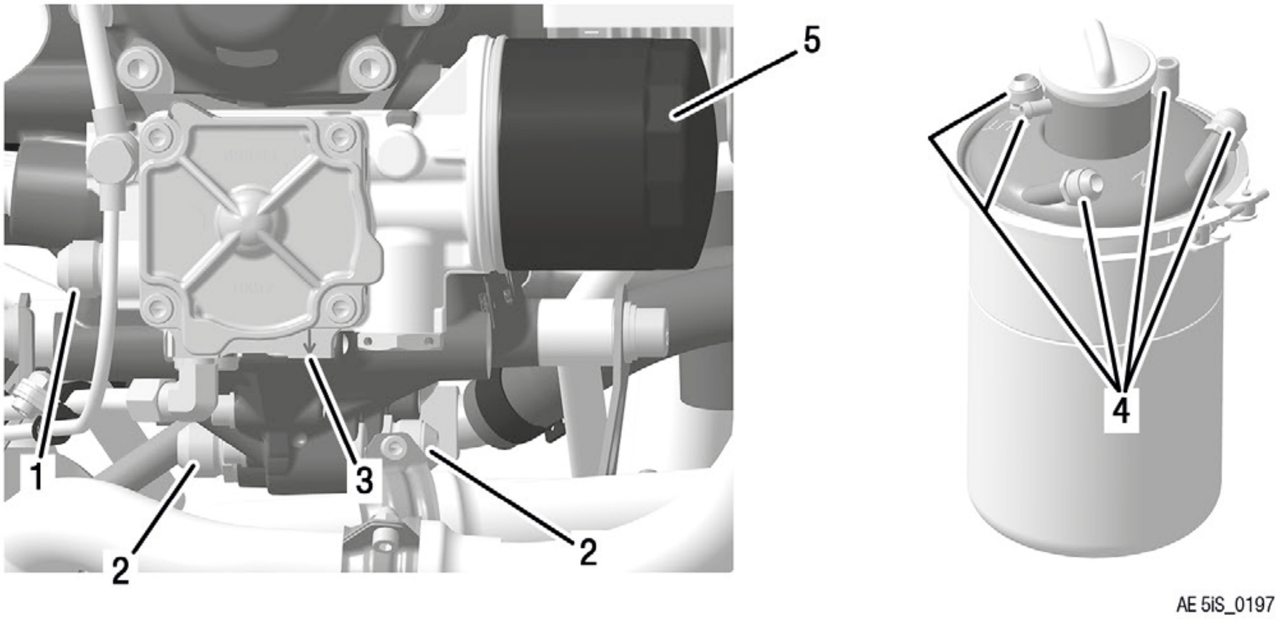

Figure 12.5: Lubrication system interfaces

1	*Oil pump inlet (hydraulic interface)*	*2*	*Oil return outlet (hydraulic interface)*
3	*Oil return outlet (turbocharger) (hydraulic interface)*	*4*	*Oil tank in- and outlets (hydraulic interface)*
5	*Oil filter (hydraulic interface)*		

OIL TANK DIMENSIONS

Oil tank The oil tank must be mounted by using appropriate clamps.

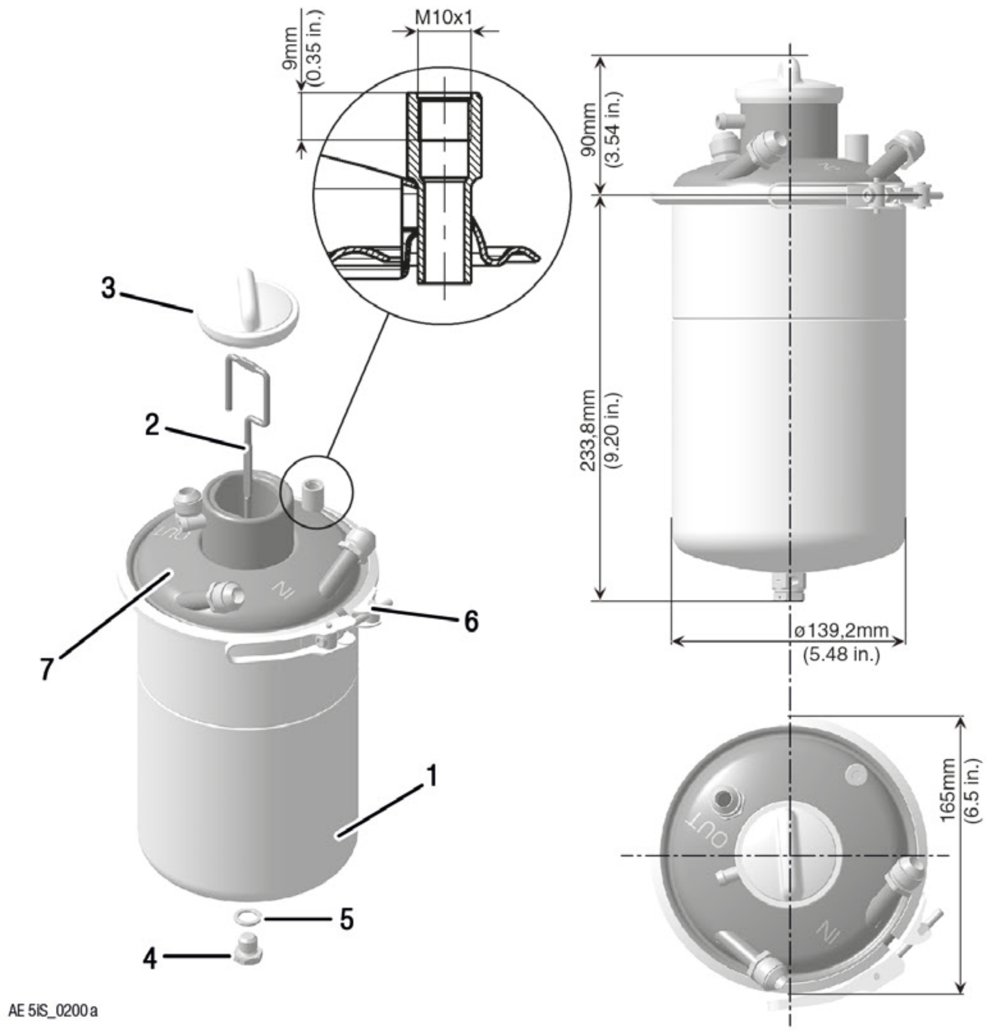

Figure 12.6: Oil tank dimensions

1	*Oil tank*	2	*Oil dipstick*
3	*Oil tank cover*	4	*Plug screw M12x12*
5	*Gasket ring C12x18*	6	*Profile clamp 163*
7	*Oil tank cover assy. (metric or UNF)*		

OIL TANK INTERFACES

Oil tank inlet and outlet

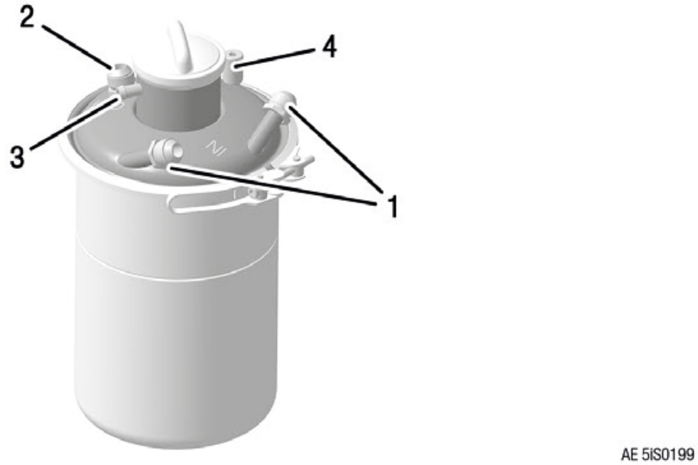

Figure 12.7: Oil tank interfaces

1	*Oil tank inlet*	2	*Oil tank outlet*
3	*Vent socket*	4	*Oil tank inlet (turbo charger)*

NOTE

The oil tank cover is also marked: IN — oil tank inlet, OUT — oil tank outlet.

NOTICE
Both oil tank inlets must be connected with the oil return outlets.

2x Oil tank inlet

Interface Parameter	Value
Screw socket	M18x1.5 or 3/4–16 UNF
Tightening torque	25 Nm (18 ft. lb)

Oil tank outlet

Interface Parameter	Value
Screw socket	M22x1.5 or 7/8–14 UNF
Tightening torque	25 Nm (18 ft. lb)

Vent socket

Interface Parameter	Value
Outside diameter	8 mm (0.31 in.)
Slip–on length	15 mm (0.59 in.)

⚠ WARNING

In any case the vent fitting must ensure a release of pressure from the oil tank at any time. Otherwise oil could emerge into the turbo housing which conveys through the exhaust. Formation of smoke is possible.

Oil tank inlet (turbo charger)

Interface Parameter	Value
Screw socket	M10x1
Tightening torque	15 Nm (133 in. lb)

OIL PUMP

Oil pump inlet The oil pump inlet must be connected directly with the oil tank outlet.

Interface Parameter	Value
Screw socket	M22 x1.5 or 7/8–14 UNF
Tightening torque	25 Nm (18 ft. lb)

Oil return outlet The oil return outlet must be connected directly with the oil tank inlet.

NOTICE
Both oil return outlets need to be used. Only the oil return lines on magneto side must be used. The hoses must have approx. the same length.

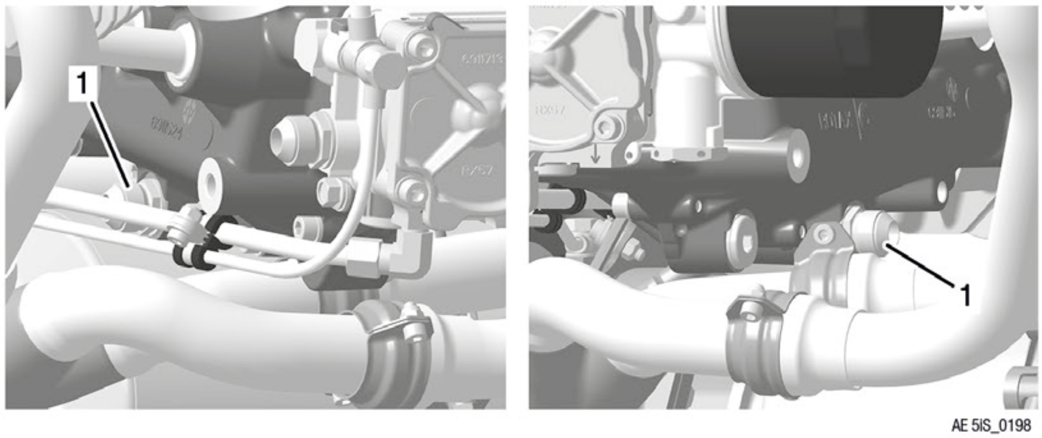

Figure 12.8: Oil return outlets

1 Oil return outlet

Interface Parameter	Value
Screw socket	M18 x 1.5 or 3/4–16 UNF
Tightening torque	25 Nm (18 ft.lb)

Oil return outlet (turbo charger)

The oil return outlet (turbo charger) must be connected directly with the oil tank inlet (turbo charger).

Interface Parameter	Value
Screw socket	M10 x 1
Tightening torque	15 Nm (133 in. lb)

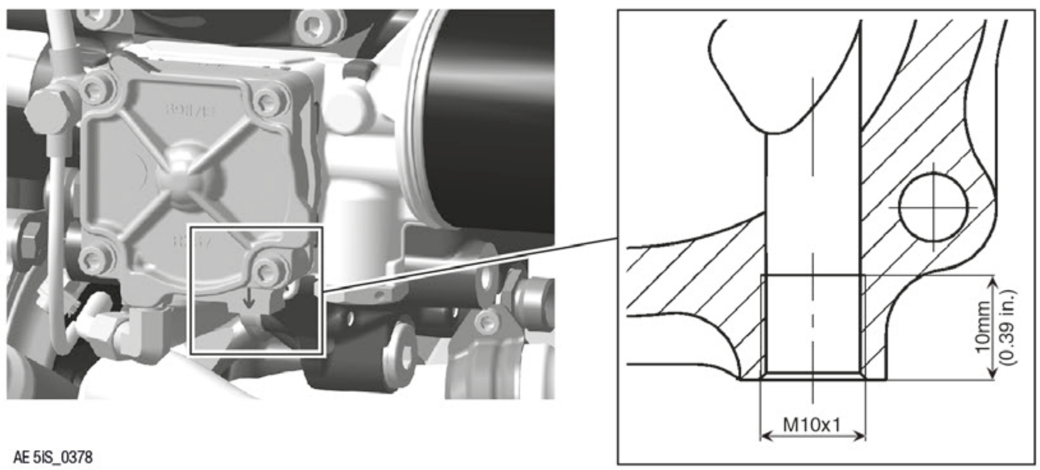

Figure 12.9: Oil return outlet (turbo charger)

INSTALLATION NOTES

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.
The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.
The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

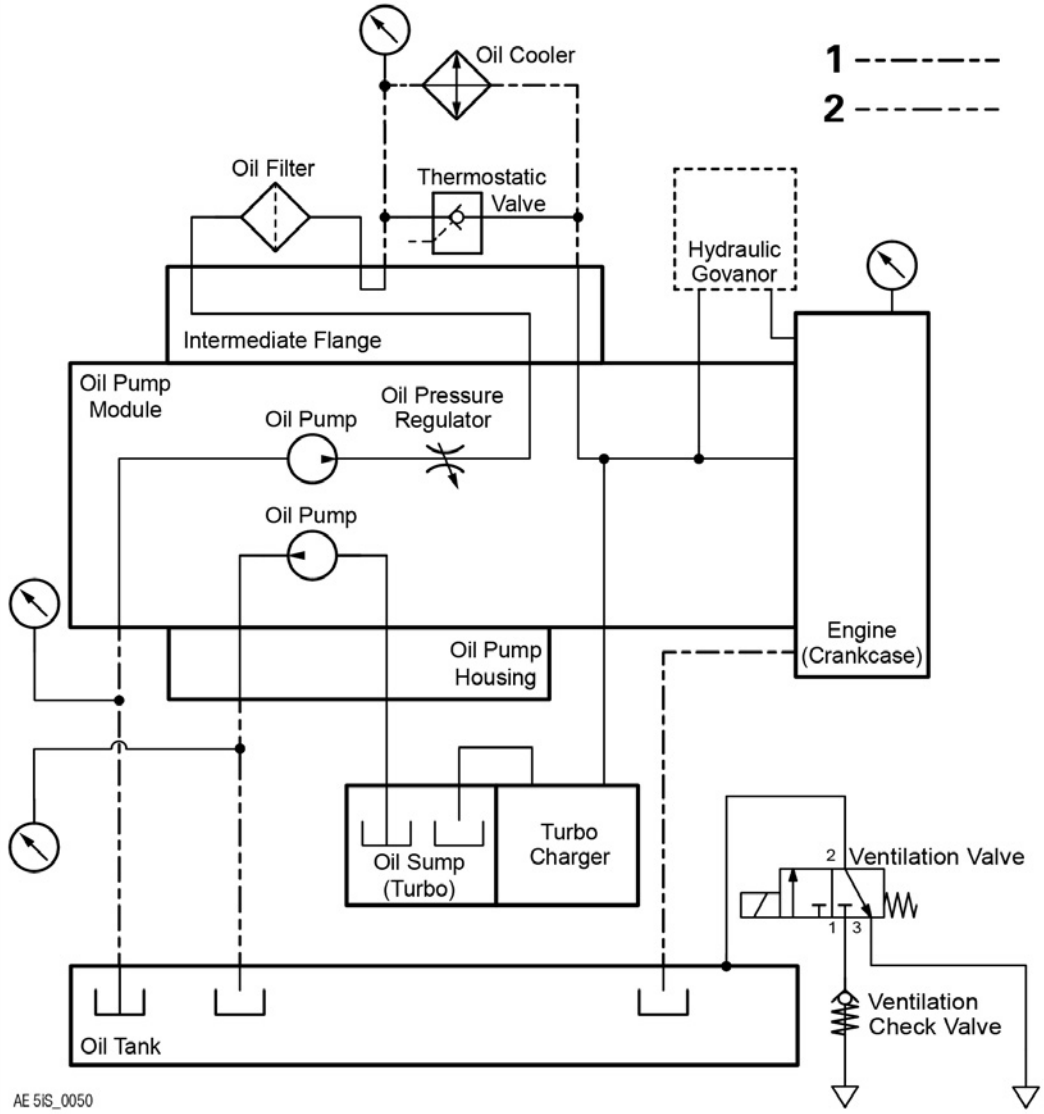

Figure 12.10: Lubrication system overview

1	*Engine circuit*	2	*Turbocharger return line*

OIL THERMOSTAT

When operating at low temperatures the installation of an oil thermostat parallel to the oil cooler is highly recommended. The advantages are safe oil pressure after cold start and prevention of fuel and water accumulation in the oil.

OIL LINES

At negative pressure of -500 mbar and a oil temperature of 140 °C (284 °F) the oil lines must not collapse.
A minimum inner diameter of at least 10 mm (0.39 in.) should be used.

Oil tank venting line

Following points should be considered when installing the oil tank venting line:

- Route the line without kinks and avoid sharp bends
- Route the venting line in a continuous decline. Otherwise a drain bore at the lowest point should be foreseen to drain any condensate.

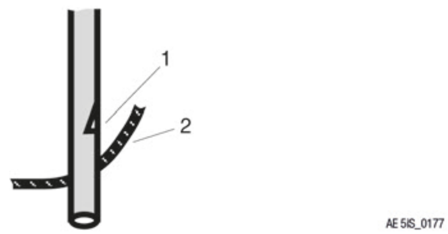

Figure 12.11: Bypass opening

1	*Bypass opening*	*2*	*Cowling*

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 a venting line.
The venting line must be protected from any kind of ice formation for condensation by using e.g. isolation protection or a routing in a hose with hot air flow. Additionally a bypass opening should be installed before the cowling outlet.

OIL RADIATOR (OPTIONAL)

Essential parts of the cooling system, such as radiator, etc., are available for this engine from BRP-Rotax. See also SI-PAC-014.Oil radiator /-sets.

⚠ 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.

Specifications of the oil radiator
The radiator must be designed to dissipate approx. 30 kW (28.43 BTU/s) of thermal energy at take-off performance.
Weight: max. 0.82 kg (1.8 lb) for oil radiator “extra large”.

NOTICE

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

FILLING AND PURGING THE OIL SYSTEM

Introduction

Ensure that oil lines are connected correctly and secured. Also ensure that the oil cooler (if fitted) is in the suction line between the oil tank and the oil pump, see following figure. Verify that the oil tank is filled up to the maximum level (to the top of the flat portion of the dipstick). The capacity of the oil system without oil cooler and connection lines is approx. 3l (0.79 gal.). Additional oil (up to 0.5 litres (0.13 gal)) may be added to the tank for the purpose of this procedure.

Instruction

The following work procedures must be carried out for purging the oil system:

1. Disconnect oil return lines from the oil tank.
2. Place the free end of the return lines into a suitable container (4) below the engine.
3. Plug open connection on oil tank with suitable air tight caps.
4. Remove the spark plug connectors.
5. For easier rotation of engine remove one spark plug from each cylinder.

   NOTE

   Prevent any foreign objects entering the spark plug hole.

6. Using compressed air, pressurize the oil tank through its vent fitting (6) (on the neck of the tank). Adjust the compressor outlet regulator so that the air line pressure is between 0.4 bar (5.8 psi) and 1 bar (14.5 psi). Do not exceed 1 bar (14.5 psi).

   NOTE

   The oil tank cap is not pressure-tight, some air can escape.

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.

   NOTE

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

   NOTE

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

8. Stop the pressurization.
9. Open the caps for the oil return lines on the oil tank and reconnect the engine oil return lines to the tank. Ensure that the suction oil line and oil return lines are connected to the proper fittings on the oil tank. Note: If the oil lines from the engine to the oil tank are incorrectly connected, severe engine damage may result.
10. Re-fit the spark plug. Restore aircraft to original operating condition.
11. Residual oil may have accumulated in the crankcase. Return it to the oil tank by following the oil level check procedure in the relevant Operators Manual (OM).
12. Fill the oil in the tank up to the full mark on the dipstick.

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

ENVIRONMENTAL NOTE
Protect the environment! Do not spill oil and pay attention for adequate disposal.

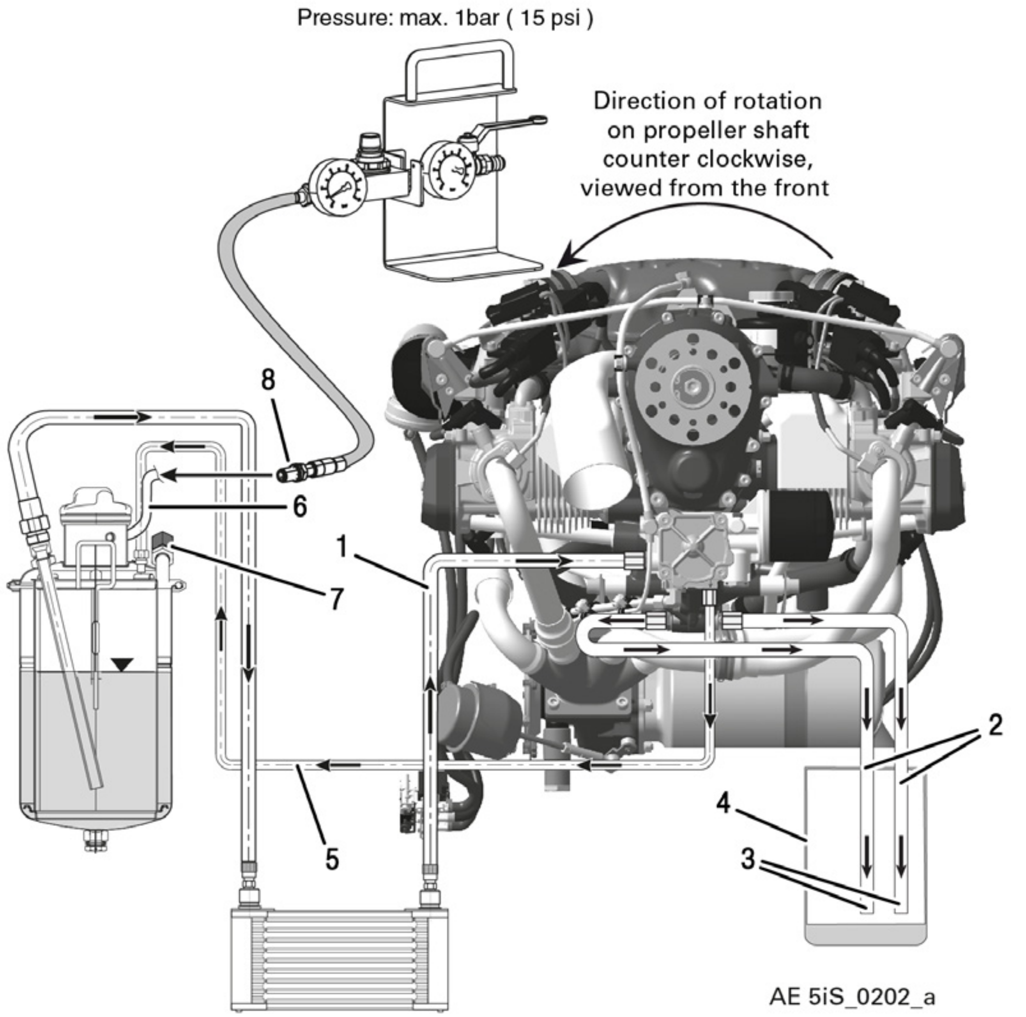

Figure 12.12: Setup for venting the oil system, TYPICAL

1	*Suction line*	2	*Oil return line*
3	*Free end*	4	*Temporary oil collection tank*
5	*Oil return line (Turbocharger)*	6	*Vent fitting*
7	*2 x Screw socket (Oil inlet)*	8	*Temporary connection for purging*

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

1. Remove magnetic plug or crankshaft locking screw.
2. Attach pressure sensor (pressure gauge with liquid damping). The thread for the magnetic plug must be M12x1,5 (metric). The thread for the crankshaft lock pin hole must be M8.
3. Start the engine according the Operators Manual (OM) and read the crankcase pressure value at full throttle.
4. Compare the read out value with the limitations for the crankcase pressure specified in the section “System Limitations” of this chapter.
   If the readings exceed the pressure limits, then the flow resistance in the oil return line from oil sump to oil line is too high in the current engine installation (contamination, restrictions of cross-section etc.) This condition is unsafe and must be rectified immediately.
5. Re-install magnetic plug or screw into crankshaft locking pin hole. When reinstalling the screw always use a new gasket.

Chapter: 80–00–00
STARTING

TOPICS IN THIS CHAPTER

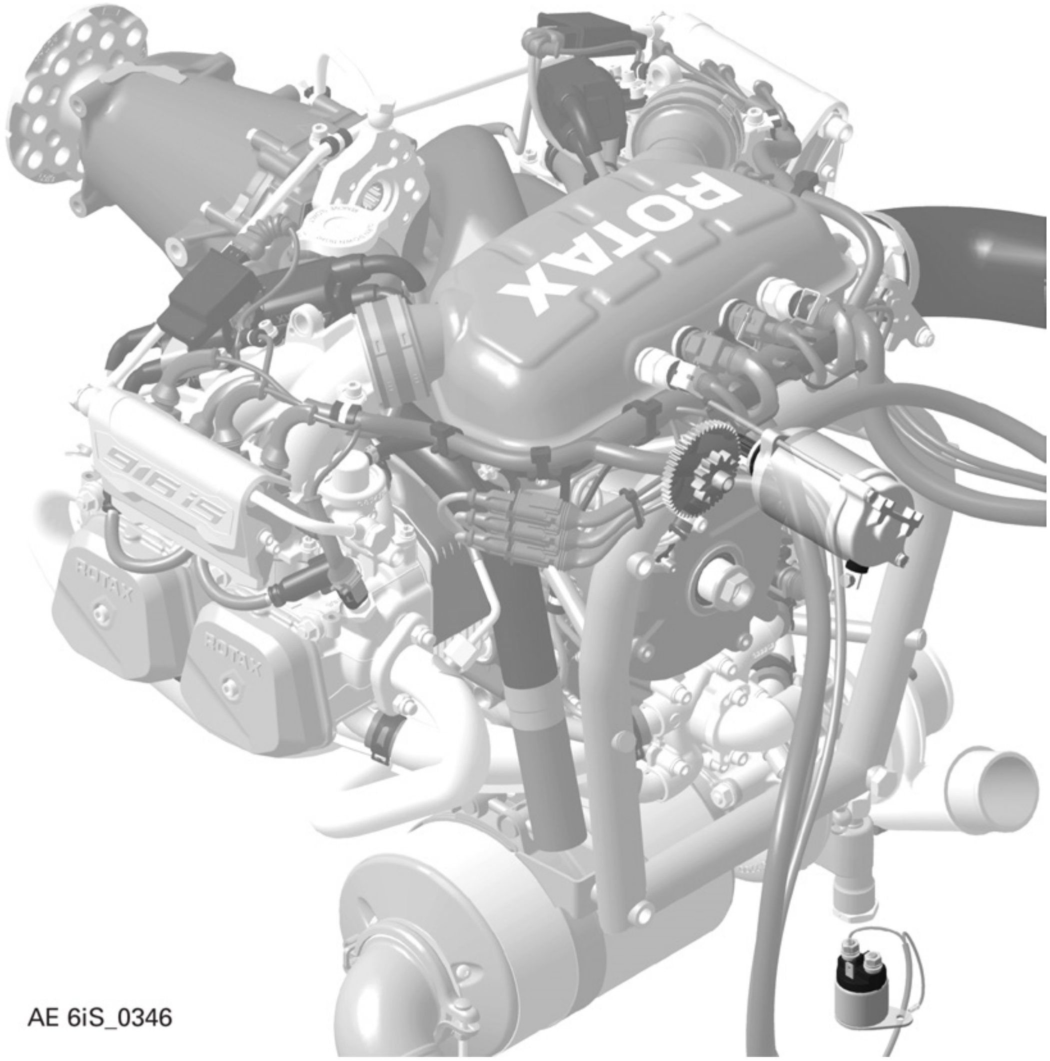

Figure 13.1: Starting

SYSTEM DESCRIPTION

For a detailed System description refer to the latest issue of the Operators Manual (OM).

SYSTEM LIMITATIONS

Operating limits Refer to latest issue of the Operators Manual (OM).

Ambient temperatures

System Limit	Min.	Max.
Electric Starter	- 40 °C (- 40 °F)	80 °C (176 °F)

Thermal durability Suitable for short starting periods only. Activate starter for max. 10 seconds (without interruption), followed by a cooling period of 2 minutes.

Aircraft ground The engine block must be connected to the aircraft using a properly sized ground strap (minimum the same cable cross section as starter supply), to provide the required starter current and to avoid static electricity between the engine and the aircraft.

INTERFACE DESCRIPTION

INTERFACE OVERVIEW

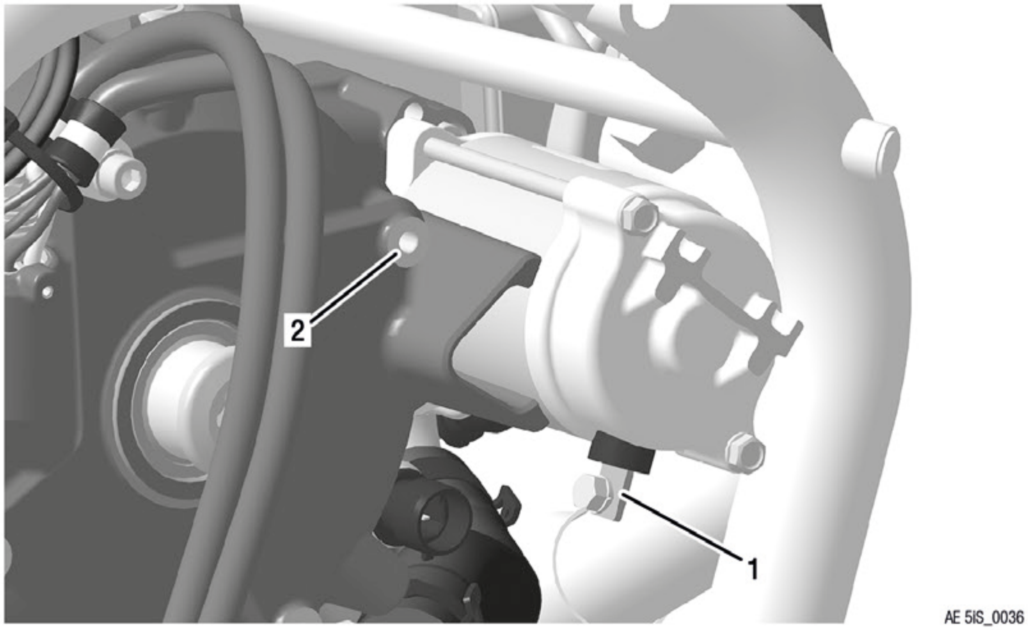

Figure 13.2: Starter interfaces

1 *Positive terminal*

2 *Negative terminal*

ELECTRICAL INTERFACES

Positive terminal

916 i TYPE A

Interface Parameter	Min.	Max.	Nominal
Input voltage:			12 V
Input load:* * for resistance of starter circuit Rsmax = <20 mOhm	20 A	350 A[4]	

The terminal must be conducted as M5 screw connection suitable for cable lug according to DIN 46225.
Tightening torque: Min. 3 Nm (27 in.lb) Max. 5 Nm (44 in.lb).

4. When electric starter is activated

Positive terminal

916 i TYPE C24

Interface Parameter	Min.	Max.	Nominal
Input voltage:			24 V
Input load:* * for resistance of starter circuit Rsmax = <20 mOhm	20 A	350 A[5]	

The terminal must be conducted as M5 screw connection suitable for cable lug according to DIN 46225.
Tightening torque: Min. 3 Nm (27 in.lb) Max. 5 Nm (44 in.lb).

Negative terminal The engine block must be connected to the airframe using a properly sized ground strap (minimum the same cable cross section as the starter supply), for carrying the starter current and to avoid static electricity between the engine and the airframe.

5. When electric starter is activated

INSTALLATION NOTES

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.
The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.
The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

INSTALLATION OVERVIEW

916 i TYPE A

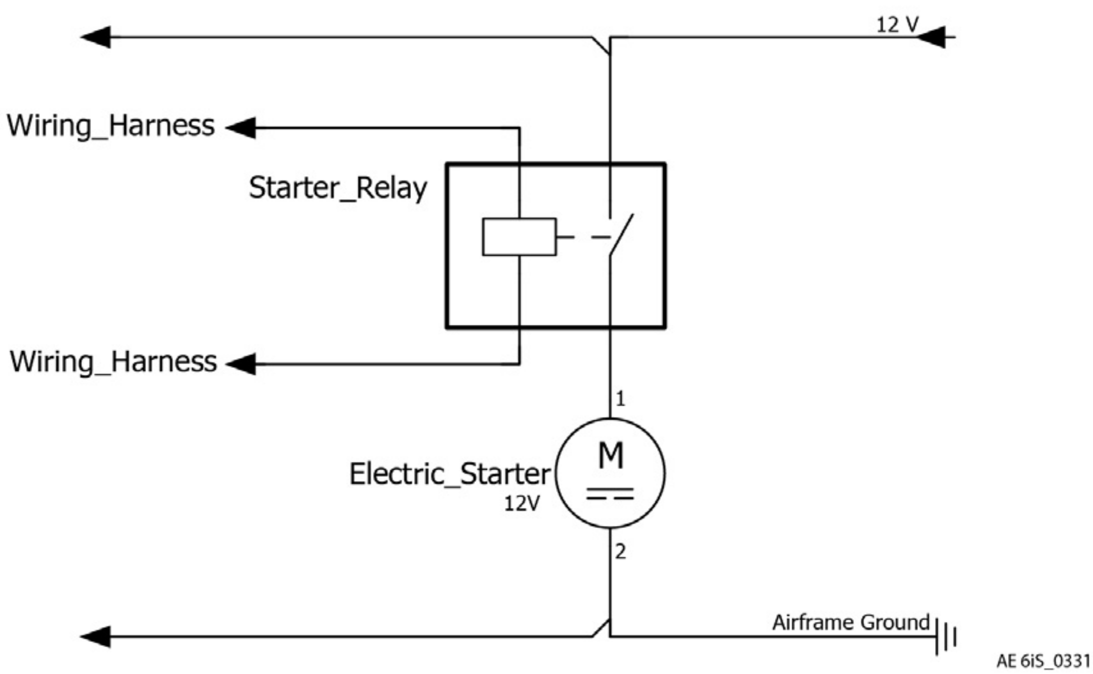

Figure 13.3: Engine starting circuit

916 i TYPE C24

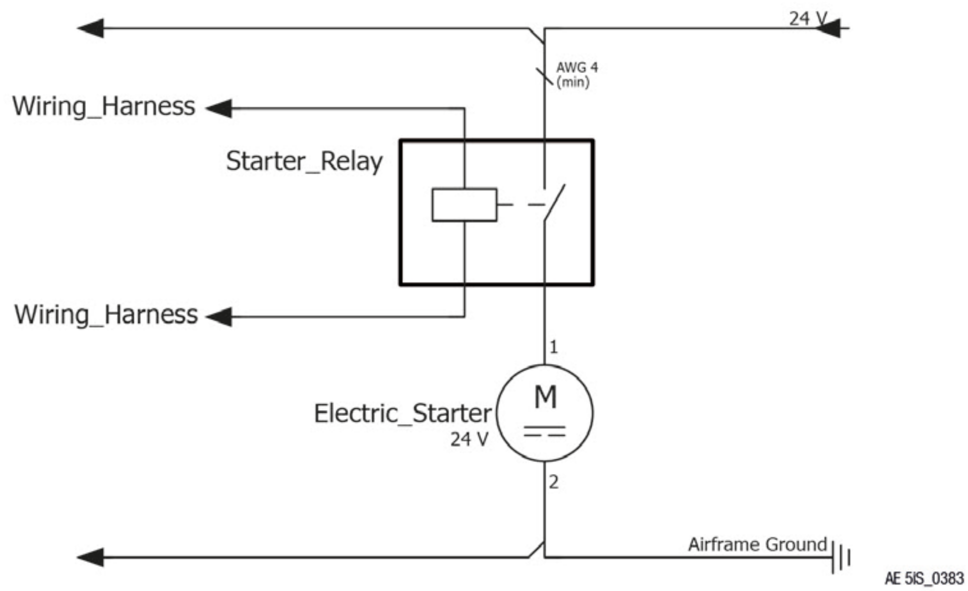

Figure 13.4: Engine starting circuit

WIRING

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 is recommended to be calculated according to the following table.

l [m]	l [ft]	$A_{min.}$ [mm²]	$A_{min.}$ [in²]	$A_{max.}$ [mm²]	$A_{max.}$ [in²]	$AWG_{min.}$
<4	<13	20.408	0.031	25	0.039	4
4<l<4.5	13<l<14.8	22.959	0.036	35	0.054	3
4.5<l<5	14.8<l<16.4	25.51	0.04	35	0.054	3
5<l<5.5	16.4<l<18	28.061	0.043	35	0.054	2
5.5<l<6	18<l<19.7	30.612	0.047	35	0.054	2
6<l<6.5	19.7<l<21.3	33.163	0.051	35	0.054	2
6.5<l<7	21.3<l<23	35.714	0.055	50	0.078	1
7<l<7.5	23<l<24.6	38.265	0.059	50	0.078	1
7.5<l<8	24.6<l<26.2	40.816	0.063	50	0.078	1
8<l<8.5	26.2<l<27.9	43.367	0.067	70	0.109	0
8.5<l<9	27.9<l<29.5	45.918	0.071	70	0.109	0

l [m]	l [ft]	$A_{min.}$ [mm²]	$A_{min.}$ [in²]	$A_{max.}$ [mm²]	$A_{max.}$ [in²]	$AWG_{min.}$
9<l<9.5	29.5<l<31.2	48.469	0.075	70	0.109	0
9.5<l<10	31.2<l<32.8	51.02	0.079	70	0.109	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 (RS^{max}) may not exceed 0.015 Ω.

$R_{Smax} = \Sigma R = R_{iBatt} + R_{C\ Starter\ relay} + R_L + R_{Other}$

Symbol	Description
R_{iBatt}	Inner resistance of battery
$R_{C\ Starter\ Relay}$	Contact resistance starter relay
R_L	Line resistance
R_{Other}	Any other resistor (e.g. Master relay, contact resistance...)

STARTER RELAY ASSY. TECHNICAL DATA

NOTICE

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

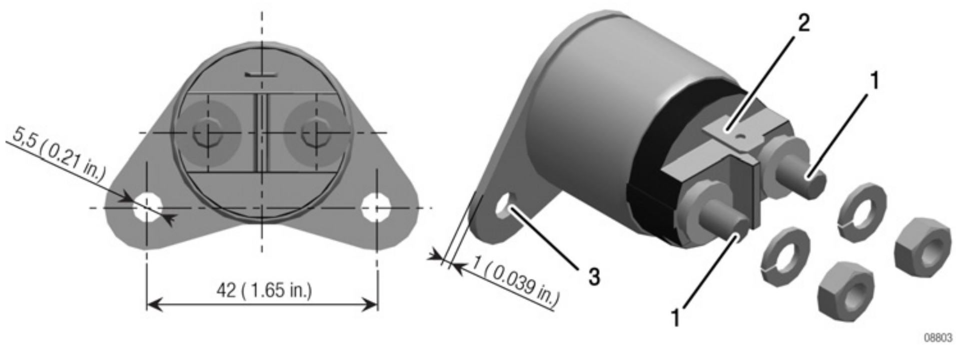

Figure 13.5: Starter relay

1 *Main current connections*
2 *Control wiring*
3 *Mounting point*

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

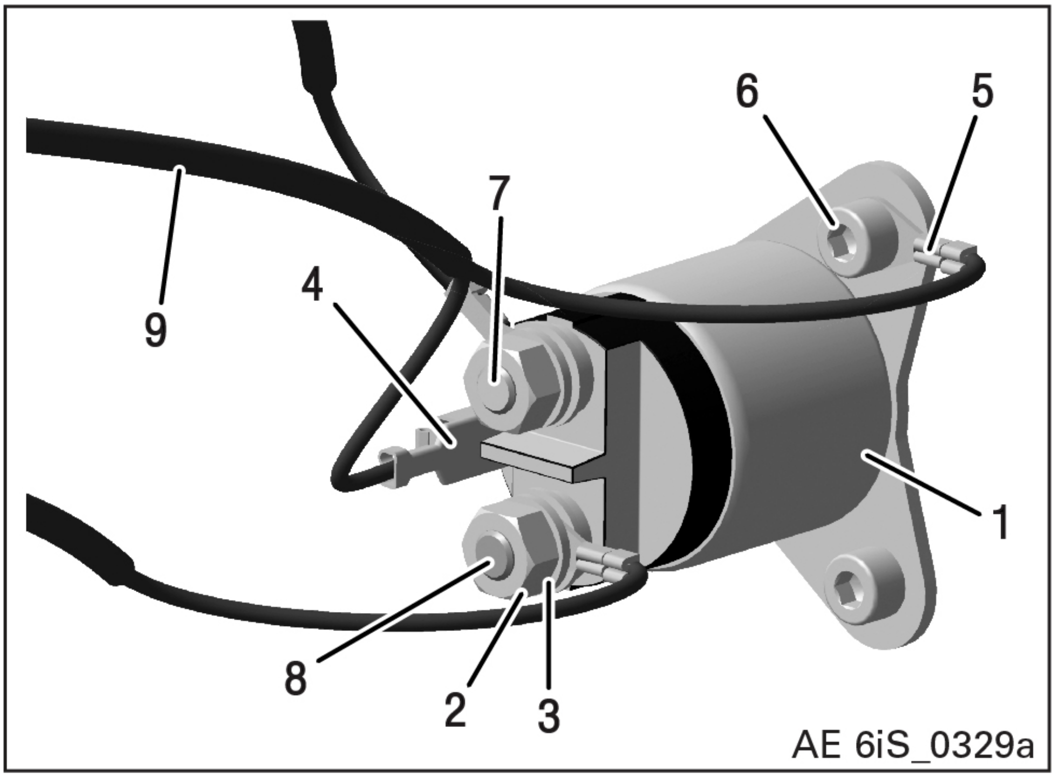

Figure 13.6: Starter relay

1	*Starter relay*	2	*Hex. nut M6*
3	*Washer 6.4*	4	*Terminal S*
5	*Ground*	6	*Bolt/screw*
7	*Terminal B*	8	*Terminal M*
9	*Wiring harness (Engine)*		

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.

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Chapter: 92–00–00
WIRING DIAGRAMS

TOPICS IN THIS CHAPTER

General

This Chapter contains the wiring diagrams for each relevant engine system installation.

The wiring diagrams have the same numbering system and abbreviations as used in this Manual

Title	Drawing Number	Rev. Number	Number of Sheets
Wiring diagram ROTAX® 916 i Type A	Z16855	0	1
Wiring diagram ROTAX® 916 i Type C24	Z17217	0	1

Dashboard
Firewall
MaintenancePort_Lane_A
MaintenancePort_Lane_B
Fuel_Pump_1
Fuel_Pump_2
Lane_Select_Switch_A
Lane_Select_Switch_B
Engine_Start_Button
Warning_Lamp_A
Warning_Lamp_B
External_Generator_Indicator_Lamp
External_Generator_Switch
Master_Switch
Start_Power_Switch
Battery_Backup_Switch
EMS_Ground
HIC_A
HIC_B
Ring Terminal
Starter_Relais
ECU A1
ECU A2
ECU B
ECU
Lane_A1
Lane_A2
Lane_B
AmbientAirPressureAndTemperature_Sensor_1
AmbientAirPressureAndTemperature_Sensor_2
OilPressure_Sensor
OilTemperature_Sensor
ExhaustGasTemperature_Sensor_1-3
Boost_Pressure_Sensor_1
Boost_Pressure_Sensor_2
Solenoid_Valve_A_B_C
PCV_C
PCV_A
PCV_B
AAPTS_1
AAPTS_2
OPS
OTS
EGTS_1-3
BPS_1
BPS_2
TPS
ThrottlePosition_Sensor
Deutsch_Connector_Black
EMS_Ground
MATS_1
ManifoldAirTemperature_Sensor_1
MAPS_1
ManifoldAirPressure_Sensor_1
CrankPosition_Sensor_1
CPS_1
KNOCK
Knock_Sensor
CPS_2
CrankPosition_Sensor_2
MATS_2
ManifoldAirTemperature_Sensor_2
MAPS_2
ManifoldAirPressure_Sensor_2
Only if installed (optional)
External_Generator
Regulator_A
Regulator_Plate_A
Regulator_Plate_B
Fusebox
ExhaustGasTemperature_Sensor_2-4
EGTS_2-4
CTS
Coolant_Temperature_Sensor
Airframe_Ground
Starter
Battery
Master_Switch
Airframe_Ground
Airframe_power_bus_+28V
Generator_A
Generator_B
INJ_1
Injector_1
INJ_3
Injector_3
INJ_5
Injector_5
INJ_7
Injector_7
COIL_1
Ignition_Coil_1
COIL_3
Ignition_Coil_3
COIL_4
Ignition_coil_4
COIL_2
Ignition_coil_2
INJ_8
Injector_8
INJ_6
Injector_6
INJ_4
Injector_4
INJ_2
Injector_2
Rev. Date: 05.06.2023
Description: 916iS_A_C24 wiring harness
Rev.: 01
Drawing Nr.: Z17217
Sheet 1
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