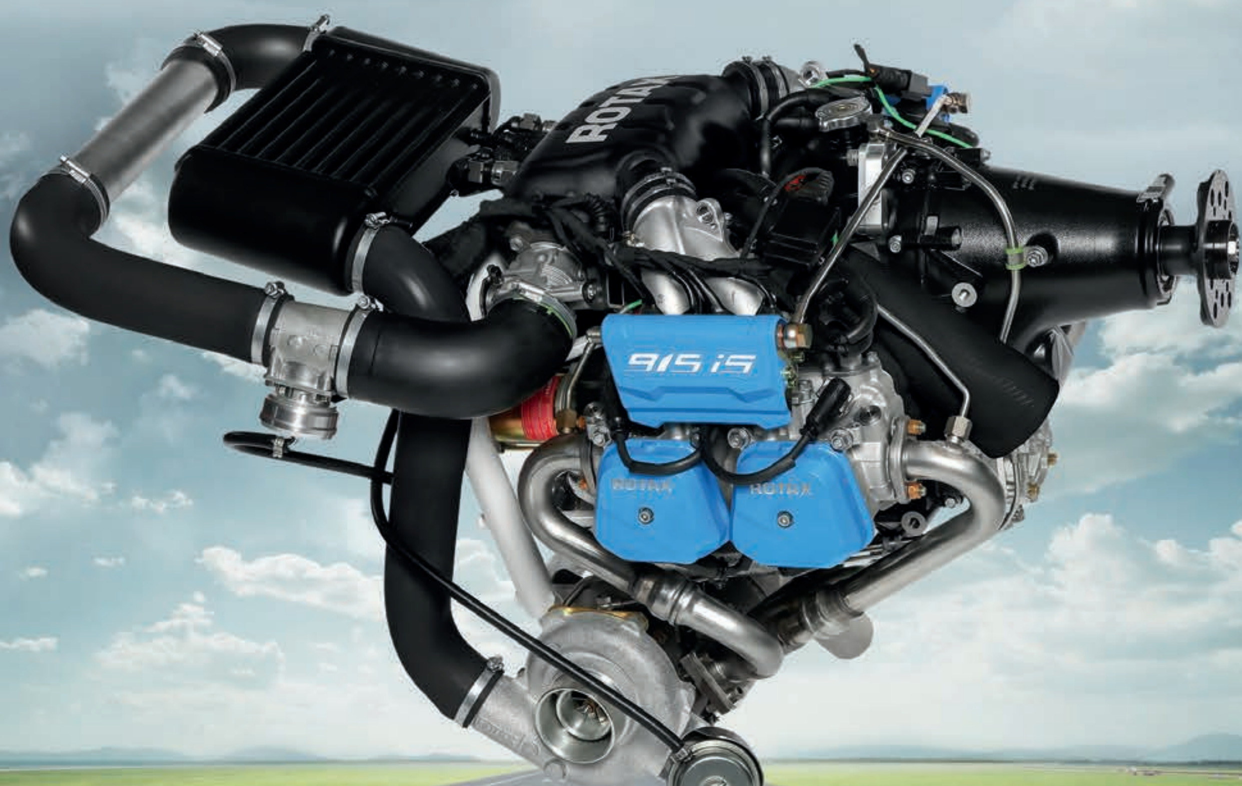
ROTAX®
AIRCRAFT ENGINES

BRP

MAINTENANCE MANUAL

(HEAVY MAINTENANCE) FOR ROTAX® ENGINE TYPE 915 i A SERIES



picture: ROTAX® 915 i A with options

⚠ WARNING

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

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

Table of Content

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Chapter: INTRO
GENERAL NOTE

Foreword

Before carrying out maintenance work on the engine, read this Maintenance Manual carefully.
If any passages of the Manual are not clearly understood or in case of any questions, please contact your nearest ROTAX® Authorized Aircraft Engines Distributors or their independent Service Centers.

BRP-Rotax wishes you much pleasure and satisfaction flying your aircraft powered by this ROTAX®-aircraft engine.

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

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LIST OF EFFECTIVE PAGES

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

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Chapter: TOA
TABLE OF AMENDMENTS

Approval*
The technical content of this document is approved under the authority of DOA ref. EASA.21.J.048.
This document is part of the ICA for product [2019].

Current no.	Chapter	Page	Date of change	Remark for approval	Date of approval from authorities	Date of inclusion	Signature
0	INTRO	all	August 01 2018	DOA*			
0	LEP	all	August 01 2018	DOA*			
0	TOA	all	August 01 2018	DOA*			
0	00-00-00	all	August 01 2018	DOA*			
0	24-20-00	all	August 01 2018	DOA*			
0	61-20-00	all	August 01 2018	DOA*			
0	71-00-00	all	August 01 2018	DOA*			
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0	76-50-00	all	August 01 2018	DOA*			
0	76-70-00	all	August 01 2018	DOA*			

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0	80-00-00	all	August 01 2018	DOA*			

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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	00–00–00	3,4	June 01 2019	New configuration 2. New - wiring color codes
1	72–10–00	all	June 01 2019	Change of text and figures. New - Configuration 2
1	78–20–00	16,18	June 01 2019	Change of text. New - Adjustment of the wastegate

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Chapter: 00–00–00
GENERAL NOTE

TOPICS IN THIS CHAPTER

GENERAL

Purpose

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

Documentation

For more 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, maintenance or parts, you can also contact your nearest ROTAX® authorized Aircraft Engines distributor or their independent Service Center.

ROTAX Distributors

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

Engine serial number

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

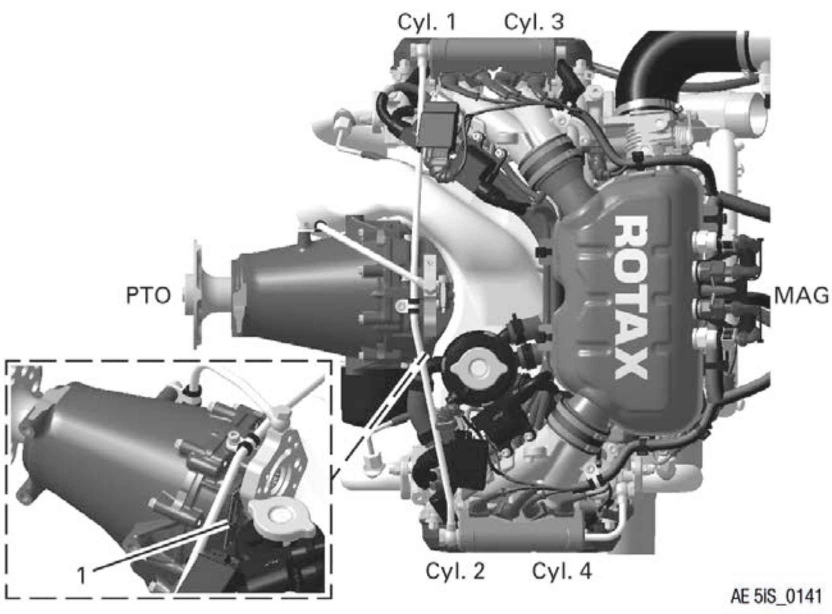

Figure 1.1: Engine serial number

1 Engine serial number

TYPE DESCRIPTION

The type description consists of the following parts:

e. g. **ROTAX**	**915**	**iSc**	**2**	**A**
	type	certification	configuration	additional designation

Designation

Designation		**Description**
Type	**915**	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**	Standard 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 version 2 to version 3 and vice versa may be accomplished by BRP-Rotax Authorized Distributors or their Service Center.

ABBREVIATIONS AND TERMS

Abbreviations	Description
*	Reference to another section
⊕	center of gravity
💧	The drop symbol indicates use of sealing agents, adhesives or lubricants (only in the Illustrated Parts Catalog).
°C	Degrees Celsius (Centigrade)
°F	Degrees Fahrenheit
rpm	Revolutions per minute
A	Ampere
AAPTS	Ambient Air Pressure Temperature Sensor
AC	alternating current
AD	Airworthiness Directives
Ah	Ampere hour
A/C	Aircraft
AR	as required
assy.	assembly
ASB	Alert Service Bulletin
ACG	Austro Control GmbH
ACL	Anti Collision Light
API	American Petrol Institute
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
AWG	American Wire Gauge
CAN	Controller Area Network
Coil 1–4	Ignition coils 1–4
CPS 1+2	Crankshaft Position Sensor 1+2
CSA	Constant Speed Actuator
CTS	Cooling Temperature Sensor
CW	clockwise
CCW	counter-clockwise
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
Fuse box	Power conditioning and distribution for the Engine Management System
hr.	hours
HIC A	Harness Interface Connector A
HIC B	Harness Interface Connector B
IAT	Indicated Air Temperature
ICA	Instructions for Continued Airworthiness
IFR	Instrument Flight Rules
IFSD	In-flight-shutdown
INJ 1–8	Injector 1–8
IPC	Illustrated Parts Catalog
ips	inch per second
iRMT	independent ROTAX Maintenance Training
ISA	International Standard Atmosphere
kg	Kilograms

KNOCK	Knock sensor
Lane A	System A of Engine Management System
Lane B	System A of Engine Management System
LOPC	Loss of power control
MAPS 1 & 2	Manifold Air Pressure Sensor 1 & 2
MATS 1 & 2	Manifold Air Temperature Sensor 1 & 2
MON	Motor Octane Number
MAG	Magneto Side
N	Newton
n.a.	not available
NDT	Non Destructive Testing
Nm	Newtonmeter
NVFR	Night Visual Flight Rules
OAT	Organic Acid (Additive) Technology
OHM	Overhaul Manual
OHV	Over Head Valve
OM	Operators Manual
OPS	Oil Pressure Sensor
OTS	Oil Temperature Sensor
PCD	Pitch Circle Diameters
PCV	Pressure Control Valve
PMA	Permanent magnet alternator
POA	Production Organisation Approval
PS	Power supply
PTFE	Polytetrafluoroethylene (Teflon)
PTO	Power Take Off
Rev.	Revision
ROTAX®	is a trademark of BRP-Rotax GmbH & Co KG
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	Shield twisted pair
SL	Service Letter
SMD	Surface Mounted Devices
TBO	Time Between Overhaul
TC	Type certificate
part no.	part number
TOA	Table Of Amendments
TOC	Table of content
TPS	Throttle Position Sensor
TSN	Time Since New
TSNP	Time Since New Part
TSO	Time Since Overhaul
V	Volt
VFR	Visual Flight Rules
LEP	List of Effective Pages
MM	Maintenance Manual
MEP	Multi Engine Piston
X3	Connector on Engine Management System wiring harness which serves as an interface for power supply
XXXX	shows the serial component number

WIRING COLOR CODES

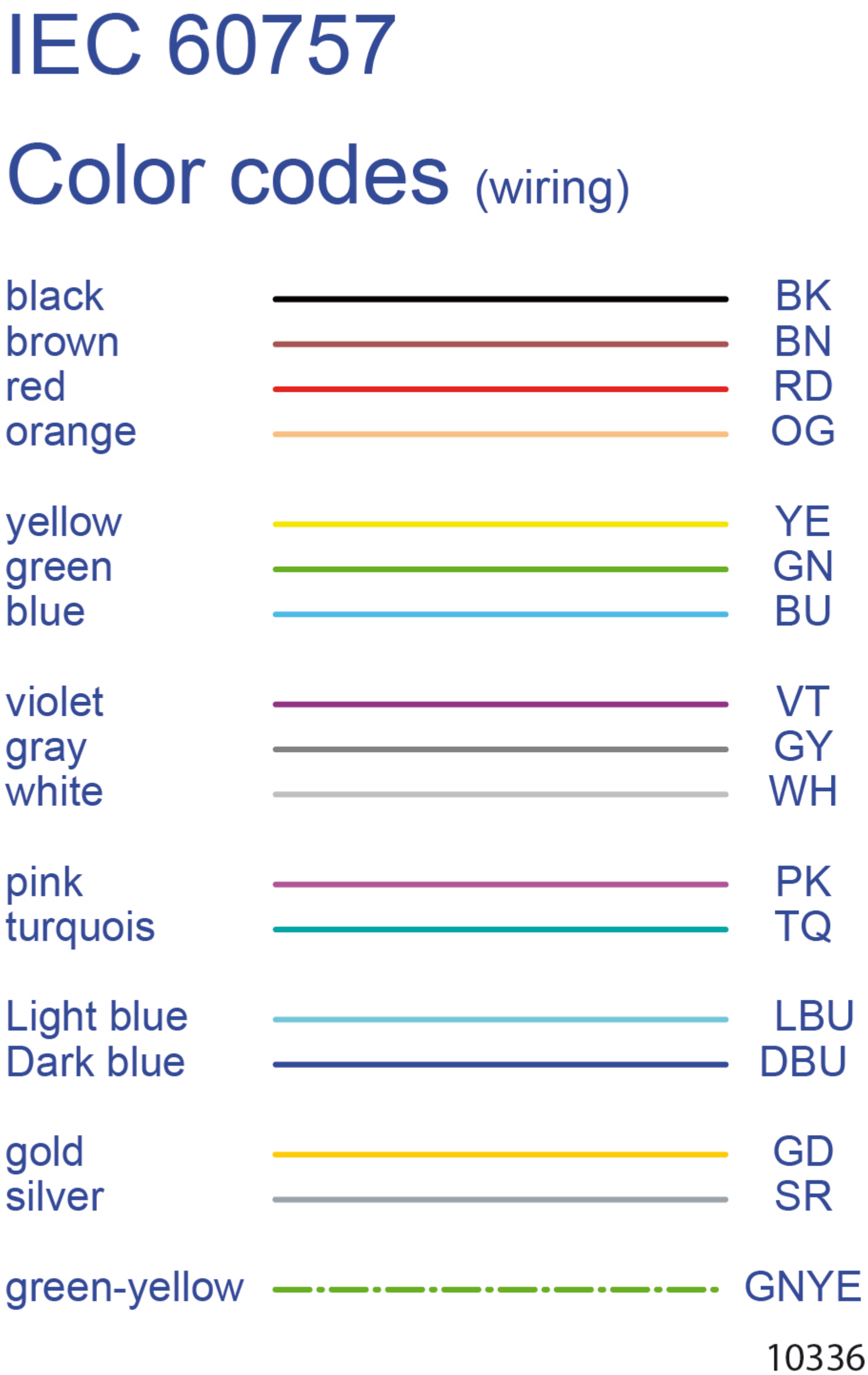

Figure 1.2

CONVERSION TABLE

Units of length:	**Units of power:**
1 mm = 0.03937 in 1 in = 25.4 mm 1 ft = 12 in = 0.3048 m	1 kW = 1.341 hp 1 hp = 0.7457 kW 1 kW = 1.3596 PS 1 PS = 0.7355 kW
Units of area:	**Units of temperature:**
1 cm^2 = 0.155 sq. in (in^2) 1 sq. in (in^2) = 6.4516 cm^2	K = °C – 273,15 °C = (°F – 32) / 1,8 °F = (°C x 1.8) +32
Units of volume:	**Units of velocity:**
1 cm^3 = 0.06102 cu in (in^3) 1 cu in (in^3) = 16.3871 cm^3 1 dm^3 = 1 l 1 dm^3 = 0.21997 gal (UK) 1 gal (UK) = 4.5461 dm^3 1 dm^3 = 0.26417 gal (US) 1 gal (US) = 3.7854 dm^3	1 m/s = 3.6 km/h 1 ft/min = 0.3048 m/min = 0.00508 m/sec 1 m/s = 196.85 ft/min 1 kt = 1.852 km/h 1 km/h = 0.53996 kn
Units of mass:	**spec. fuel consumption:**
1 kg = 2.2046 lbs. 1 lb. = 0.45359 kg	1 g/kWh = 0.001644 lb/hph 1 lb/hph = 608.277 g/kWh
Density:	**Units of torque:**
1 g/cm^3 = 0.016018 lb/ft^3 1 lb/ft^3 = 62.43 g/cm^3	1 Nm = 0.737 ft lb = 8.848 in lb 1 ft lb = 1.356 Nm 1 in lb = 0.113 Nm
Units of force:	**Cable cross-section: Conversion table-Wire Gauge: AWG-mm^2**
1 N = 0.224809 lbf 1 lbf = 4.4482 N	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.

ATTENTION

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

NOTE

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

ENVIRONMENTAL NOTE

Environmental notes give you tips on environmental protection.

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

SAFETY INFORMATION

Use for intended purpose

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

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

- This engine is not suitable for aerobatics (inverted flight, etc.). Flight attitudes outside the permissible limits are not allowed
- This engine has exclusively been developed and tested for fixed wing, gyrocopter, pusher and tractor applications. In case of any other usage, the OEM is responsible for testing and the correct function of the engine
- It should be clearly understood that the choice, selection and use of this particular engine on any aircraft is at the sole discretion and responsibility of the aircraft manufacturer, assembler or owner/user
- Due to the varying designs, equipment and types of aircraft, BRP-Rotax grants no warranty on the suitability of its engines use on any particular aircraft. Further, BRP-Rotax grants no warranty on this engines suitability with any other part, component or system which may be selected by the aircraft manufacturer, assembler or user for aircraft application

> ⚠ **WARNING**
>
> **Non-compliance can result in serious injuries or death!**
> For each use of DAY VFR, NIGHT VFR or IFR in an aircraft the applicable legal requirements and other existing regulations must be adhered to.

- In addition to observing the instructions in our Manual, general safety and accident precautions, legal regulations and regulations of any aeronautical authority must be observed
- Where differences exist between this Manual and regulations provided by any authority, the more stringent regulation shall be applied
- For continued airworthiness see Maintenance Manual Line
- Unauthorized modifications of engine or aircraft will automatically exclude any liability of the engine manufacturer for consequential damage

Engine operation

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

INSTRUCTION

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

Safety notice

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

Accessories

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

Spare parts

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

ATTENTION

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

Standard tools / Special tools

ATTENTION

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

State of delivery

⚠ WARNING

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

See latest Operators Manual and Service Instruction SI-915 i-001 “Selection of suitable operating fluids“, current issue.

MAINTENANCE CONCEPT

General note

The maintenance functions detailed in this Manual are divided into two categories:

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

Repairs beyond the levels detailed in Manual I and Maintenance Manual II are not recommended as maintenance functions and must be conducted by an authorized overhaul facility.

Maintenance I (Line Maintenance)

Chapter 00,05 and 12
The scope of line maintenance consists of servicing and adjustment of engine components (including part wear). All procedures in this Manual are to be considered line maintenance.

NOTE

Where applicable, you will be referred to the Heavy Maintenance Manual for work above and beyond line maintenance.

Maintenance II (Heavy Maintenance)

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

NOTE

This Manual can only be used in combination with Maintenance Manual I (Line Maintenance), as it builds upon it.

TECHNICAL DOCUMENTATION

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

Documentation

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

Status

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

Replacement pages

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

Reference

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

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

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

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.

USE FOR INTENDED PURPOSE

⚠ WARNING
Explosion hazard. Flying components can cause serious injuries. Never run an engine without propeller.

Use

The engine ROTAX® 915 iSc is intended for use in certified aircraft. In case of doubt the regulations of the national authorities or the respective sportive federations have to be observed.

Certified engines

The certified aircraft engine ROTAX® 915 iSc A has been tested as per aeronautical standards for safety and time between overhaul. It was developed to conform to the latest technological standards and has been rigorously tested.

Non certified engines

The ROTAX® 915 iS A is not certified. These engines have not received any aeronautical standards or regulatory safety or durability testing, and do not conform to any aircraft standards. These engines are meant for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety.

NOTE

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

Engine stoppage

In using the engine the operator assumes all risk of use and acknowledges that he/she knows this engine is subject to sudden stoppage.

Maintenance and repair conditions

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

INSPECTION OF PARTS AND REPORT OF FINDINGS

General note

Measure all parts listed in the dimension sheets. These are attached directly after each section.
All measurements must be entered in the corresponding dimension sheets as shown.

Filling in the dimension sheets

Following the description how to fill in the dimension sheets.

ATTENTION
If the engine is overhauled/repaired before the end of the TBO, the 50 % specified values for wear limits do not apply and must be calculated separately in accordance with section ”Classification of parts for maintenance/repair”.

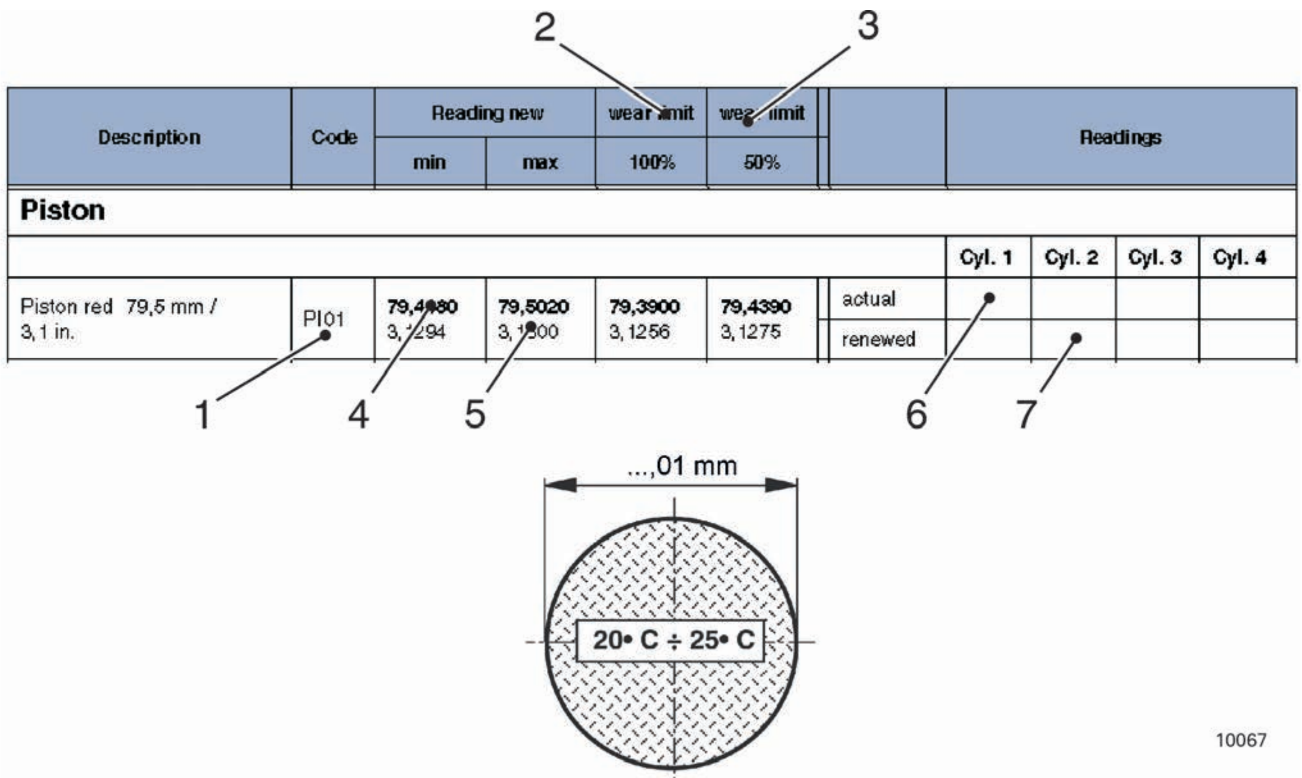

Figure 1.3: EXAMPLE ONLY

- Look up the desired control point code (1) in the illustration in the specified section
- The maximum limits for wear are divided into the columns maximum wear 100 % (2) and 50 % wear (3)
- The first line (4) gives the maximum permissible value in [mm], the second line (5) in [inches]

- The respective actual value must be entered in the corresponding box (6) in [mm] or [inches]
- The actual value for any part which has been replaced must be entered in the corresponding field (7) in [mm] or [inches]

List of abbreviations

The following table shows the abbreviations used for the control points.

Abbreviation	Description
AL	**al**ternator
CA	**ca**mshaft
CC	**c**rank**c**ase
CH	**c**ylinder **h**ead
CR	**c**on**r**od
CS	**c**rank**s**haft
CY	**cy**linder
EL	**el**ectric
ES	**e**lectric **s**tarter
EX	**ex**haust
GB	**g**ear**b**ox
GO	**go**vernor
OP	**o**il **p**ump
PI	**pi**ston **pi**n
ST	**st**ator
VT	**v**alve **t**rain
WP	**w**ater **p**ump

ATTENTION

Where measurement values are taken in hundredth of a millimeter or more precisely, the temperature of the part must be 20 to 25 °C (68 to 77 °F).

CLASSIFICATION OF PARTS FOR MAINTENANCE/REPAIR

General note

As for an overhaul, parts for maintenance/repair must be classified. They are classified either as “parts usable“ (“On-Condition“) or as “parts to be replaced“ (“100 % Parts“).

Criteria

The classification is made on the basis of following criteria:

- Hours of operation (decisive are the total operating hours of the part/engine or hours since the last overhaul)
- Determined (measured) actual dimension of the respective parts

Max. permissible wear

Proceed as follows:

- Determine the hours of operation for the part in question (logbook etc.)
- Determine wear as a percentage of the wear tolerance (see the dimension sheets attached directly after each section for the wear limit (100 %) of the part in question)
- The classification is carried out as per following table:

TSN [h] Time Since New		max. permissible wear for repair [%]
from	**to**	**TBO 1200 h – 915 i Series**
0	25	2
26	50	4
51	75	9
76	100	12
101	150	18
151	200	24
201	250	30
251	300	36
301	350	42
351	400	46
401	450	52
451	500	56
501	550	60
551	600	62
601	700	67
701	800	72
801	900	76
901	1000	80

TSN [h] Time Since New		max. permissible wear for repair [%]
from	**to**	**TBO 1200 h – 915 i Series**
1001	1100	83
1101	1200	87

Determination of actual wear [%]

- Determine actual dimension F of the part in question
- For new dimension (max.) B and wear limit C see the corresponding dimension sheets attached after each section
- Determine the actual wear [%] with following formula

$$\text{Actual wear} = \frac{\{\text{Actual dimension (F) - New dimension max. (B)}\} \times 100}{\{\text{Wear limit (C) - New dimension max. (B)}\}} \quad [\%]$$

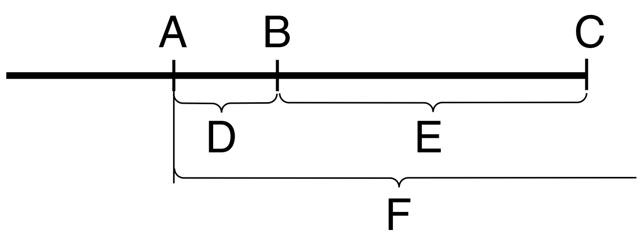

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Figure 1.4: Formula

A	*New dimension (min)*	**B**	*New dimension (max)*
C	*Wear limit*	**D**	*New dimension tolerance*
E	*Wear tolerance*	**F**	*Actual dimension*

ATTENTION
New dimension (max.) B is always the dimension which is closest to wear limit C.

Classification of “On-Condition“ parts at maintenance/repair:

Actual wear [%] is **greater** than or **equal** to the **max. permissible wear** [%] calculated from the table	Parts must be replaced
Actual wear [%] is **smaller** than the **max. permissible wear** [%] calculated from the table	Parts can be used again

NOTE

*A negative result means that the actual dimension **F** is within the new dimension tolerance **D** and the part can be used again.*

Example

The hours of operation are indicated with 300 h. The determined percentage of maximum permissible wear is therefore 36 %.

New dimension (max.)	**B**	28.03 mm (1.1035 in.)
Wear limit	**C**	28.10 mm (1.1062 in.)
Actual dimension	**F**	28.07 mm (1.1051 in.)
Actual wear		57.1%

This part must be replaced because it is excessively worn for only 300 hours of operation.

MAINTENANCE

General note

Beyond the maintenance and special checks (see therefore Line Maintenance Manual), as well as the system descriptions hitherto, the following sections describe the maintenance procedures for affected engine type. The description is subdivided into subsections and descriptions of the function of the various systems.
Some overlapping maintenance instructions are treated as generally valid information at the beginning of this section.

Troubleshooting

In the Operators Manual possible problems as well as feasible remedies are listed. At the same time, brief reference is made to the necessary remedial action.

See the respective section in the Operators Manual for the engine Type 915 i A Series.

Tightening torques

Tighten fasteners to the torque specified in the exploded view(s) and/or in the written procedure.

⚠ WARNING

Non-compliance can result in serious injuries or death!
Exactly observe the tightening torques for screws and nuts. Overtightening or a connection which is too loose could cause serious engine damage.

In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

- Manually screw all screws, bolts and/or nuts
- Apply half the recommended torque value
- Tighten fastener to the recommended torque value

ATTENTION

Be sure to use the recommended tightening torque for the specified fastener.

NOTE

When possible, always apply torque on the nut.

NOTE

Always torque screws, bolts and/or nuts using a crisscross pattern when multiple fasteners are used to secure a part. Some parts must be torqued according to a specific sequence and torque pattern as detailed in the installation procedure.

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

FASTENER INFORMATION

Self locking fasteners procedure

The following describes common procedures used when working with self-locking fasteners (Hardware supplies with pre-applied adhesive).
Use a metal brush on the fastener threads or a tap to clean the hole properly, then use a solvent. Allow the solvent time to act, then wipe off or blow out with shop air. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

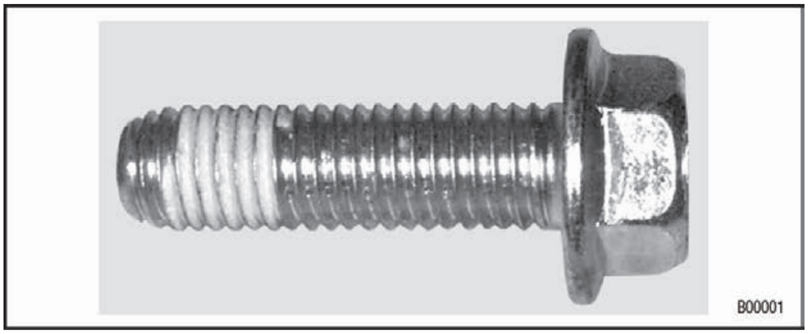

Figure 1.5: Fastener Information

LOCTITE APPLICATION PROCEDURE

The following describes common procedures used when working with LOCTITE products.

NOTE

Always use proper strength LOCTITE product as recommend in this Manual.

Observe the instructions of the manufacturer!

Thread locker application

Thread locker application for uncovered holes (Bolts and nuts).

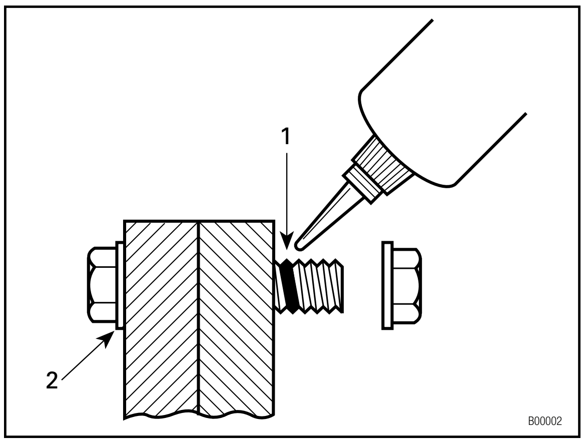

Figure 1.6: Application for uncovered holes (Bolts and nuts)

1 Apply here

2 Do not apply

Step	Procedure
1	Clean threads (bolt and nut) with solvent.
2	Apply LOCTITE 7063 on threads and allow to dry.
3	Choose proper strength LOCTITE thread locker.
4	Fit bolt in the hole.
5	Apply a few drops of thread locker at proposed tightened nut engagement area.
6	Position nut and tighten as required.

Thread locker for blind holes

Thread locker application for blind holes.

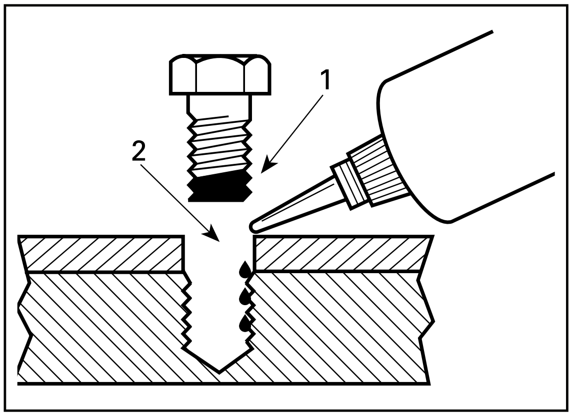

Figure 1.7: Application for blind holes

1 On fastener threads

2 On threads and at the bottom of hole

Step	Procedure
1	Clean threads (bolt and nut) with solvent.
2	Apply LOCTITE 7063 on threads and allow to dry.
3	Choose proper strength LOCTITE thread locker.
4	Apply several drops along the threaded hole and at the bottom of the hole.
5	Apply several drops on bolt threads.
6	Tighten as required.

Thread locker for stud installation

Thread locker application for stud installation in blind holes.

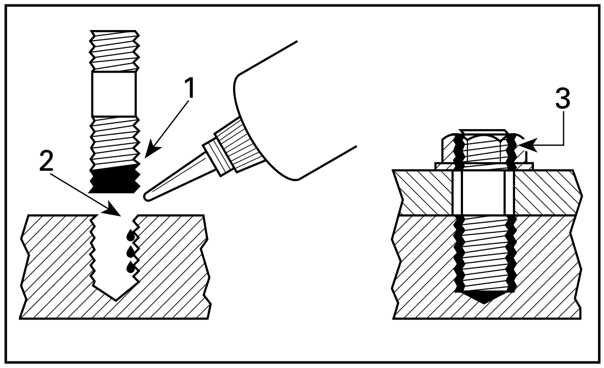

Figure 1.8: Application for stud installation in blind holes

1 On stud threads
2 On threads and in the hole
3 On retaining nut threads

Step	Procedure
1	Clean threads (stud and hole) with solvent.
2	Apply LOCTITE 7063 on threads and allow to dry.
3	Put 2 or 3 drops of proper strength LOCTITE thread locker on female threads and in hole.

NOTE

To avoid a hydro lock situation, do not apply too much LOCTITE.

Step	Procedure
4	Apply several drops of proper strength LOCTITE on stud threads.
5	Install stud.
6	Install cover, part, etc.
7	Apply a few drops of proper strength LOCTITE on uncovered stud threads.
8	Install and tighten retaining nut(s) as required.

Thread locker for pre-assembled parts

Thread locker application for pre-assembled parts.

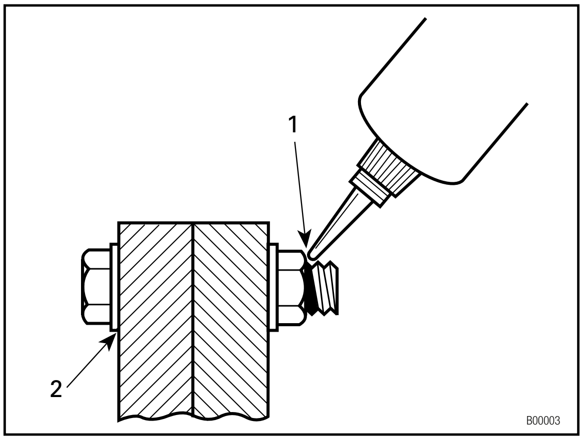

Figure 1.9: Application for pre-assembled parts

1 *Apply here*   2 *Do not apply*

Step	Procedure
1	Clean bolts and nuts with solvent.
2	Assemble components.
3	Tighten nuts.
4	Apply a few drops of proper strength LOCTITE on bolt/nut contact surfaces.
5	Avoid touching metal with tip of flask.

NOTE

For preventive maintenance on existing equipment, retighten nuts and apply proper strength LOCTITE on bolt/nut contact surfaces.

Thread locker for an adjustment screw

Thread locker application for an adjustment screw.

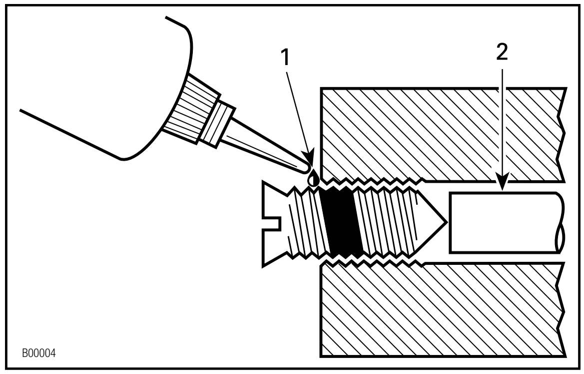

Figure 1.10: Application for an adjustment screw

1 Apply here *2 Plunger*

Step	Procedure
1	Adjust screw to proper setting.
2	Apply a few drops of proper strength LOCTITE thread locker on screw/body contact surfaces.
3	Avoid touching metal with tip of flask.

NOTE

If it is difficult to readjust, heat screw with a soldering iron (232 °C) (450 °F).

LUBRICANT

Consumable materials

ATTENTION

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

Consider the curing time of the sealing surface compound as stated by the manufacturers instructions.

No.	Part no.	Description, application	Qty.
AG	897186	**Silicone heat conduction compound** Application of the heat conduction compound will increase heat transfer. The greaselike, temperature-resistant silicone compound fills cavities between components and cooling elements (e.g.: spark plug - cylinder head), which otherwise do not contribute to heat conduction	150 g
B	897651	**LOCTITE 243** Blue medium duty screw locking agent, oil tolerant	10 ml
C	899788	**LOCTITE 648** Green high temperature screw locking agent + retaining compound	5 ml
E	297434	**LOCTITE ANTI SEIZE 8151** Long-term lubricant for shaft seals	50 ml
F	n.a.	**LOCTITE 7063** For degreasing and cleaning surfaces	AR
H	897870	**K&N FILTER OIL 99–11312**	14.8 ml
I	897330	**LITHIUM-BASE GREASE** Electrical isolating	250 g
O	n.a.	**Engine oil** For easier assembly of components or for first lubrication before first engine start	AR
P	899791	**LOCTITE 5910** Flange sealant provides flexibility and adhesion	50 ml
R	297711	**PU-glue** For vibration damping	310 ml

No.	Part no.	Description, application	Qty.
V	898570	**Screw securing paint** Seals screws	20 ml
Z	899789	**LOCTITE 603** Oil tolerant retaining compound, heavy-duty	10 ml

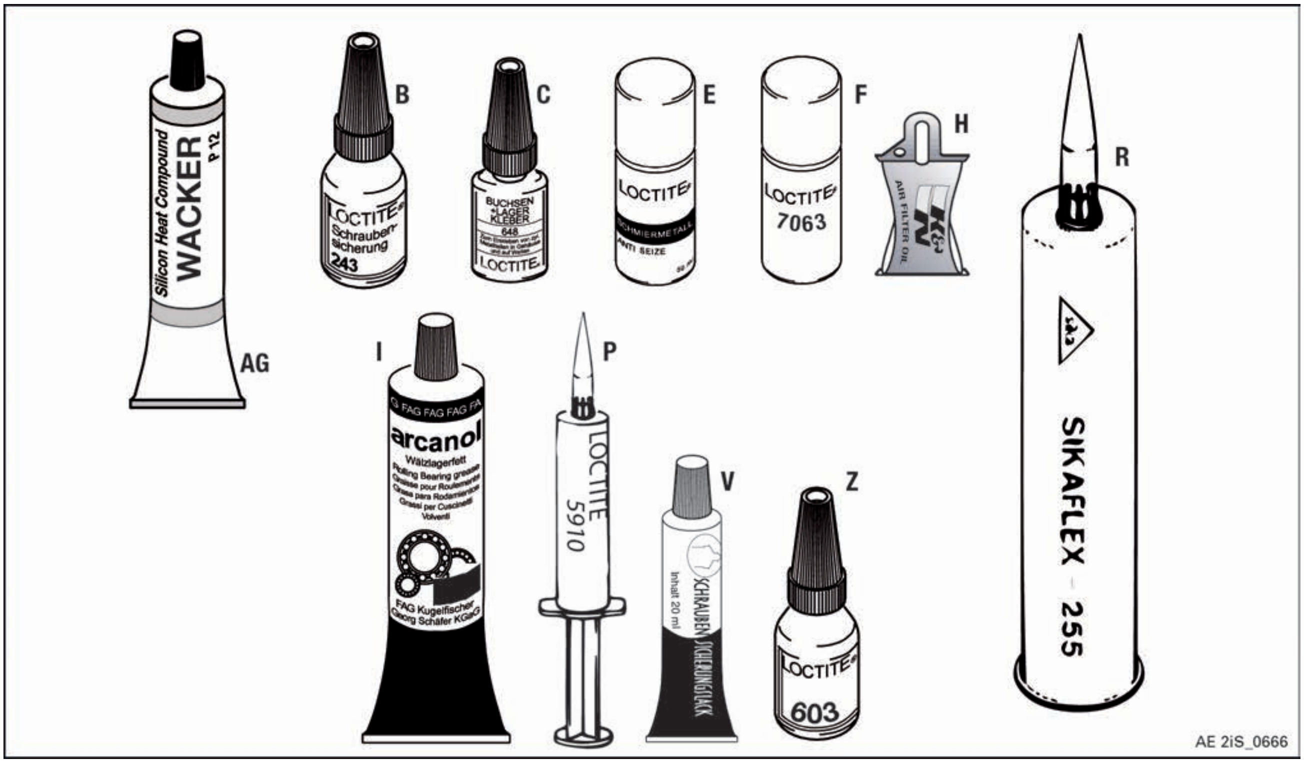

Figure 1.11: Lubricant tools

Additional materials

ATTENTION
All metal and synthetic parts should be cleaned with suitable cleaning agents. Before using new and unknown cleaning agents, check their compatibility with the materials they are being used on.

No.	Part no.	Description, application	Qty.
1	n.a.	**Cleaning agent/solvent/parts cleaner** Soak combustion chamber, piston and cylinder head with cleaning agent and remove combustion residues with a bronze brush. CASTROL “Clenvex 2000“ has proved very effective. It is a solvent - cold cleaner, free of halogen, on the basis of selected fuel fractions and is biodegradable. Never use caustic or corrosive cleaning agents.	AR
2	n.a.	**Multipurpose grease** Generally usable, neutrally colored multipurpose grease, water resistant and highly adherent. Usable for temperatures from -35 °C to +120 °C (-31 °F to 248 °F) and can be subjected to high mechanical loads.	AR
3	n.a.	**Preservation oil** This special oil has excellent penetrating capabilities and reaches even tiny gaps, its highly effective additives protect against corrosion of metal surfaces.	AR
4	n.a.	**Abrasive pad for surface finishing 3M Scotch-Brite Multi Flex - very fine or ultra fine** Is sold by the meter and used for manual removal of smaller rust spots or oxidation, especially for optimum ground connections. It is particularly suitable for removing LOCTITE from surfaces or threads to make them metallic clean. Before re-applying LOCTITE, clean surfaces with nitrothinner or degreasing agent (CASTROL ZA 30 or OMV - SOFT SOL). When using solvents, observe the safety regulations for persons and the environment.	AR

No.	Part no.	Description, application	Qty.
5	n.a.	**Valve lapping paste** This paste, produced by various manufacturers, is a fine granulate lapping paste for manual lapping of valve seats and valves. The paste is usually available in 3 different granulate sizes. Use as per manufacturers instructions.	AR
6	n.a.	**Compressed air blasting using a solid blasting agent** This method is suitable for local and gradual very fine treatment of steel parts with rust film (propeller shaft). The Compressed air blasting contains no harmful substances, is approved by the competent authorities and guarantees optimum cleaning. The granulates used are of sizes 40 to 60 µ . The achievable surface roughness is between 0.5 and 1 µ, which corresponds to ultra fine machining of surfaces.	AR

ATTENTION

Exhaust valves and intake valves may NOT undergo a compressed air blasting treatment with solid blasting, strong abrasive material. Due to this surface treatment one does gain a microscopic surface pitting which does allow as a consequence the adhesion of fuel residues. These deposits are then involved in a chemical reaction (especially of the sulfur and lead content of AVGAS) with the valve material. This effect may cause hot-gas corrosion on the affected parts.

TOOLS

Auxiliary tools

- Compression tester or 2 pressure gauges with calibrated orifice, adapter for dial gauge in spark plug thread
- Valve spring mounting pliers
- Step punch for valve guide
- Adjustable reamer 6.5 to 7.5 mm (0.256 to 0.295 in.)
- Valve seat machining device, valve lapping paste
- Gearbox support plate
- Stud extraction tool
- Scraper, very fine emery cloth, grinding tool, cover sheet, adhesive tape
- Cleaning agent, approved cleaners, funnel, graphite marker
- Magnetic holder
- Screw extractor set
- Box wrench set with torque wrench 5 Nm to 50 Nm (44 in.lb to 37 ft.lb)
- Magnetic particle tester

Disassembly device

- Manual hydraulic press

Measuring tools

Calliper rule, dial gauge indicator, micrometer, inner micrometer, inner fine measuring device, feeler gauge, spring scale up to 50 kp (500 N) (112.5 lbf).

Multimeter:

- FLUKE Series 70, Series 80 or equivalent
- Electronic, 3 1/2 digit indication
- Current range 10 A
- Direct voltage range 200 V minimum
- Resistance range 200 Ω to 2 MΩ
- Acoustic continuity tester

Chapter: 24–20–00
INTERNAL GENERATOR

TOPICS IN THIS CHAPTER

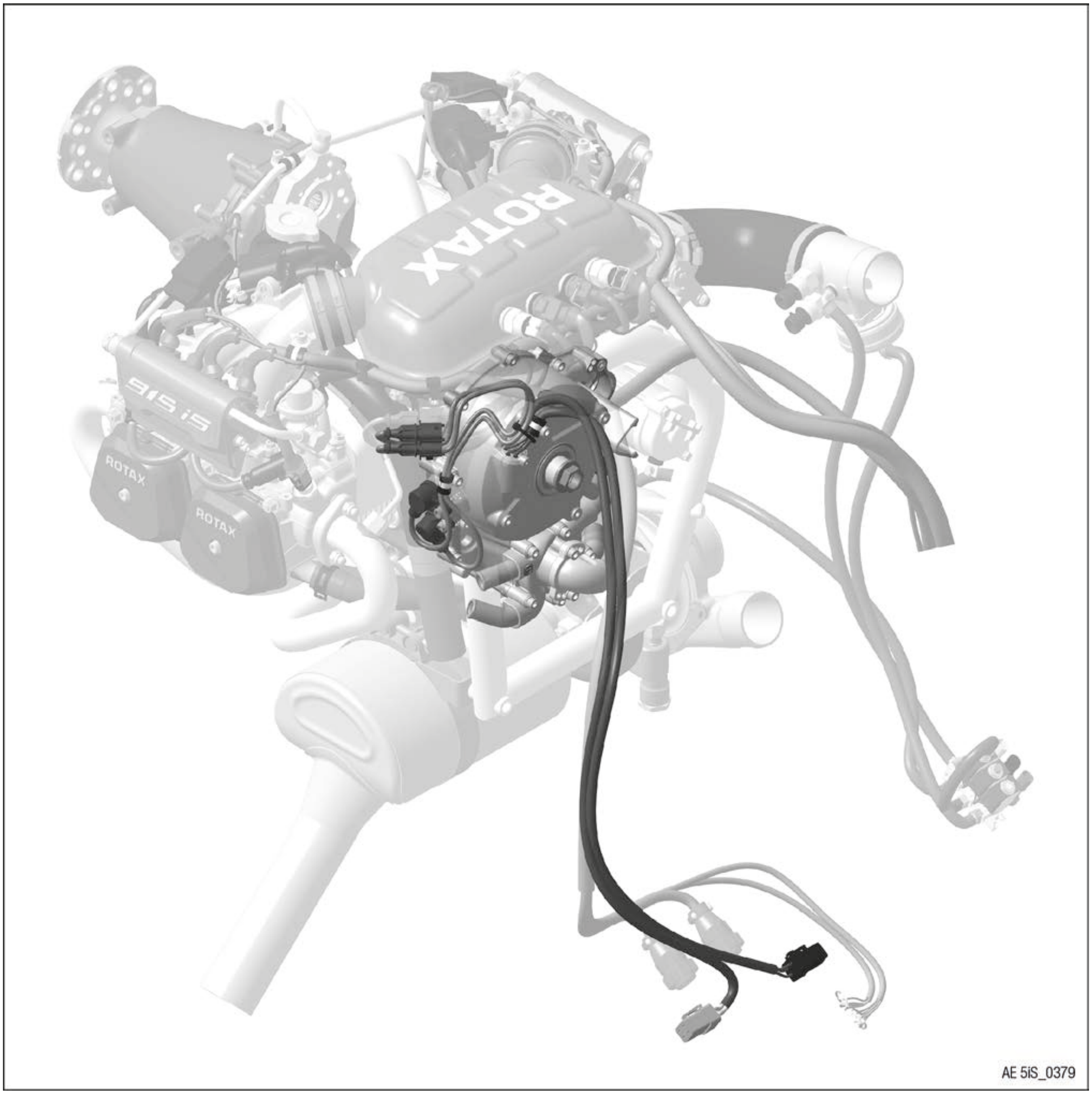

Figure 2.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Puller assy.	876010
Insertion jig	876020
Protection mushroom	877419

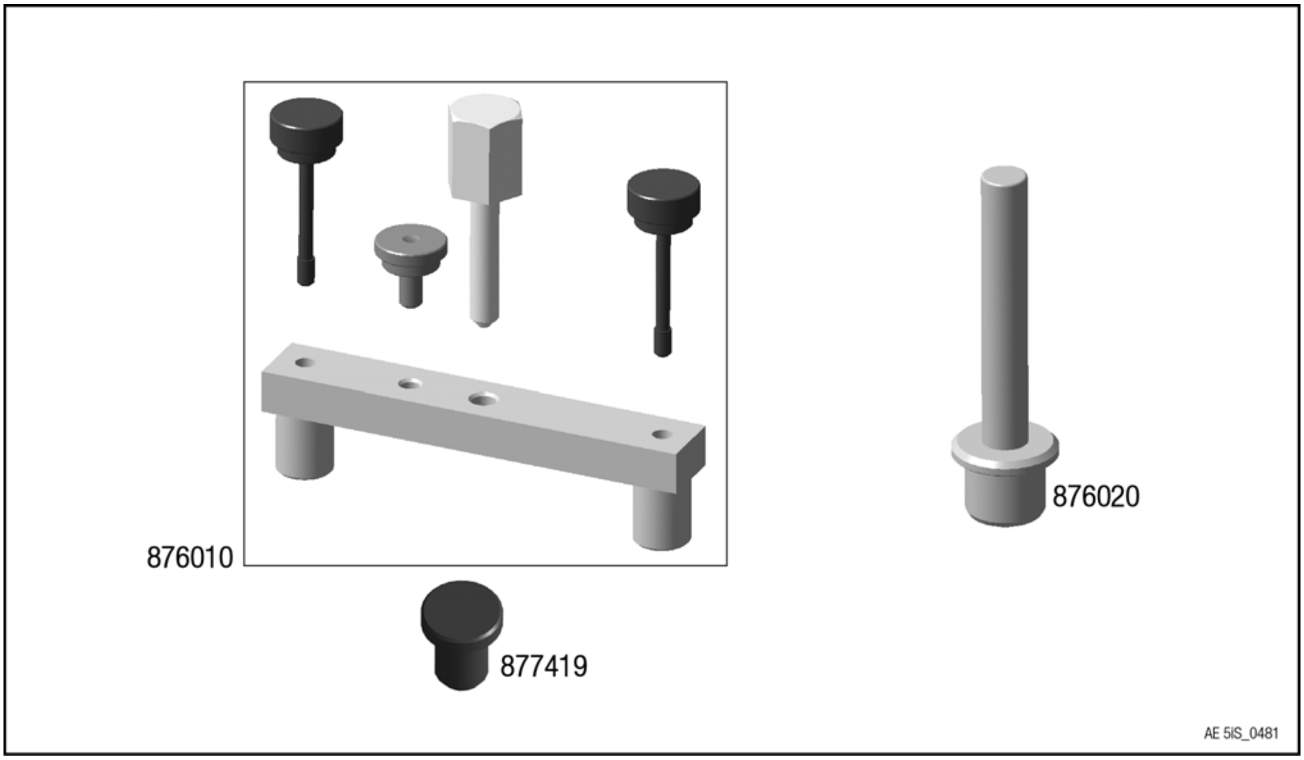

Figure 2.2: Special Tools

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 648	899788
LOCTITE 603	899789
LOCTITE 5910	899791
LOCTITE 7063	n. a.
Engine oil	n. a.
Abrasive pad	n. a.

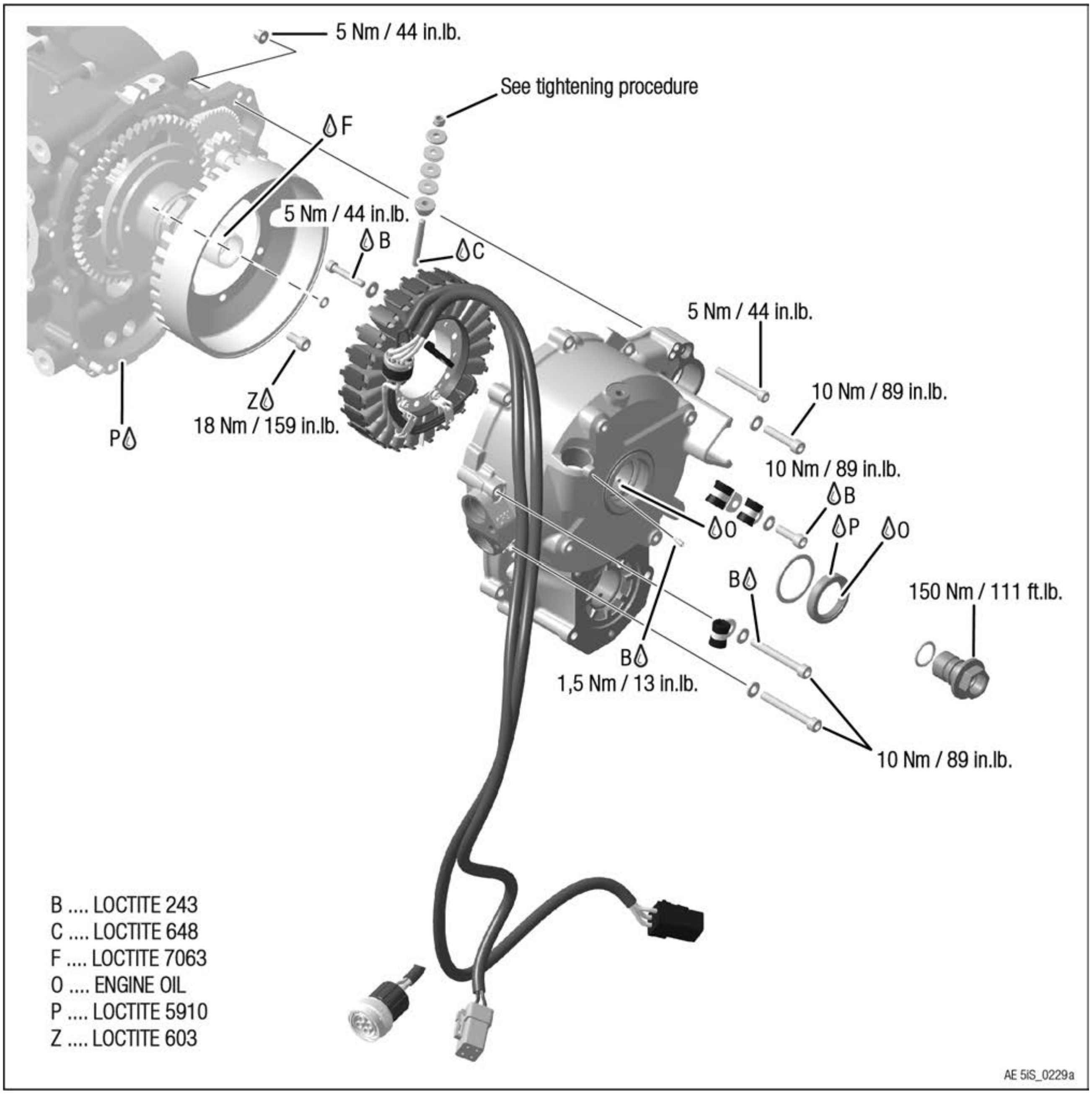

Figure 2.3: Service Products

SYSTEM DESCRIPTION

The ROTAX® engine type 915 i A Series has an electronically controlled double-ignition system with an integrated generator.

EMS POWER SUPPLY

The EMS power supply consists essentially of 2 permanent magnet generators. The two 3-phase AC generators are physically separate power supplies which are integrated in the engine. One of the generators is used for the ECU and the other is available to the aircraft frame.

DRIVE

They are driven by the crank drive and do not need an external power supply once the engine has reached idle speed.

NOTE

Until idle speed is reached, a 12 V external power supply of the EMS from the aircraft's on-board power system is required.

SAFETY INSTRUCTION

⚠ WARNING

Danger of damage to engine! There is a risk of short circuits and cable fires during work on the electric system.
All installation work on the electric system should be carried out with the engine switched off and the battery (negative terminal) disconnected. Ignition, main and LANE selector switches must be “OFF”"!

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series .

GENERAL INFORMATION

Before the component is removed, the work described below must be carried out to identify any further faults in the component and rectify them as part of repair work.

BEFORE THE INTERNAL GENERATOR IS REMOVED

ATTENTION

If these checks are omitted, it may be necessary to dismantle the product again to rectify any faults after repair work.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

Engine cleaning.
See Maintenance Manual Line for the engine type 915 i A Series.

Carry out an engine test run.
Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

Preparation

ATTENTION
Use appropriate protective coverings to prevent the ingress of foreign bodies into connected lines and connections.

Drain coolant. See Maintenance Manual Line for the engine type 915 i A Series.

- Remove adjacent assemblies (electric starter, water pump).
- Remove coolant hoses from cylinder head.
- Remove CPS - crankshaft position sensors (rev counter assy.) To do this, see Chapter 76-70-00 section Sensors and actuators.

NOTE

The assemblies and lines are only to be removed if necessary and only as far as is necessary!

IGNITION HOUSING – REMOVAL

NOTE

Engines produced 2019 and later have for generator B a round Amphenol connector.

Step	Procedure
1	Detach the electrical connection to the stator by disconnecting the controller connector. Mark before detaching!
2	Press on the catch or unscrew (Amphenol) and disconnect the connector.

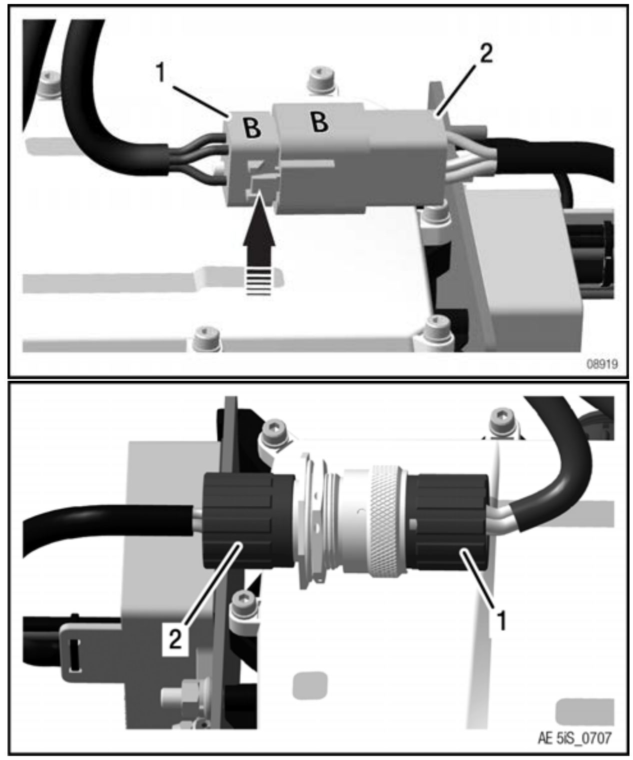

Figure 2.4

1 Controller connector 2 Connection socket

Step	Procedure
3	Loosen the airbox bracket. Loosen the lock nut and remove it along with the washer.

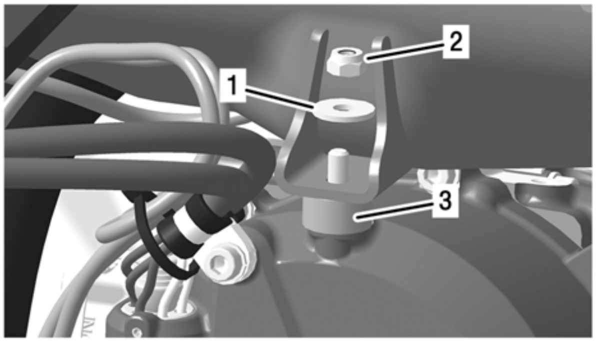

Figure 2.5

1	*Washer A 6.4*	*2*	*Lock. nut M6*
3	*Rubber buffer 20x10xM6*		

NOTE

Push airbox upwards and wedge in place.

Step	Procedure
4	Loosen 2 Allen screws M5x45 and hex. nuts M5 on electric starter.

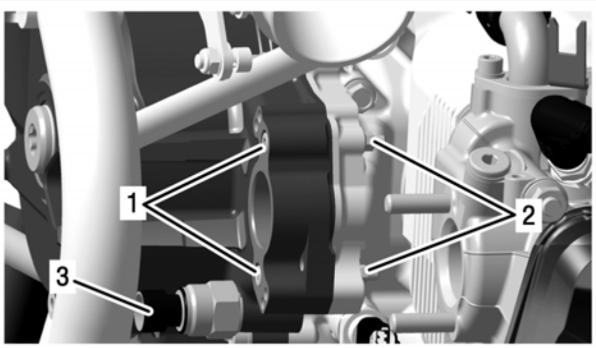

Figure 2.6

1	*Allen screw M5x45*	*2*	*Hex. nut M5*
3	*OPS pressure sensor (oil)*		

Step	Procedure
5	Loosen plug screw M20x1.5.

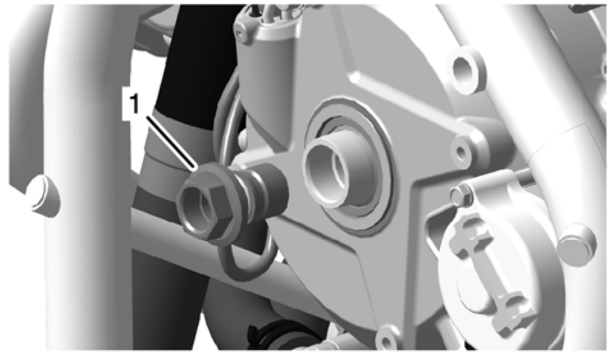

Figure 2.7

1	*Plug screw M20x1.5 with O-ring*

Step	Procedure
6	Loosen 5 Allen screws M6x30 and 2 Allen screws M6x50 with washer 6.4.
7	Disconnect OPS pressure sensor.

NOTE

The bore/thread of the Allen screws M6x50 (next to CPS_1) goes through to the crankcase. To avoid leakage and loss of crankcase pressure the screw is secured with LOCTITE 243.

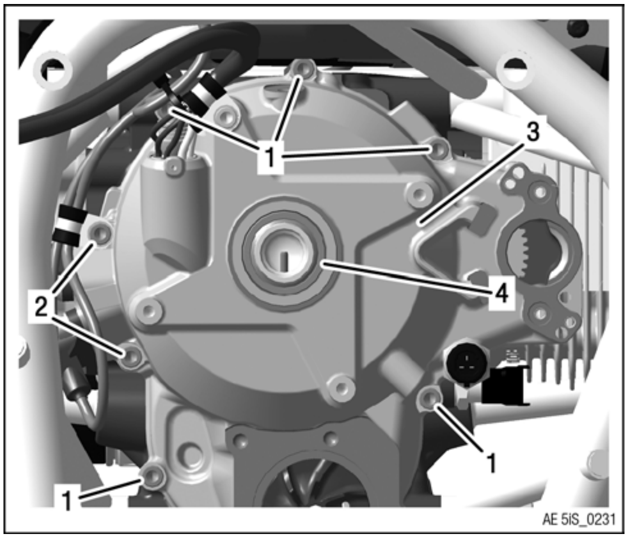

Figure 2.8

1	*Allen screws M6x30*	2	*Allen screws M6x50*
3	*Ignition housing assy.*	4	*Oil seal*

Step	Procedure
8	Remove Oil seal with a screwdriver.
9	Place the protection mushroom part no. 877419 on the crankshaft and use a puller part no. 876010 to take off the ignition housing.

NOTE

The ignition housing has one dowel pin.

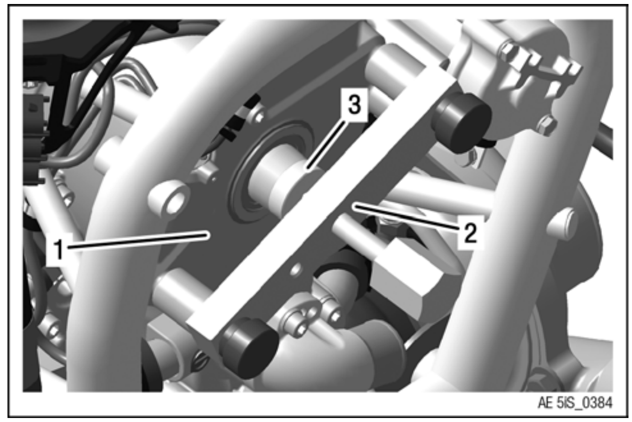

Figure 2.9

1	*Ignition housing assy.*	2	*Puller assy. part.no. 876010*
3	*Protection mushroom part no. 877419*		

Step	Procedure
10	Remove O-ring from the crankcase or the ignition housing.

NOTE

The crankshaft bearing in the ignition housing is lubricated through the oil duct. The oil duct at the contact surface between the crankcase and the ignition housing is sealed using O-ring 5X2.

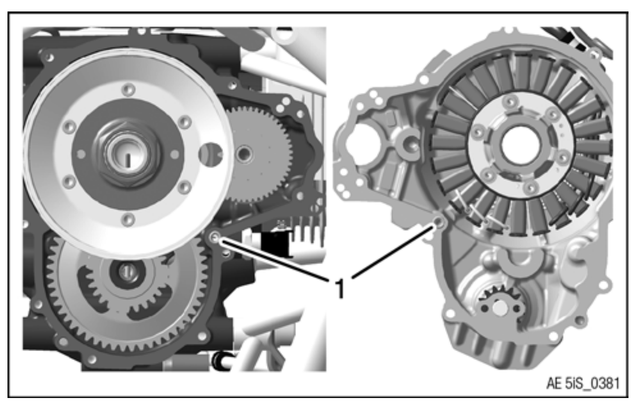

Figure 2.10

1	*O-ring 5x2*

FLY WHEEL ASSY. REMOVAL

Preparation

Fix the crankshaft.
See Maintenance Manual Line for the engine type 915 i A Series.

Step	Procedure
1	Loosen 6 Allen screws M6x12.
2	Remove the fly wheel.

NOTE

The location of the fly wheel does not have to be marked on the freehub body.

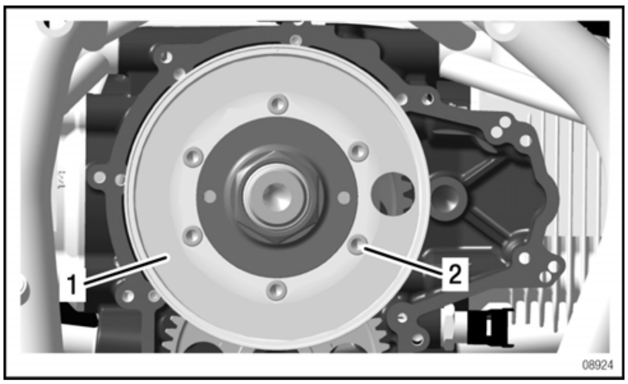

Figure 2.11: TYPICAL

1 *Fly wheel* 2 *Allen screw M6x12*

CONTROLLER CONNECTOR AMPHENOL — DISASSEMBLY

Engines produced 2019 or later have for generator B a round Amphenol connector.

Step	Procedure
1	Unscrew the connector cap and remove the rubber seal out of the sleeve.
2	Mark position of the wires.
3	Push each pin out using a pin extractor tool.

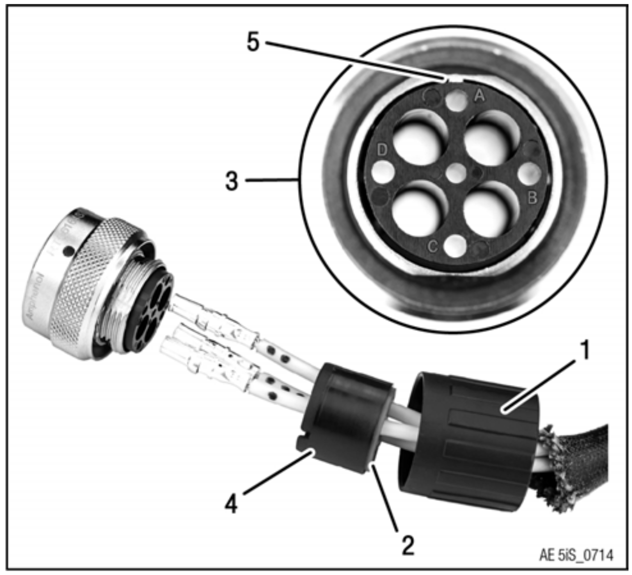

Figure 2.12

1 *Connector cap* 2 *Rubber seal*
3 *Position letter* 4 *Sleeve*
5 *Key slot*

STATOR ASSY. — REMOVAL

ATTENTION

Mark cables and connectors before removing the connector receptacle. Generator A and B have different sizes and power.

Step	Procedure
1	Mark cables and connectors. See following Figures.

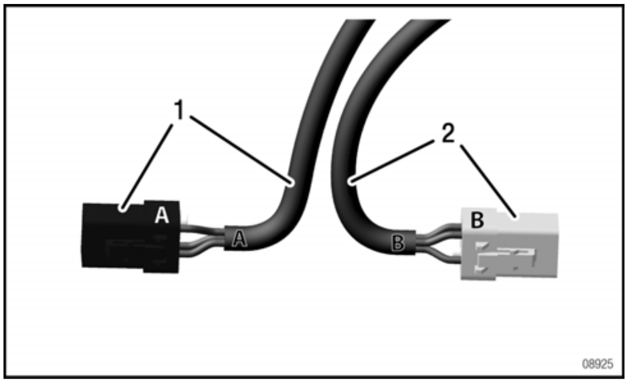

Figure 2.13

1 *Generator coil A (black connector)*	2 *Generator coil B (gray connector)*

Step	Procedure
2	Pull out the orange latch with a needle nose plier.

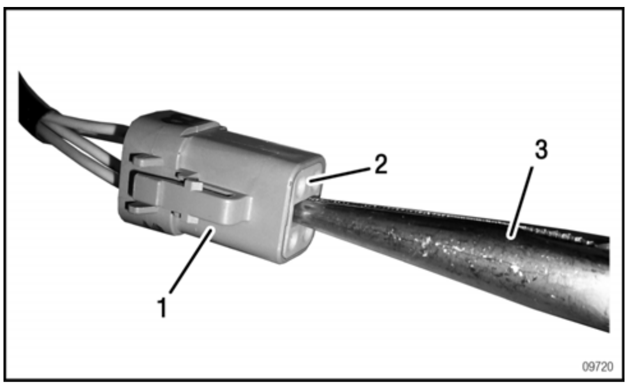

Figure 2.14

1 *Connector*	2 *Latch*
3 *Needle nose pliers*	

Step	Procedure
3	Bend back the retaining tab and at the same time carefully pull on the cable until the terminal is detached.

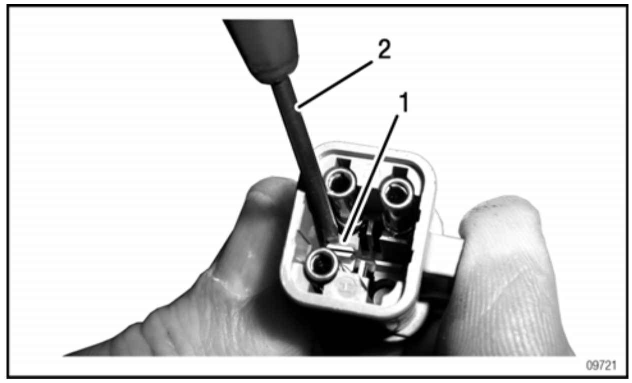

Figure 2.15

1 *Retaining tab*	2 *Screwdriver*

Step	Procedure
4	Pull off the rubber seal.

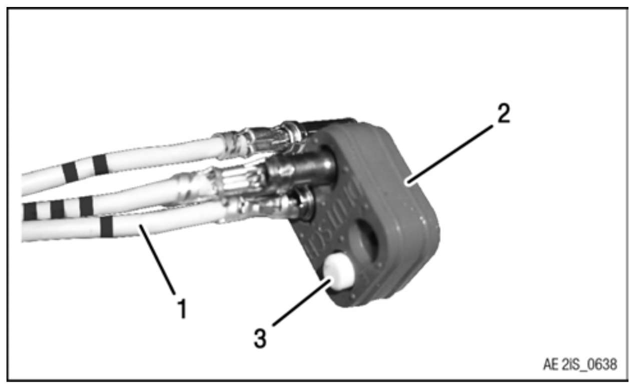

Figure 2.16

1 *Cable*	2 *Rubber seal*
3 *Filler plug*	

Step	Procedure
5	Remove cable clamps.
6	Unscrew lock nut and remove the washer, disk springs and distance sleeve.
7	Remove the adjustment screw and lead through seal.

NOTE

Note the location and orientation of the cable clamps for reassembly! (Back to Back)

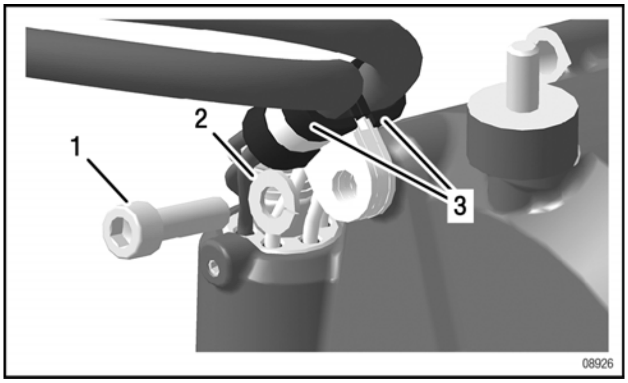

Figure 2.17

1 Allen screw M6x20 *2 Lock washer M6*
3 Cable clamp

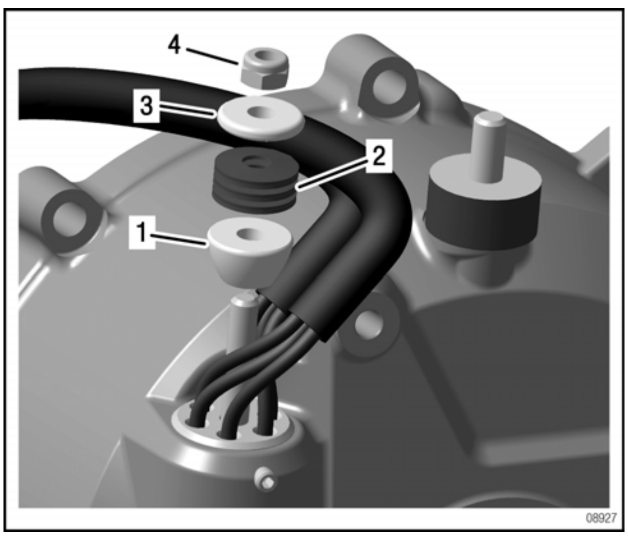

Figure 2.18: TYPICAL

1 Distance sleeve *2 Disk springs (6 pcs.)*
3 Washer 5.1/15.5/2.5 *4 Lock nut M5*

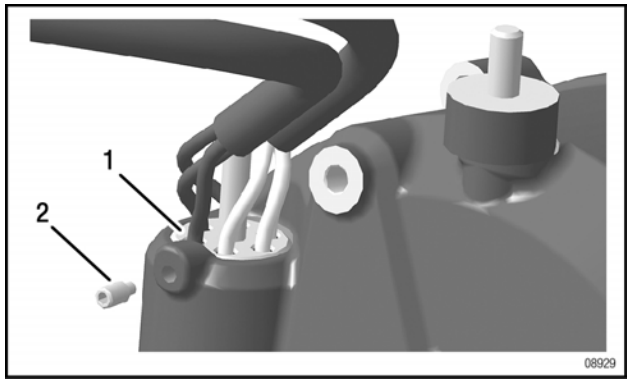

Figure 2.19

1 Grommet *2 Adjustment screw M4x8*

Step	Procedure
8	Loosen 6 Allen screws M5x30 and remove stator assy.

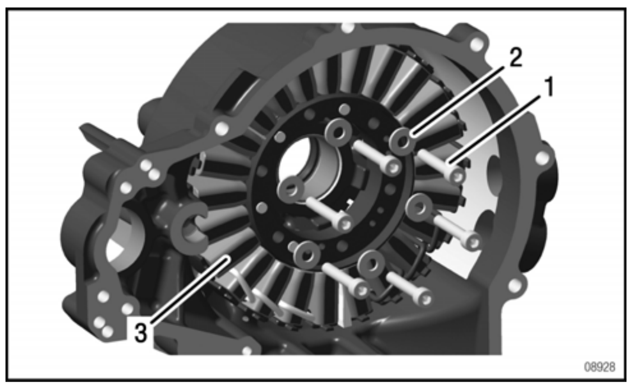

Figure 2.20

1 Allen screw M5x30 *2 Washer A 5.5*
3 Stator assy.

Step	Procedure
9	Push the grommet in and pull the cable out.

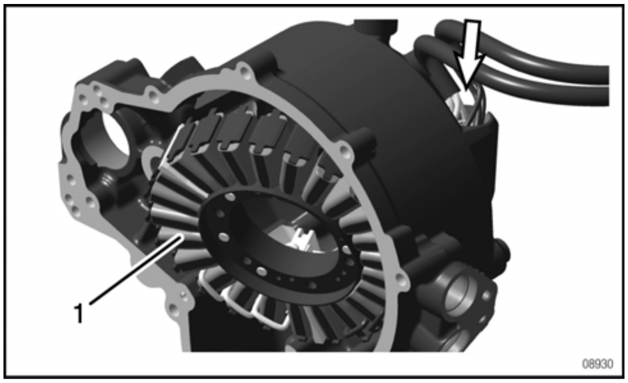

Figure 2.21

1 *Stator assy.*

CRANKSHAFT POSITION SENSOR ASSY. (CPS_1, CPS_2) — REMOVAL

To remove the crankshaft position sensor see Chapter 76-70-00 section Crankshaft position sensor assy. (CPS_1, CPS_2) — removal.

INSPECTION

IGNITION HOUSING — SINGLE PARTS CHECK

Preparation

Clean all parts carefully. See Maintenance Manual Line for the engine type 915 i A Series. Chapter 05-00-00 section Procedures.

IGNITION HOUSING — CHECK

Step	Procedure
1	Carry out visual inspection of sealing surfaces.
2	Unscrew pressure sensor (oil). To do this, see Chapter 76-70-00 section Sensors and actuators.

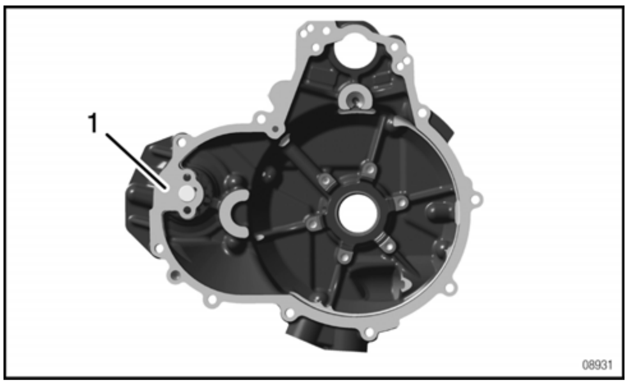

Figure 2.22

1 Sealing surface

Step	Procedure
3	Blow compressed air through the lubrication bore and check it is clear.
4	Check that the pressed–in ball is sealed.

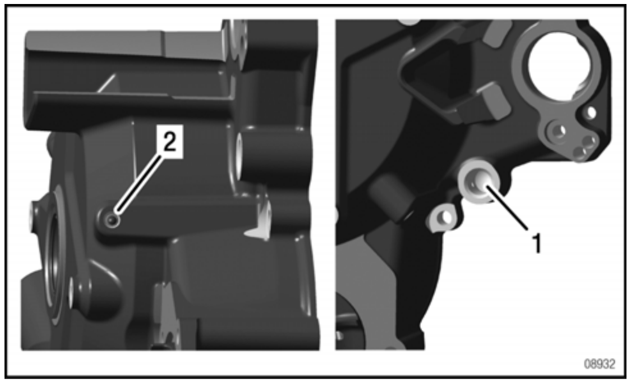

Figure 2.23

1 Lubrication bore *2 Caulked ball*

Step	Procedure
5	Check the sealing surface of the rubber grommet for scratches (especially lengthways).

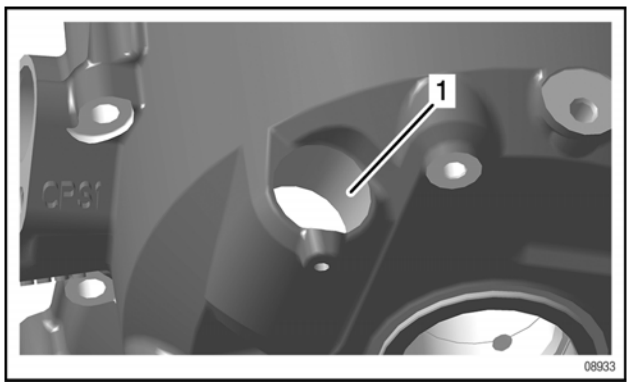

Figure 2.24

1 Sealing surface for rubber grommet

BEARING BUSHING — CHECK

NOTE

It is not possible to replace the bearing bushing, as the inner bore and the lubrication bore are machined after the bushing has been pressed. If the bearing bushing is worn, the entire ignition housing must be replaced.

Step	Procedure
1	Check the bearing bushing for damage and wear.
2	Check that the oil bore is clear.

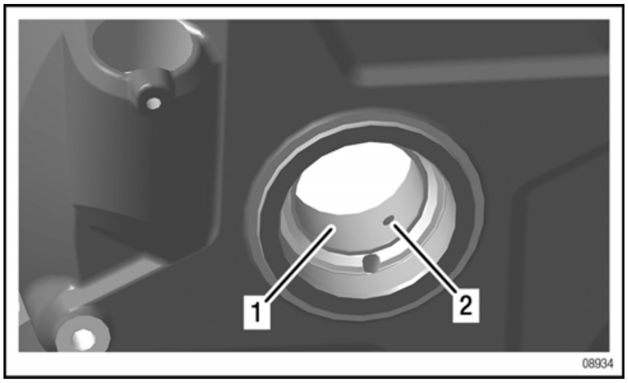

Figure 2.25

1 *Bearing bushing*	2 *Oil bore*

STATOR ASSY. — INSPECTION

ATTENTION

Danger of consequent damage to engine!
The stator may not be repaired! If the stator or its wiring is damaged or worn, it must be replaced with a new part.

Step	Procedure
1	Carry out a visual inspection of the stator assy. and wiring, checking for damage and wear.

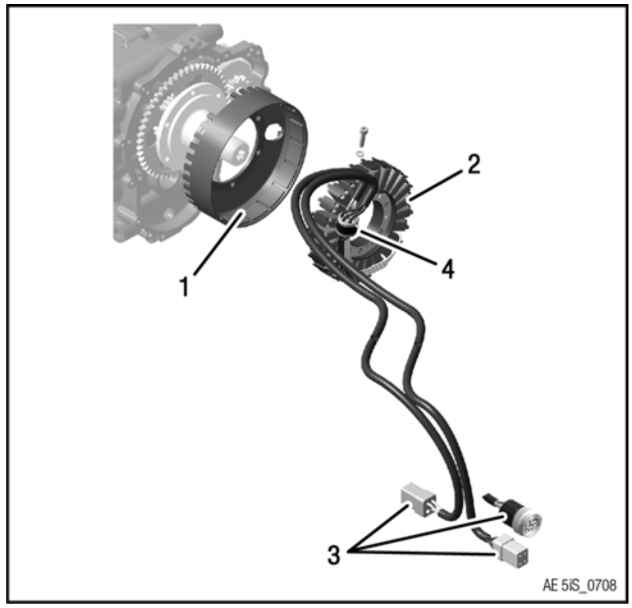

Figure 2.26

1 *Fly wheel assy.*	2 *Stator assy.*
3 *Controller connectors A, B*	4 *Rubber grommet*

FLY WHEEL ASSY. –INSPECTION

ATTENTION

Signs of wear on the magnet are not permissible! Damaged parts on the fly wheel are not permissible!

Step	Procedure
1	Carry out a visual inspection of the fly wheel assy. and checking for damage and wear.

CRANKSHAFT POSITION SENSOR (CPS_1/CPS_2) — INSPECTION

To inspect the crankshaft position sensor see Chapter 76-70-00 section Crankshaft position sensor (CPS_1/CPS_2) — inspection.

WEAR LIMITS

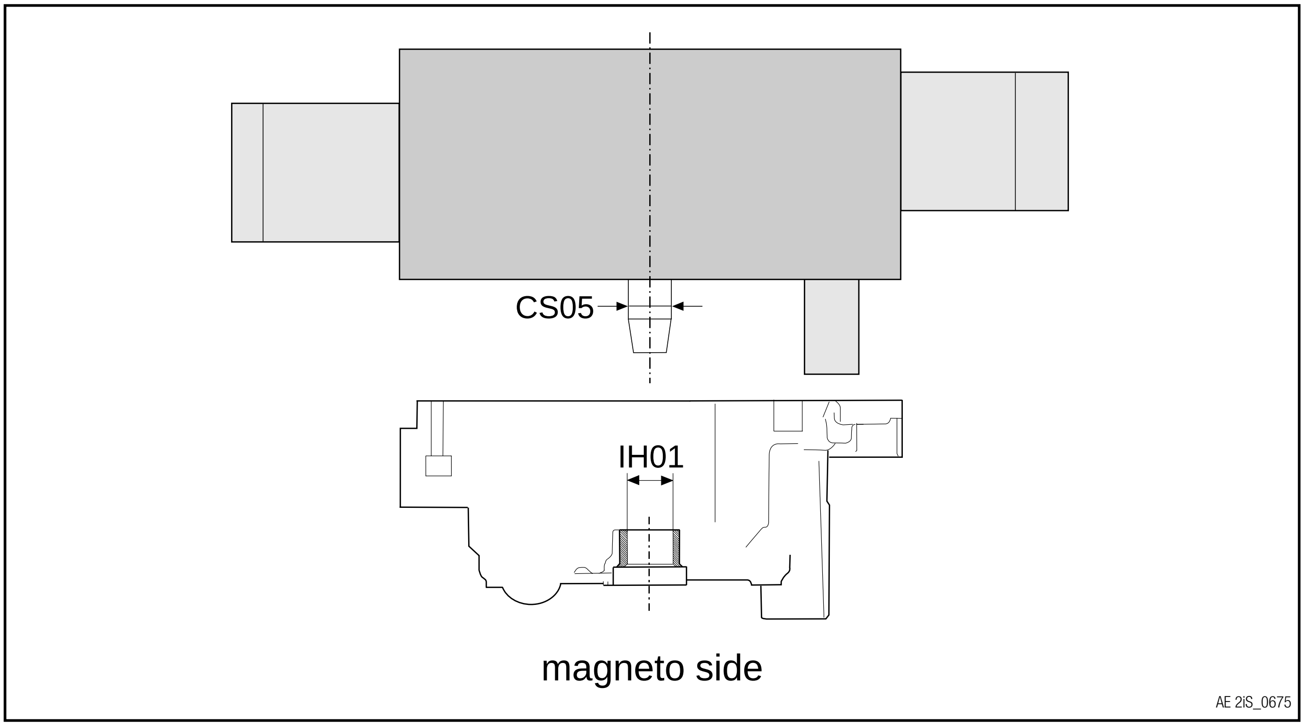

Figure 2.27: Ignition housing

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Bearing bush-ing in ignition housing	IH01	28.04 mm 1.104 in.	28.05 mm 1.1044 in.	28.11 mm 1.1067 in.	28.08 mm 1.1055 in.	current replaced	
Radial clearance	IH01/ CS05	0.03 mm 0.0012 in.	0.05 mm 0.0020 in.	0.12 mm 0.0047 in.	0.09 mm 0.0033 in.	current replaced	
Crankshaft end	CS05	27.970 mm 1.1012 in.	28.000 mm 1.103 in.	27.930 mm 1.0996 in.	27.950 mm 1.1004 in.	current replaced	

ASSEMBLY

IGNITION HOUSING — ASSEMBLY

NOTE

Whenever the ignition housing is installed or assembled, new, acid-free greased O-rings and other sealing elements must always be used correctly!

Step	Procedure
1	Polish and then clean the contact surface for the oil seal.

OIL SEAL REPLACEMENT

ATTENTION
The oil seal must be replaced!

NOTE

There is a 1.5 mm (0.06 in.) washer behind the oil seal.

Step	Procedure
1	If the crankshaft is damaged or worn in the area of the oil seal sealing lip, the channel in the sealing lip can be moved 1.5 mm (0.06 in.) by omitting the washer.

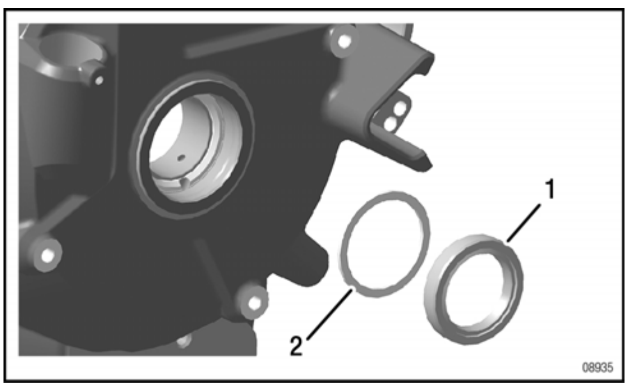

Figure 2.28

1 Oil seal *2 Washer (Shim)*

OIL SEAL — INSTALLATION

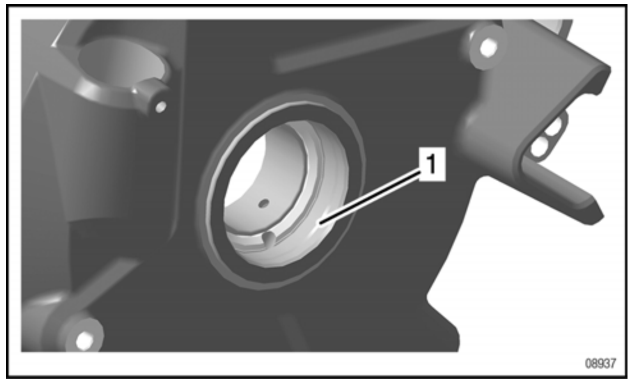

Figure 2.29

1 Contact surface

Step	Procedure
2	Place new oil seal on insertion jig part no. 876020 and lubricate. Outer: LOCTITE 5910. Inner: Engine oil.

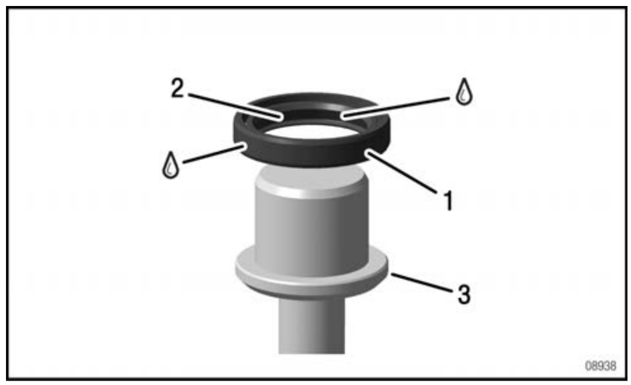

Figure 2.30

1 Outer oil seal *2 Inner oil seal*
3 Insertion jig part no. 876020

Step	Procedure
3	Using a soft-faced hammer, tap the oil seal with the insertion jig to press it in to the ignition housing.

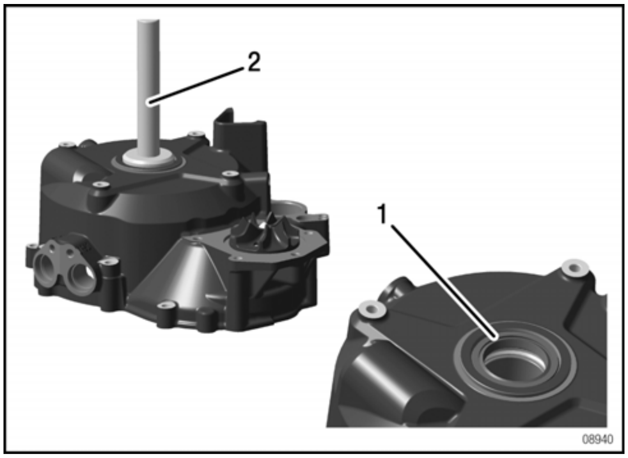

Figure 2.31: TYPICAL

1	*Oil seal positioned*	2	*Insertion jig*

STATOR ASSY. — INSTALLATION

Step	Procedure
1	Thread in the cable and then secure adjustment screw M4x8 with LOCTITE 243 and tighten them. Tightening torque 1.5 Nm (13 in.lb.).

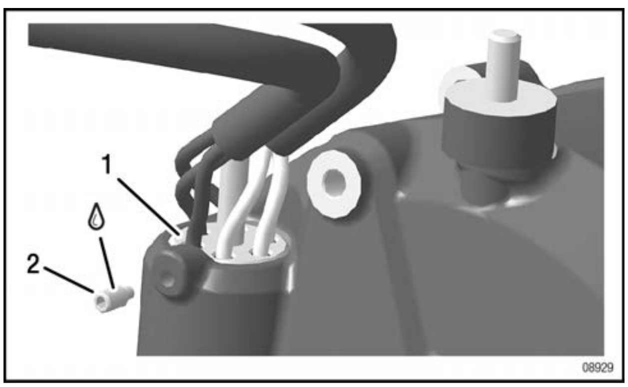

Figure 2.32

1	*Rubber grommet*	2	*Adjustment screw M4x8*

Step	Procedure
2	Position the stator assy. Then secure 6 Allen screws M5x30 including washers A 5.5 with LOCTITE 243 and tighten them. Tightening torque 5 Nm (44 in.lb.).

The separation paper of the two generator coils are in proximity with the water pump gear.

NOTE

When positioning, make sure there is as little spacing possible between the cable lead-through in the ignition cover and the cable connection to the coils.

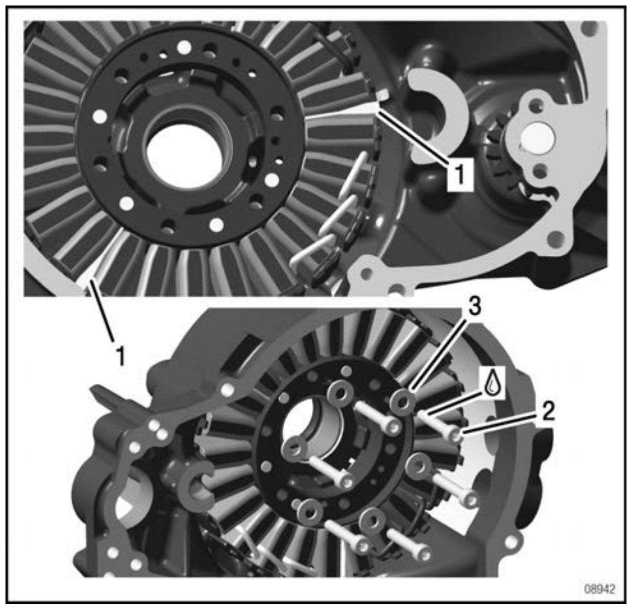

Figure 2.33

1	*Separation paper between the two generator coils*		
3	*Allen screw M5x30*	4	*Washer A 5.5*

Step	Procedure
3	Install the distance sleeve, disk springs and washer.

4	Tighten lock nut M5. Tightening torque 3 Nm (27 in. lb.) and then open counter-clockwise by 1.5 turns.
5	Slip on the full length of the black protection hoses.

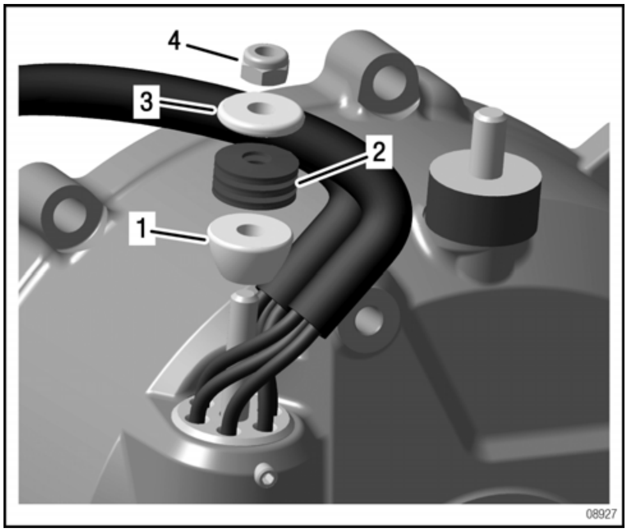

Figure 2.34: TYPICAL

1	*Distance sleeve*	2	*Disk springs 15x5.2x0.7*
3	*Washer 5.1/15.5/2.5*	4	*Lock nut M5*

CONTROLLER CONNECTOR — ASSEMBLY

Step	Procedure
1	Position the filler plug correctly. Position wires correctly to connector pin labels, using previously applied marks on wire insulation.
2	Thread the lines through the insulator (rubber).
3	Make the cable sleeves latch.

NOTE

Cables of generator B are thicker than cables of generator A. Cables of generator B are yellow..

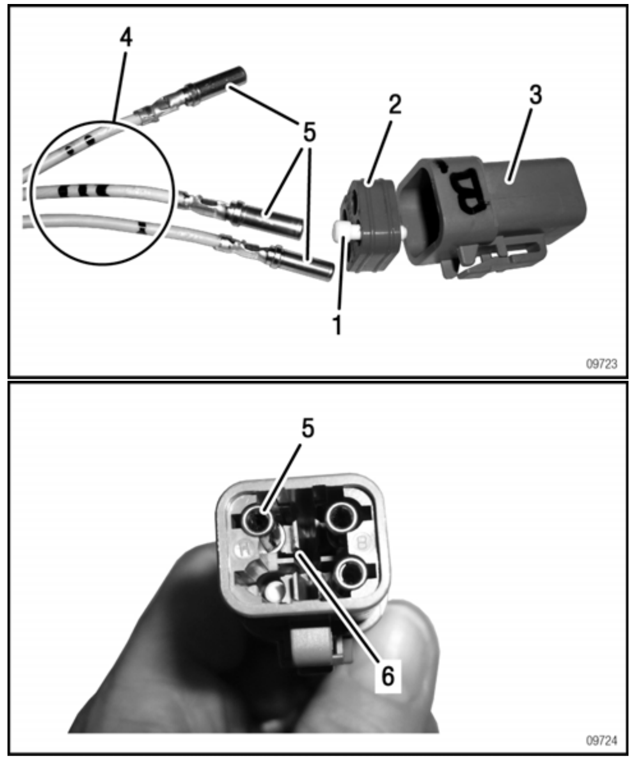

Figure 2.35

1	*Filler plug*	2	*Insulator (rubber)*
3	*Connector receptacle*	4	*Marks*
5	*Cable sleeves*	6	*Latch*

Step	Procedure
4	Install the orange lock.

NOTE

At malfunctions such as wire breakage and faulty plugs, the particular damage can be repaired.
Cable must be long enough after repair is made. Repair of malfunctions with the tools mentioned here must conform to the aircraft standards of the respective country.

See also relevant Illustrated Parts Catalog for the 915 i A Series engine type.

Part no. of connector set	Corresponding tool
866420	DEUTSCH HDT- 48 - 00
866422	

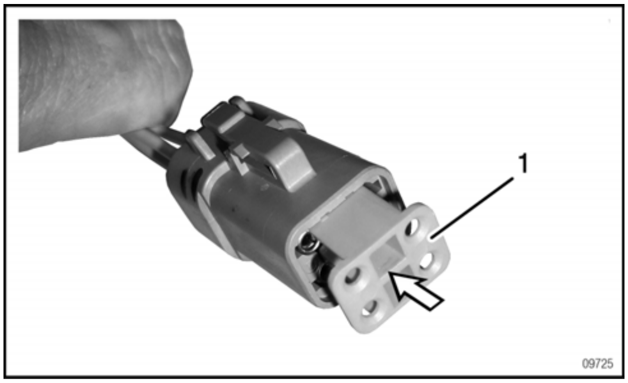

Figure 2.36

1 Lock

Step	Procedure
5	Install cable clamps 8/M6.

NOTE

The bends of the cable clamps must be installed in a diametrically opposed manner (back to back).

Step	Procedure
6	Adjust cables. Tighten Allen screw M6x20. Tightening torque 10 Nm (89 in. lb.).

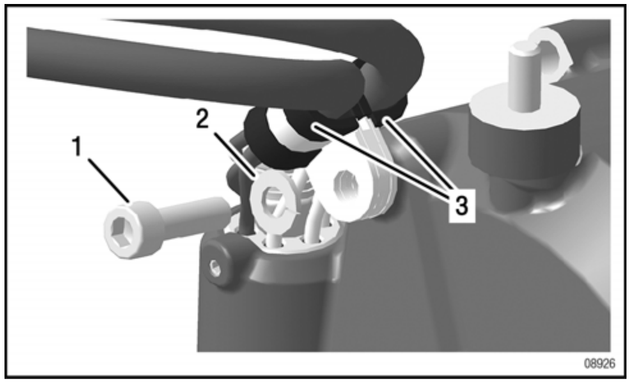

Figure 2.37

1 Allen screw M6x20
2 Lock washer M6
3 Cable clamps 8/M6

CONTROLLER CONNECTOR AMPHENOL — ASSEMBLY

Engines produced 2019 or later have for generator B a round Amphenol connector.

Step	Procedure
1	Push each wire into connector until its pin snaps securely in place.

NOTE

Correctly secured pins will travel further into connector and lock in place.

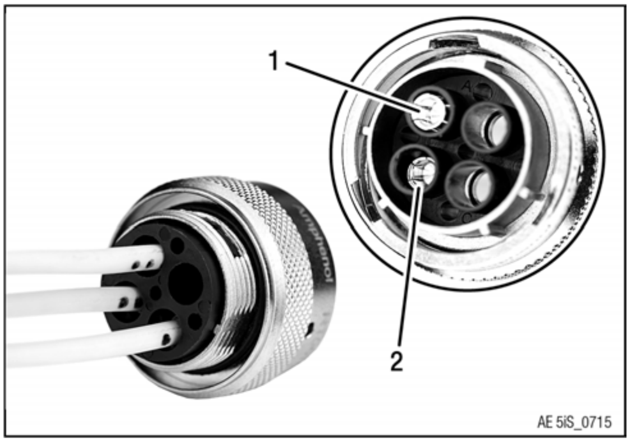

Figure 2.38

1	*Secured pin*	2	*Un-secured pin*

Step	Procedure
2	With all connector pins secured, push the rubber seal into sleeve and screw on the connector cap.

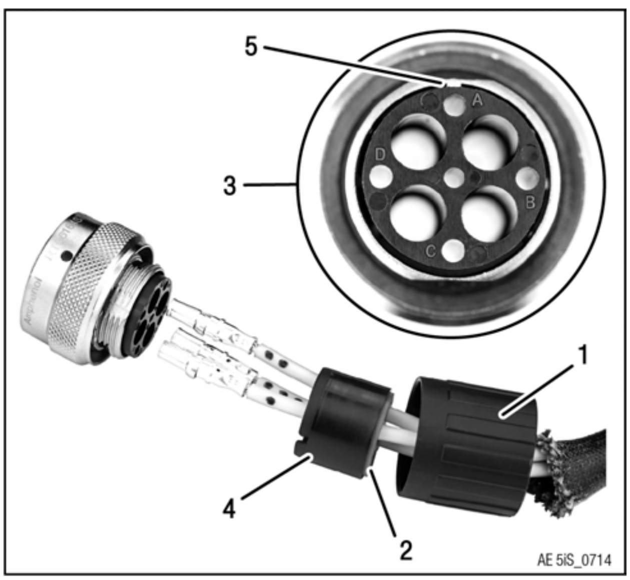

Figure 2.39

1	*Connector cap*	2	*Rubber seal*
3	*Position letter*	4	*Sleeve*
5	*Key slot*		

Step	Procedure
3	Place plastic sealing plug into empty position of the rubber seal.

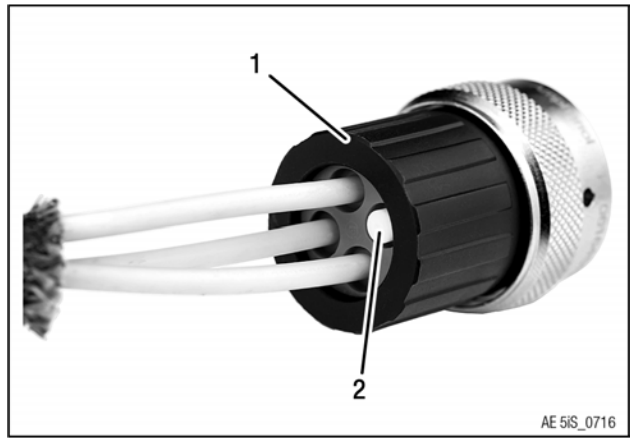

Figure 2.40

1	*Connector cap*	2	*Plastic sealing plug*

CRANKSHAFT POSITION SENSOR ASSY. (CPS_1/CPS_2) — INSTALLATION

To install the crankshaft position sensor see Chapter 76-70-00 section Crankshaft position sensor assy. (CPS_1/CPS_2) — installation.

INSTALLATION

FLY WHEEL ASSY. — INSTALLATION

Preparation

NOTE

Clean all flat surfaces

Step	Procedure
1	Apply a small thin layer of LOCTITE 648 to the flat surface of the sprag clutch housing.
2	Place fly wheel on top.
3	Secure 6 Allen screws M6x12 (12.9 screw strength) with LOCTITE 603 and tighten them. Tightening torque 18 Nm (159 in. lb.).

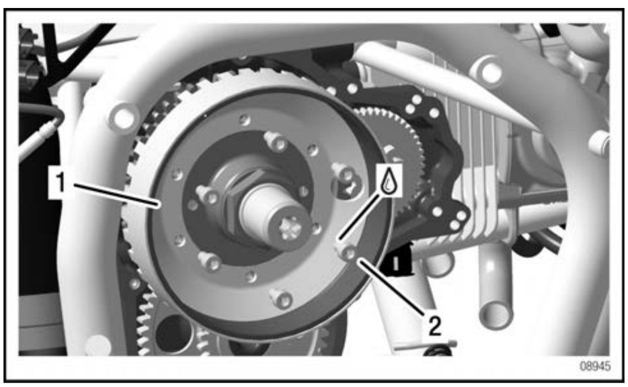

Figure 2.41: TYPICAL

1 *Fly wheel* 2 *Allen screw M6x12*

IGNITION HOUSING ASSY. — INSTALLATION

See *Ignition housing screw diagram*

Preparation

- Check whether dowel pin has been inserted

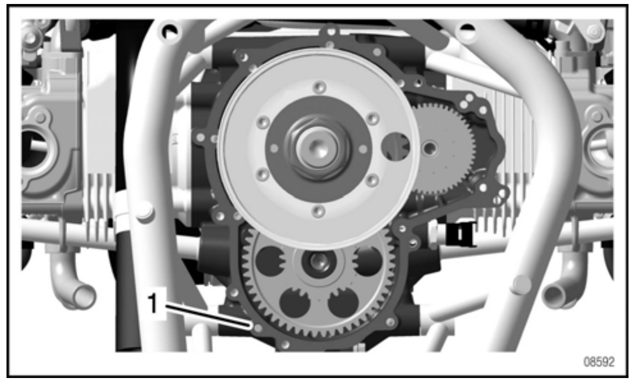

Figure 2.42: : TYPICAL

1 *Dowel pin*

Step	Procedure
1	Lubricate oil seal, bearing bushing and crankshaft stub with Engine oil.
2	Insert O-ring 5x2 into the crankcase and lubricate with Lithium-base grease to hold in position.

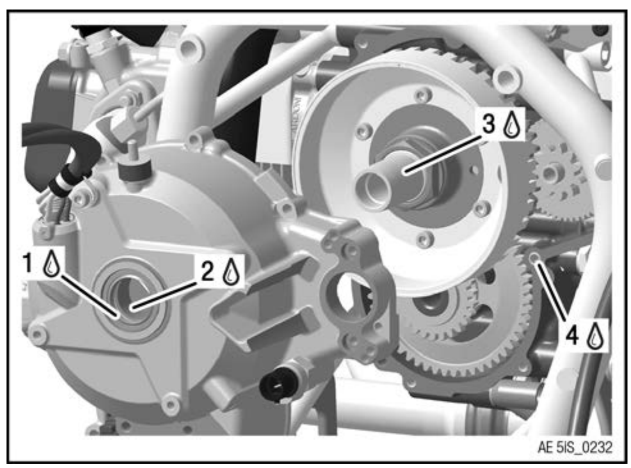

Figure 2.43

1 *Oil seal* 2 *Bearing bushing*
3 *Crankshaft stub* 4 *O-ring 5x2*

Step	Procedure
3	Install puller assy. part no. 876010 on ignition housing. Apply a thin coating of LOCTITE 5910 the sealing surface of the ignition housing. Install protective mushroom into crank shaft.

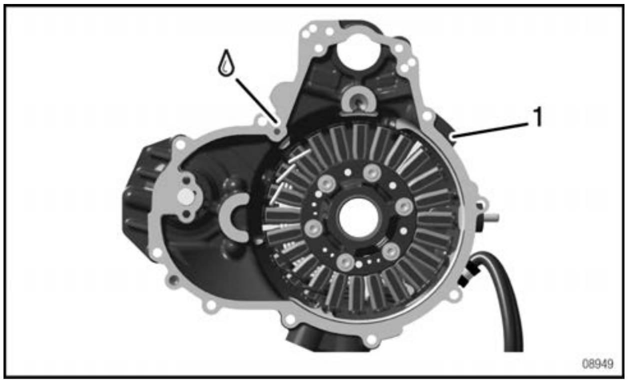

Figure 2.44

1 Ignition housing

⚠ WARNING

Danger of injury!The magnet of the fly wheel pulls the ignition cover towards the engine/ sealing surface with high force.Fingers can be crushed.
Make sure screw of puller assy. is rotated inwards so the ignition cover is not pulled towards the engine.

Step	Procedure
4	Install ignition housing on the crankcase with puller assy. part no. 876010.

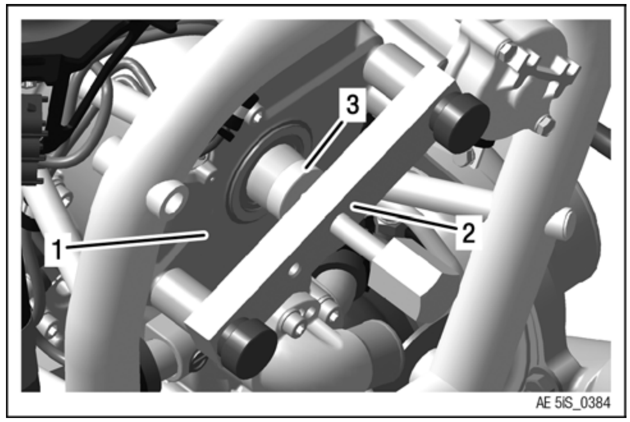

Figure 2.45

1 Ignition housing
2 Puller assy. part no. 876010
3 Protection mushroom

Step	Procedure
5	Turn the water pump wheel slightly so that the gear wheels can match.
6	Fasten the ignition housing to the crankcase using Allen screws. Tightening torque 10 Nm (89 in. lb.).

ATTENTION

The ignition housing must be attached manually without tapping.

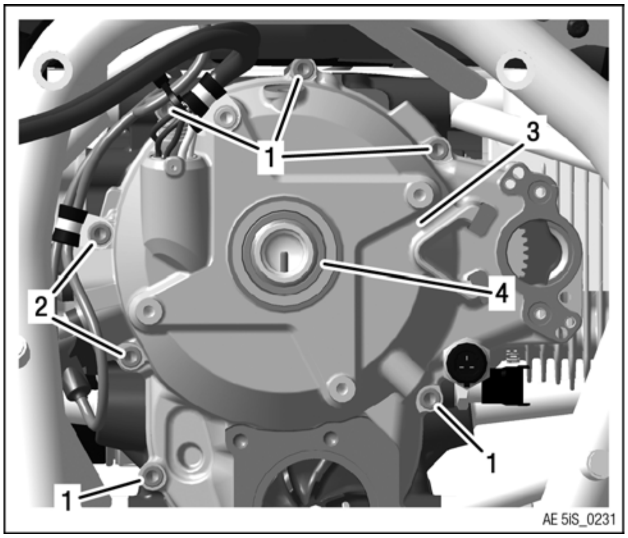

Figure 2.46: *Ignition housing screw diagram*

1 *Allen screws M6x30* 2 *Allen screws M6x50*
3 *Ignition housing assy.*

Step	Procedure
7	Secure upper Allen screw M6x50 with LOCTITE 243 and tighten it. Tightening torque 10 Nm (89 in. lb.)

ATTENTION

Do not use a longer screw! The screw would press on the cylinder sleeve and cause damage to piston and cylinder.

NOTE

The through-bore of the Allen screw M6x50 penetrates as far as the crankcase.
The engine is not leakproof if this screw is not seated with LOCTITE 243.

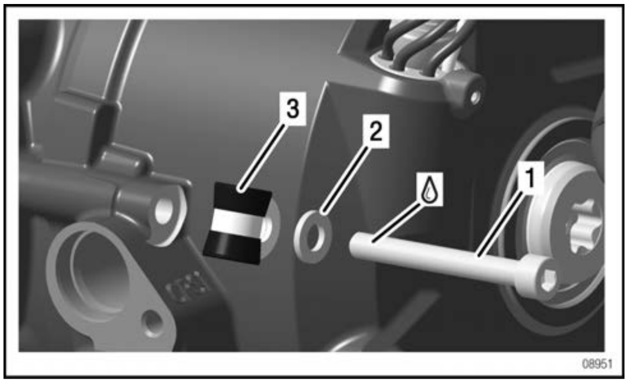

Figure 2.47: TYPICAL

1 *Allen screw M6x50* 2 *Washer A 6.4*
3 *Cable clamp*

ATTENTION

If the water pump is not installed straight away, then 2 M6x65 temporary screws with washers must be screwed in so that the sealing surface is evenly clamped.

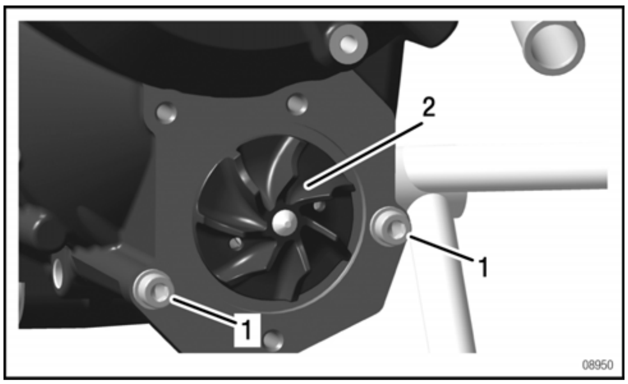

Figure 2.48

1 *Allen screw M6x65* 2 *Water pump wheel*

Step	Procedure
8	Fasten hex. screws M5x45. Tightening torque 5 Nm (44 in. lb.)

NOTE

No washers are used for these screws, as otherwise the starter does not lie flat on the flange surface.

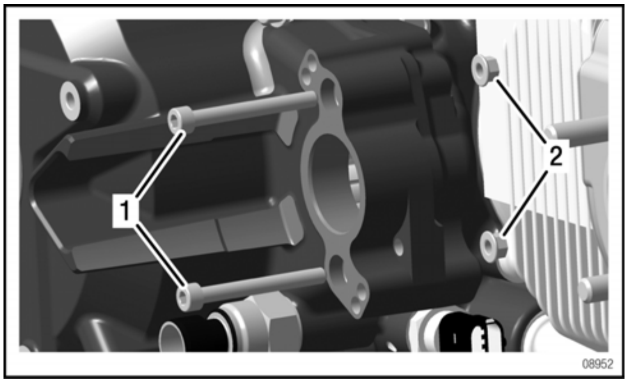

Figure 2.49

1 Hex. screw M5x45 *2 Hex. collar nut M5*

Step	Procedure
9	Fasten the plug screw with new O-ring. Tightening torque 150 Nm (111 ft. lb.)

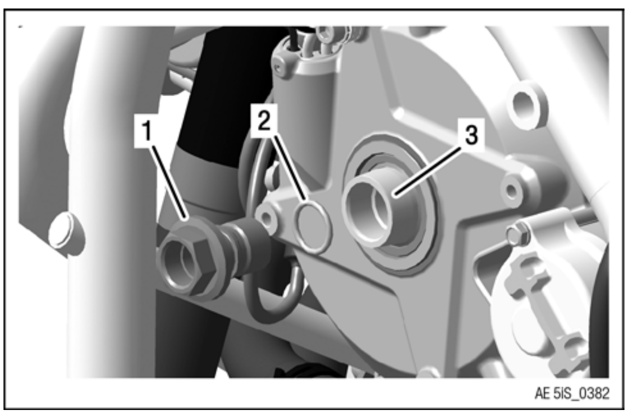

Figure 2.50

1 Plug screw M20x1.5 *2 O-ring 15.9x2.3*

3 Crankshaft stub

FINISHING WORK

- Install water pump housing with a new gasket.
  See Chapter 75-00-00 section Cooling system..
- Install electric starter.
  See Chapter 80-00-00 section Electric starter.
- Install pressure sensor.
  See Chapter 76-70-00 section Sensors and actuators.
- Install airbox on ignition housing.
  See Chapter 73-00-00 section Fuel system.

Release crankshaft.
See Maintenance Manual Line for the engine type 915 i A Series.

- Install CPS sensors.
  See Chapter 76-70-00 section Sensors and actuators.

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Chapter: 61–20–00
GOVERNOR

TOPICS IN THIS CHAPTER

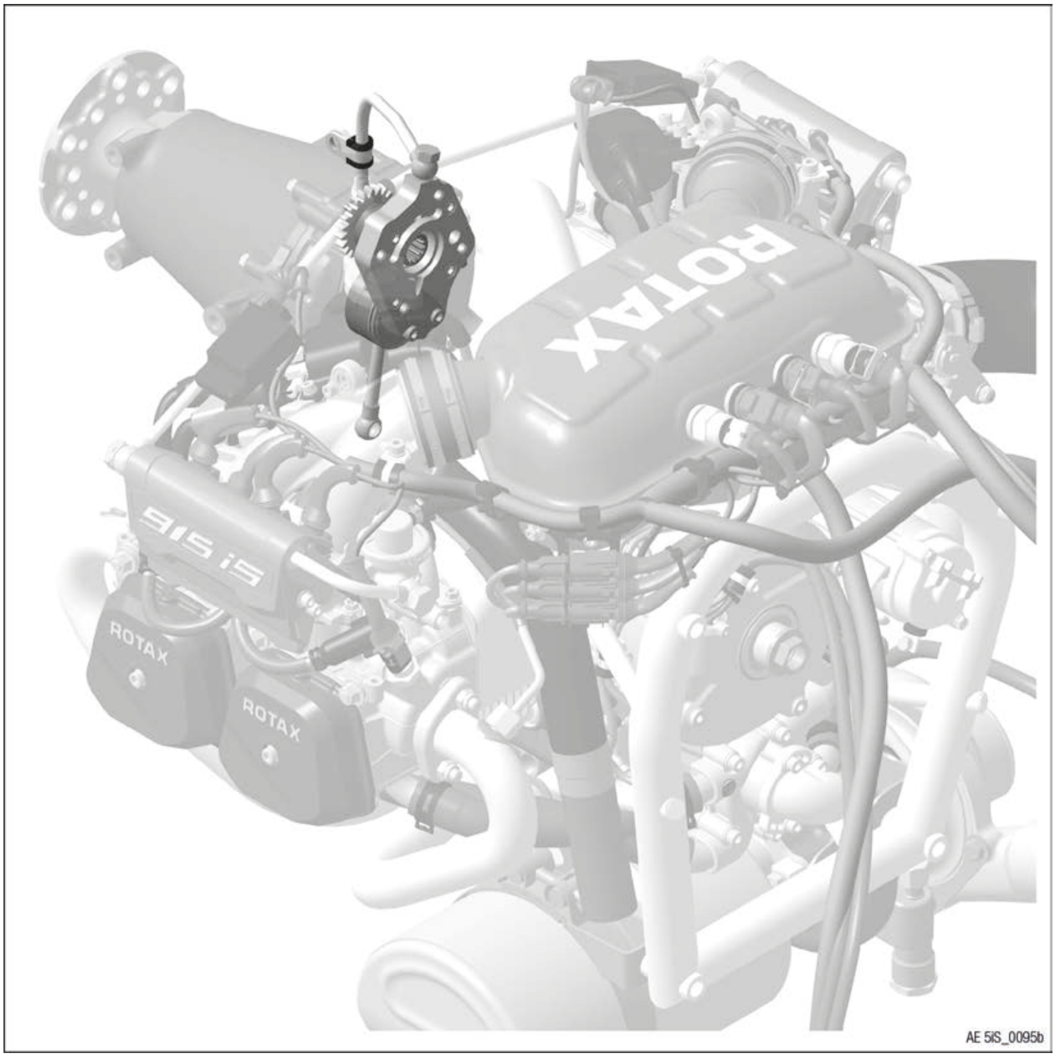


Figure 3.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Puller	876489
Insertion jig assy.	276332
Retaining device	242661
Ring spanner a/f 10/13	876470
Press-in mushroom	877595
Press-in mushroom	877597

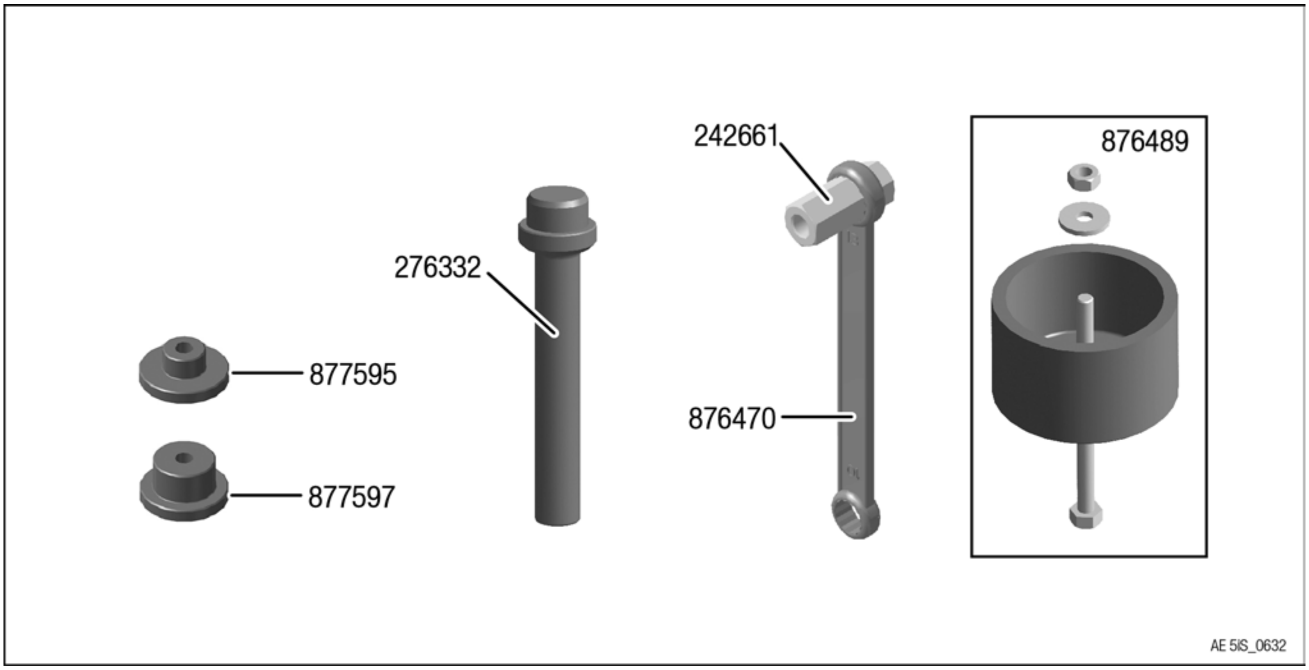


Figure 3.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 648	899788
Engine oil	n.a.

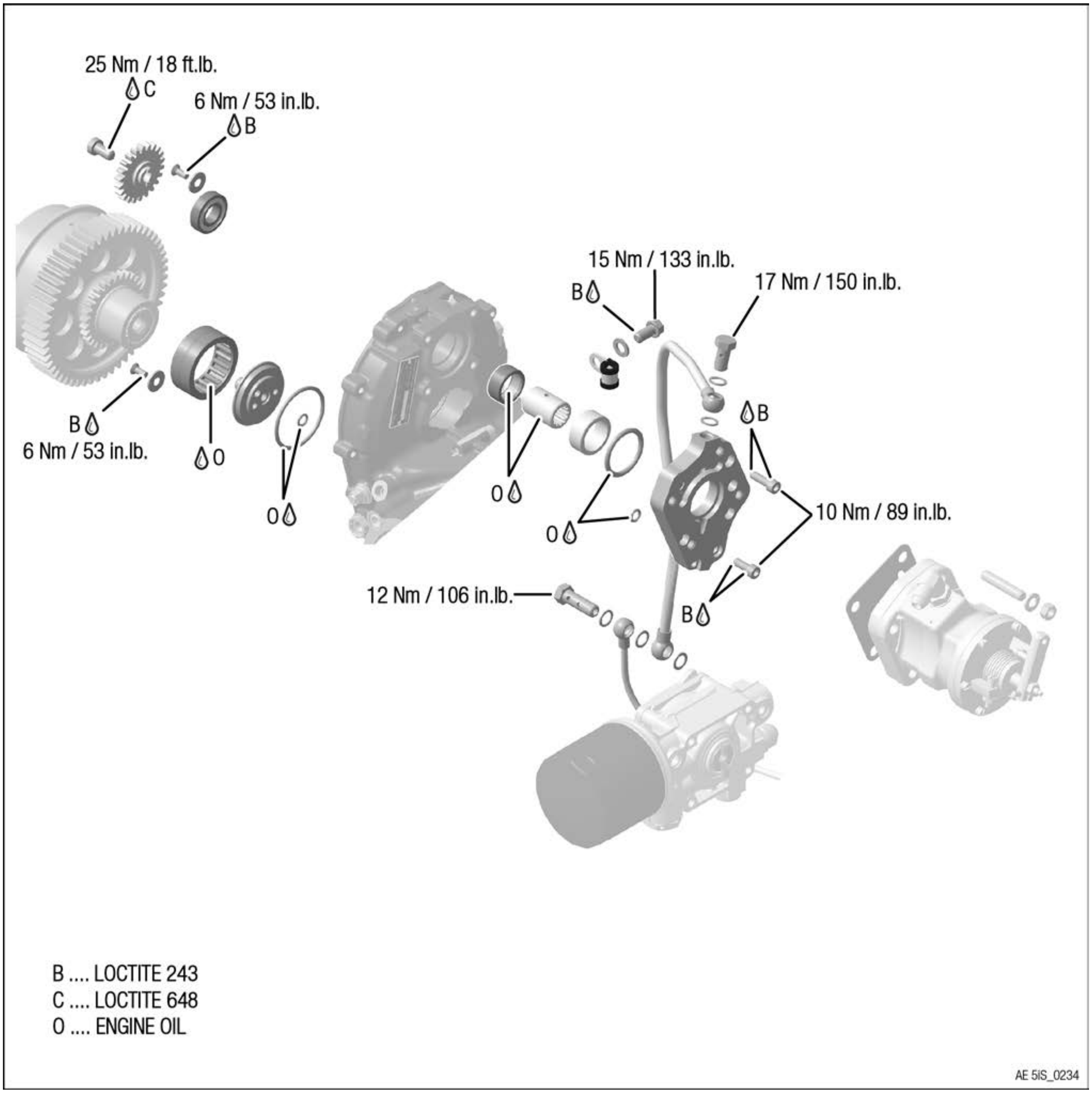


Figure 3.3: Hydraulic governor

SYSTEM DESCRIPTION

The governor for constant speed propeller is not delivered by ROTAX®

For maintenance see instructions of the aircraft manufacturer.

Gear ratio (i)		
Crankshaft: Propeller shaft	56: 22	2.545
Propeller shaft: Governor	22: 29	0.759
Total	1.93	

SAFETY INSTRUCTION

⚠ WARNING

Follow the general safety instructions during all work on the engine and the assemblies around it.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

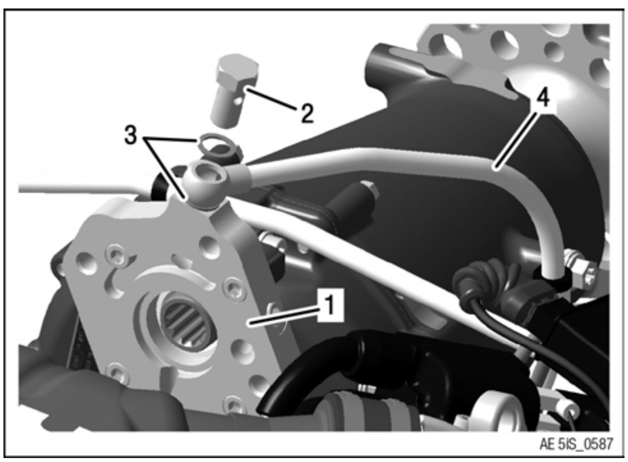
GOVERNOR — REMOVAL

See "Documentation of aircraft manufacturer".

ATTENTION
Follow the governor manufacturer's instructions for maintenance, inspection and repair.

GOVERNOR FLANGE — REMOVAL

Step	Procedure
1	Loosen banjo bolts M10x1x19 with gasket rings on both sides of the governor flange and oil pump housing and remove the oil line.
2	Loosen 4 Allen screws M6x20 and 2 Allen screws M6x16 for the flange fastening of the oil feed line.
3	Remove the governor flange with the O-ring and spacer behind it.



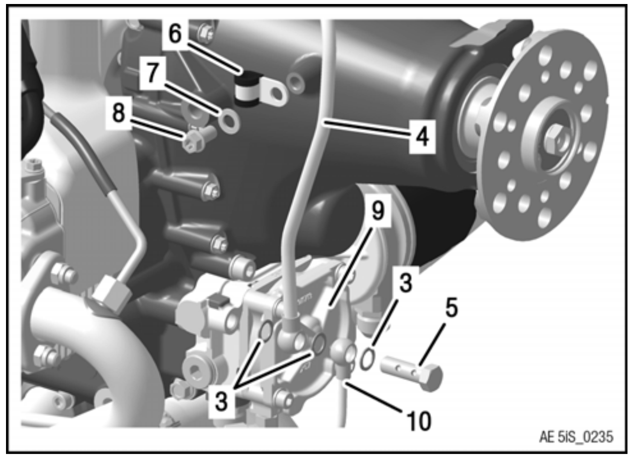


Figure 3.4

1	*Governor flange*	2	*Banjo bolt M10x1x23*
3	*Sealing rings A10x14*	4	*Governor pressure oil line assy.*
5	*Banjo bolt M10x1x34*	6	*Cable clamp 8/M8*
7	*Lock washer A8*	8	*Hex./Torx-flange screw M8x16*
9	*Oil pump housing*	10	*Turbo pressure oil line*

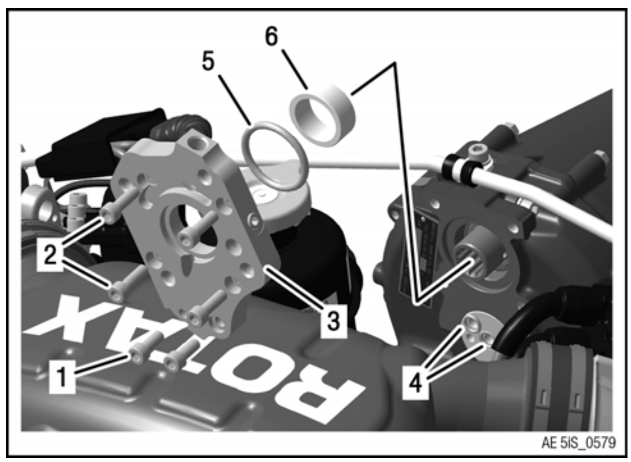


Figure 3.5

1	*Allen screws M6x16*	2	*Allen screws M6x20*
3	*Governor flange*	4	*O-ring 7x2-N*
5	*O-ring 32x4-N*	6	*Spacer 25/31.95/13*

GOVERNOR DRIVE — REMOVAL

Preparation

- The propeller gearbox must be removed so that the governor drive can be removed.
- Remove the propeller gearbox, see Chapter 72-10-00 section Gearbox.

Step	Procedure
1	Fix the drive sleeve with retaining tool part no. 242661 and 876470.
2	Loosen the Allen screw M8x16 and remove the vacuum pump gear with the drive sleeve.

ATTENTION

The M8 fastening screw for the vacuum pump gear is 16 mm (0.63 in.) long and has a low profile screw head in the governor drive.

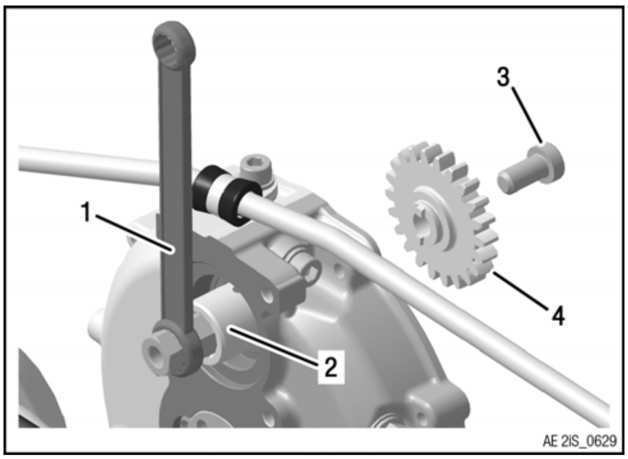


Figure 3.6

1	*Retaining tool part no. 242661 and 876470*	2	*Drive sleeve*
3	*Allen screw M8x16*	4	*Vacuum pump gear*

Step	Procedure
3	Loosen the countersunk screw M5x12 with retaining washer for the ball bearing fastening.
4	Press the needle sleeve along with the ball bearing out towards the gearbox with a suitable insertion jig part no. 276332.

NOTE

The needle sleeve and ball bearing are damaged by this and must be replaced.

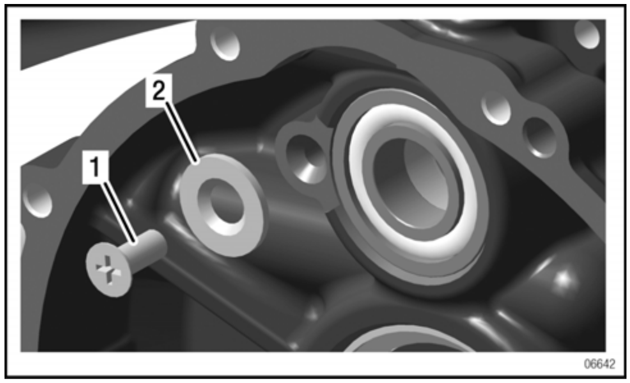


Figure 3.7

1	*Countersunk screw M5x12*	2	*Thrust washer*

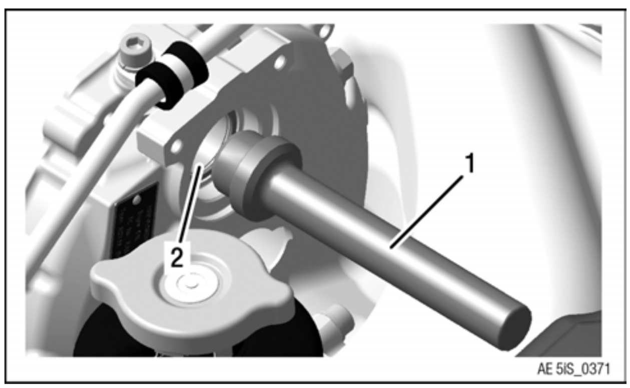


Figure 3.8

1	*Insertion jig part no. 276332*	2	*Needle bearing*

NEEDLE BEARING AND OIL INLET FLANGE— REMOVAL

See Chapter 72-10-00 section Propeller gearbox.

INSPECTION

GOVERNOR DRIVE CHECK

Preparation

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

- Clean all parts carefully.

ATTENTION

The M8 fastening screw for the vacuum pump gear is 16 mm long and has a low profile screw head for the governor drive, but only 14 mm long and with a normal screw head for the vacuum pump drive!

NOTE

If repair work is necessary on the governor, it should be sent to the manufacturer.

Step	Procedure
1	Measure the inner diameter of the propeller shaft. See wear limits.
2	Measure the journal of the oil inlet flange. See wear limits.

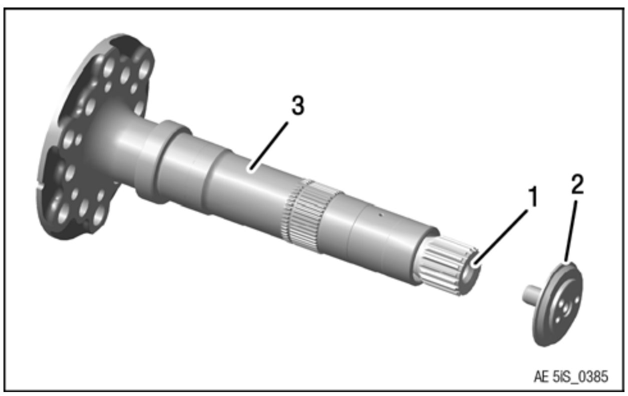


Figure 3.9: Typical

1	*Propeller shaft inner diameter*	*2*	*Oil inlet flange*
3	*Propeller shaft*		

NOTE

Wear usually appears as a flattened area on the journal.

Step	Procedure
3	Check the gear-tooth system of the drive gear and vacuum pump gear.

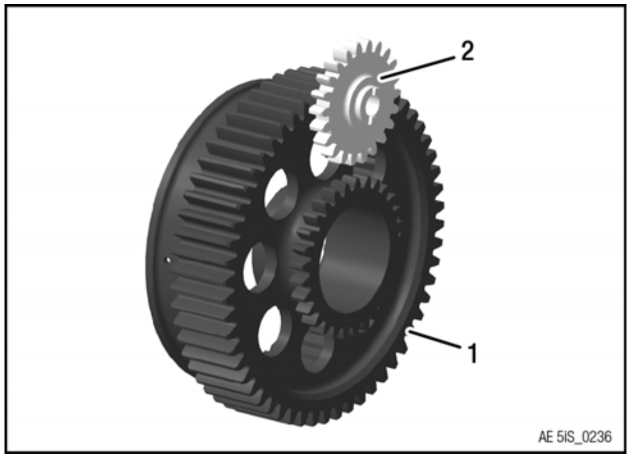


Figure 3.10

1	*Drive gear*	*2*	*Vacuum pump gear*

Step	Procedure
4	Check that all the oil bores in the governor flange are clear.

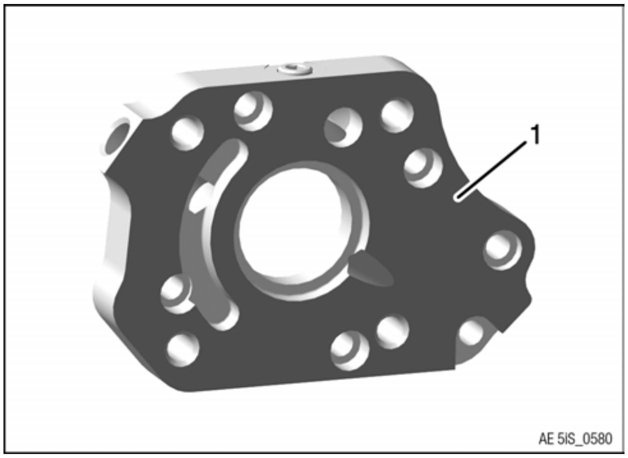


Figure 3.11: Typical

1 *Governor flange*

FINISHING WORK

- Install the propeller gearbox, see Chapter 72-10-00 section Propeller gearbox.

WEAR LIMITS

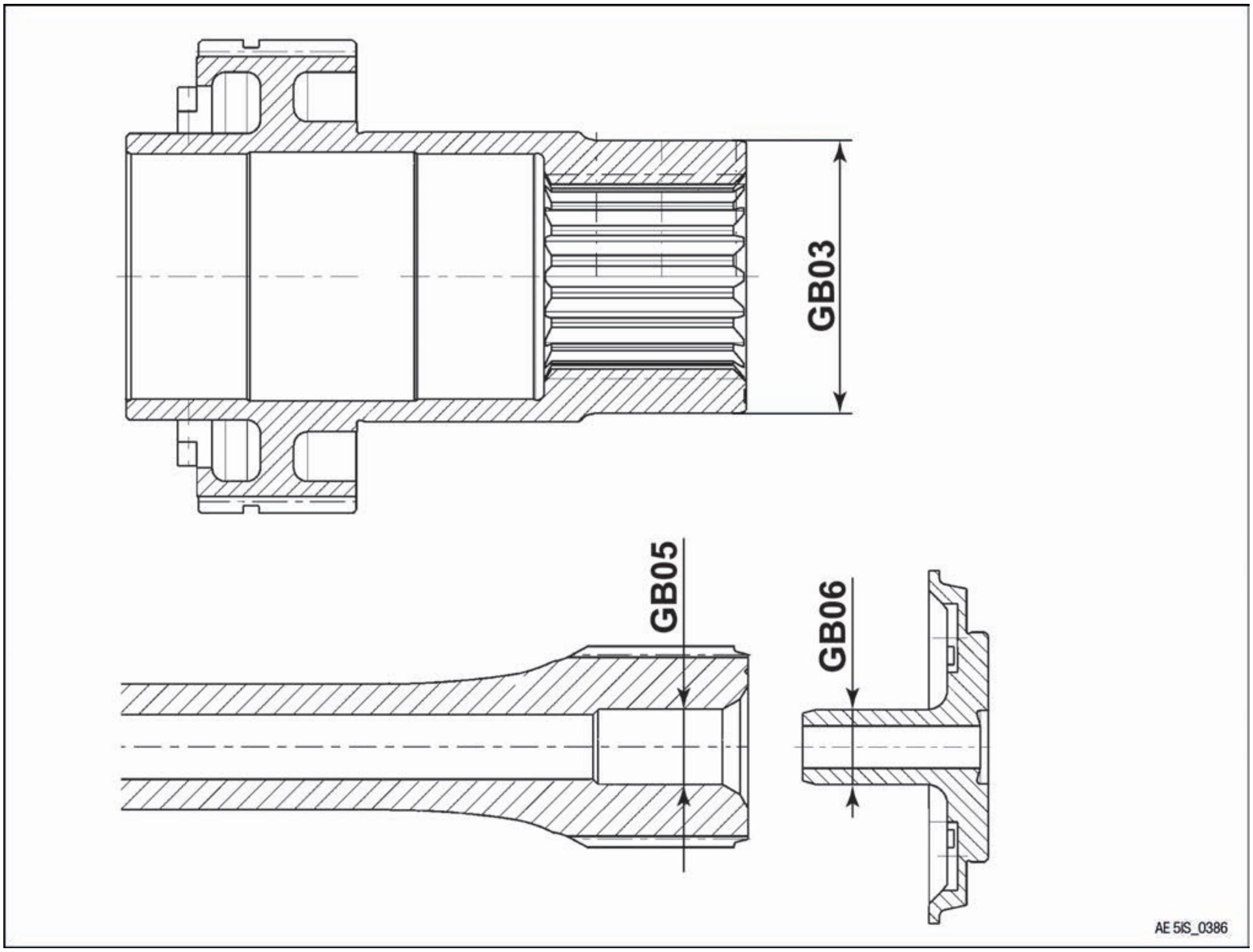


Figure 3.12: Intermediate shaft, Torsion shaft

For detailed information and measurements see Chapter 72-10-00 section Wear Limits

INSTALLATION

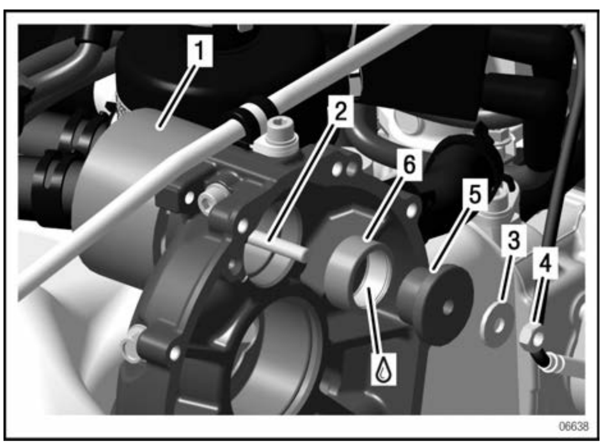
ATTENTION
The oil inlet flange must not be installed flush and the O-ring must not be pinched.

ATTENTION
Longer screws on the oil inlet flange could destroy it.

ATTENTION
All gaskets, O-rings and oil seals must be replaced!

NEEDLE SLEEVE — INSTALLATION

Step	Procedure
1	Lubricate the new needle sleeve.
2	Apply the puller part no. 876489 on the governor side.
3	Place the press-in mushroom part no. 877597 on the needle sleeve and fix it with the hex. nut.



1	*Puller part no. 876489*	*2*	*Hex. screw*
3	*Washer*	*4*	*Hex. nut*
5	*Press-in mushroom part no. 877597*	*6*	*Needle sleeve*

Figure 3.13

Step	Procedure
4	The needle sleeve is pressed in as far as it will go by turning the hex. screw clockwise.

BALL BEARING — INSTALLATION

Step	Procedure
1	Apply the puller part no. 876489 on the governor side.
2	Insert the press-in mushroom part no. 877595 into the roller bearing and fix it with the hex. nut.
3	The ball bearing is pressed in as far as it will go by turning the hex. screw clockwise.

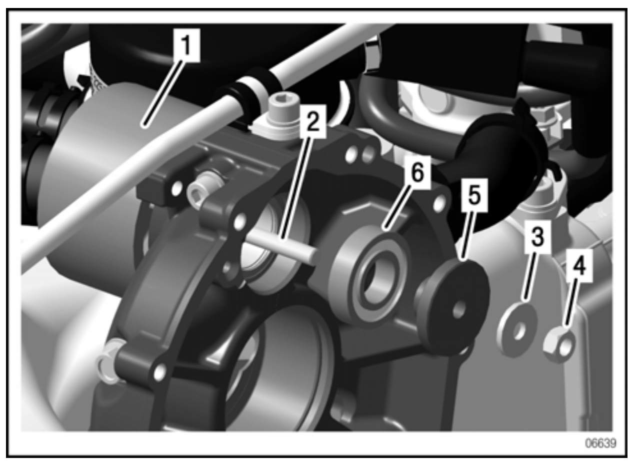


Figure 3.14

1	*Puller part no. 876489*	*2*	*Hex. screw*
3	*Washer*	*4*	*Hex. nut*
5	*Press-in mushroom part no. 877595*	*6*	*Ball bearing*

Step	Procedure
4	Secure M5x12 countersunk screw including the retaining washer with LOCTITE 243 and tighten it. Tightening torque 6 Nm (53 in.lb.)

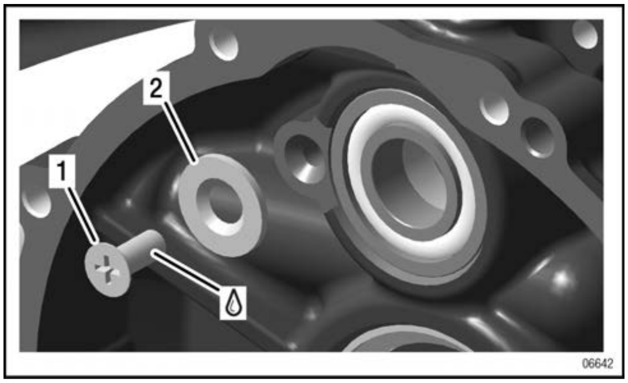


Figure 3.15

1	*M5x12 countersunk screw*	2	*Retaining washer*

NEEDLE BEARING AND OIL INLET — INSTALLATION

See Chapter 72-10-00 section Propeller gearbox.

GOVERNOR DRIVE — INSTALLATION

Step	Procedure
1	Place on the vacuum pump gear and fix the lubricated drive sleeve with the retaining tool part no. 242661.
2	Secure Allen screw M8x16 with LOCTITE 648 and tighten it. Tightening torque 25 Nm (18 ft.lb).

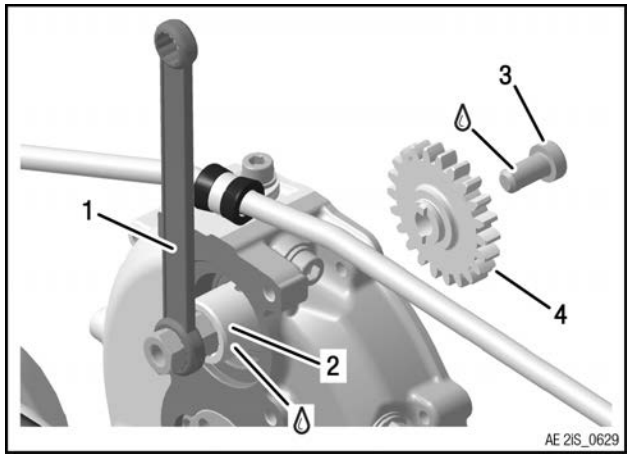


Figure 3.16

1	*Retaining tool part no. 242661 and 876470*	2	*Drive sleeve*
3	*Allen screw M8x16*	4	*Vacuum pump gear*

GOVERNOR FLANGE — INSTALLATION

Step	Procedure
1	Install the governor flange including the distance sleeve in the crankcase with a new O-ring 32x4.
2	Place one O-ring 7x2 each in the oil inlet flange and governor flange and hold them in position with a little bit of grease.

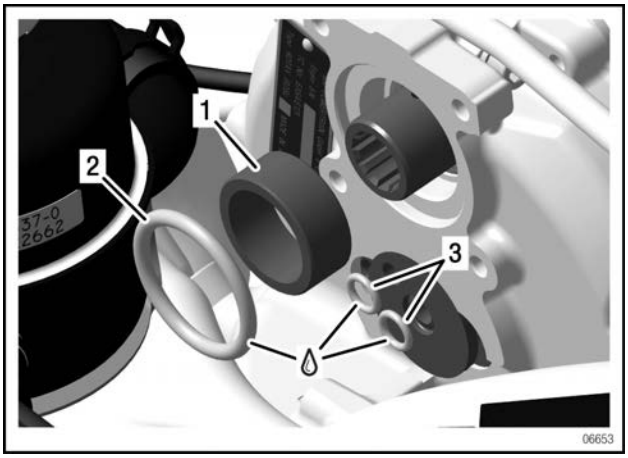


Figure 3.17: TYPICAL

1 *Distance sleeve*
2 *O-ring 32x4*
3 *O-ring 7x2*

Step	Procedure
3	Place on the governor flange, secure it using LOCTITE 243 with 4 Allen screws M6x20 on the crankcase and with 2 Allen screws M6x16 on the oil inlet flange, and tighten the screws. Tightening torque 10 Nm (89 in. lb.). LOCTITE 5910 can be used on the sealing surfaces of the governor flange.

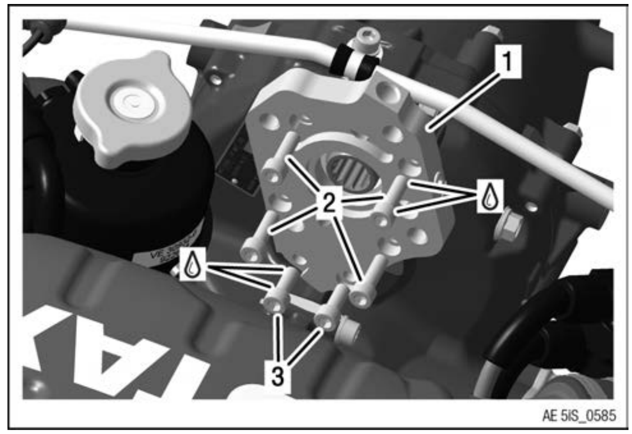


Figure 3.18

1 *Governor flange*
2 *Allen screw M6x20*
3 *Allen screw M6x16*

ATTENTION

Longer screws destroy the oil inlet flange.

Step	Procedure
4	Install the propeller gearbox. See Chapter 72-10-00 section Gearbox.
5	Install the governor pressure oil line on the governor flange. Tightening torque 17 Nm (150 in.lb.).
6	Install governor oil pressure oil line on the oil pump. Tightening torque 12 Nm (106 in.lb).
7	Fasten the governor pressure oil line with the cable clamp using the hex. screw M8x25 and LOCTITE 243. Tightening torque 15 Nm (133 in.lb.).

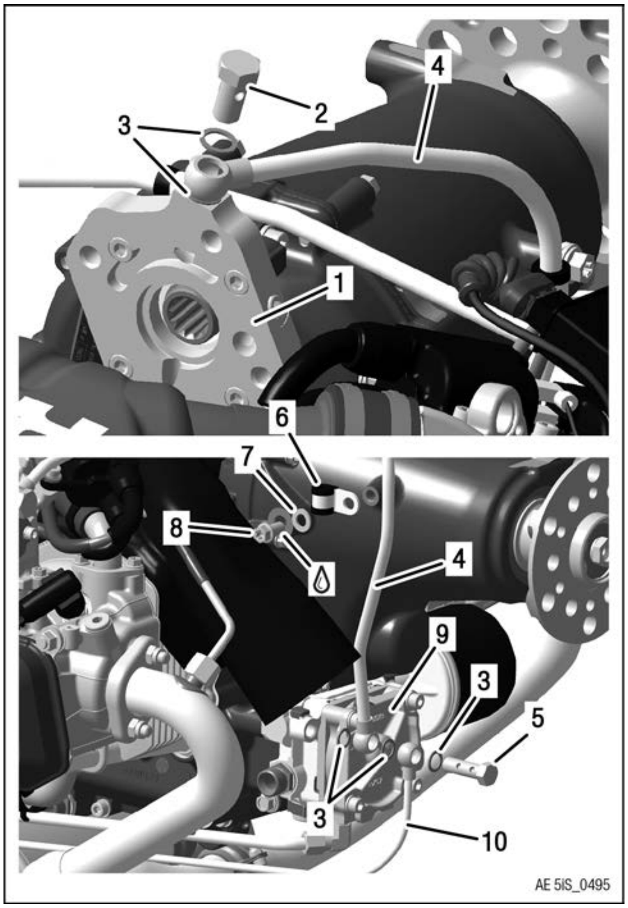


Figure 3.19

1	*Governor flange*	2	*Banjo bolt M10x1x23*
3	*Sealing ring A10x14*	4	*Governor pressure oil line assy.*
5	*Banjo bolt M10x1x34*	6	*Cable clamp 8/M8*
7	*Lock washer A8*	8	*Hex./Torx-flange screw*
9	*Oil pump housing*	10	*Turbo pressure oil line*

Step	Procedure
8	The plug screws usually remain installed. If necessary, a manometer can be connected to check the governor pressure.
9	Secure the 2 plug screw M8x1 with LOCTITE 243.

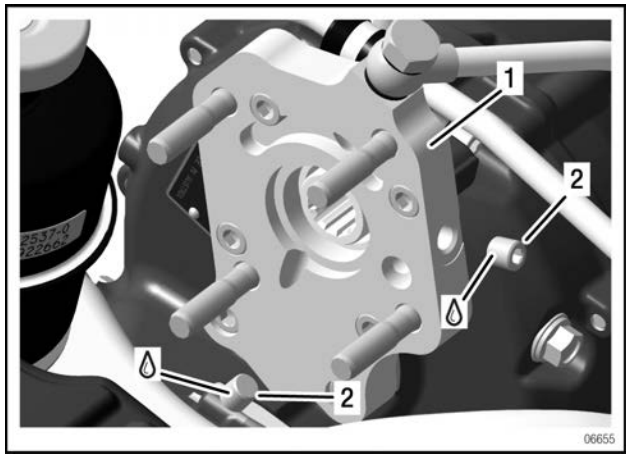


Figure 3.20

1	*Governor flange*	2	*Plug screws M8x1*

GOVERNOR INSTALLATION

Follow the governor manufacturer's instructions for maintenance, inspection and repair.

FINISHING WORK

- Install the propeller gearbox, see Chapter 72-10-00 section Propeller gearbox.

Chapter: 71–00–00
POWER PLANT

TOPICS IN THIS CHAPTER

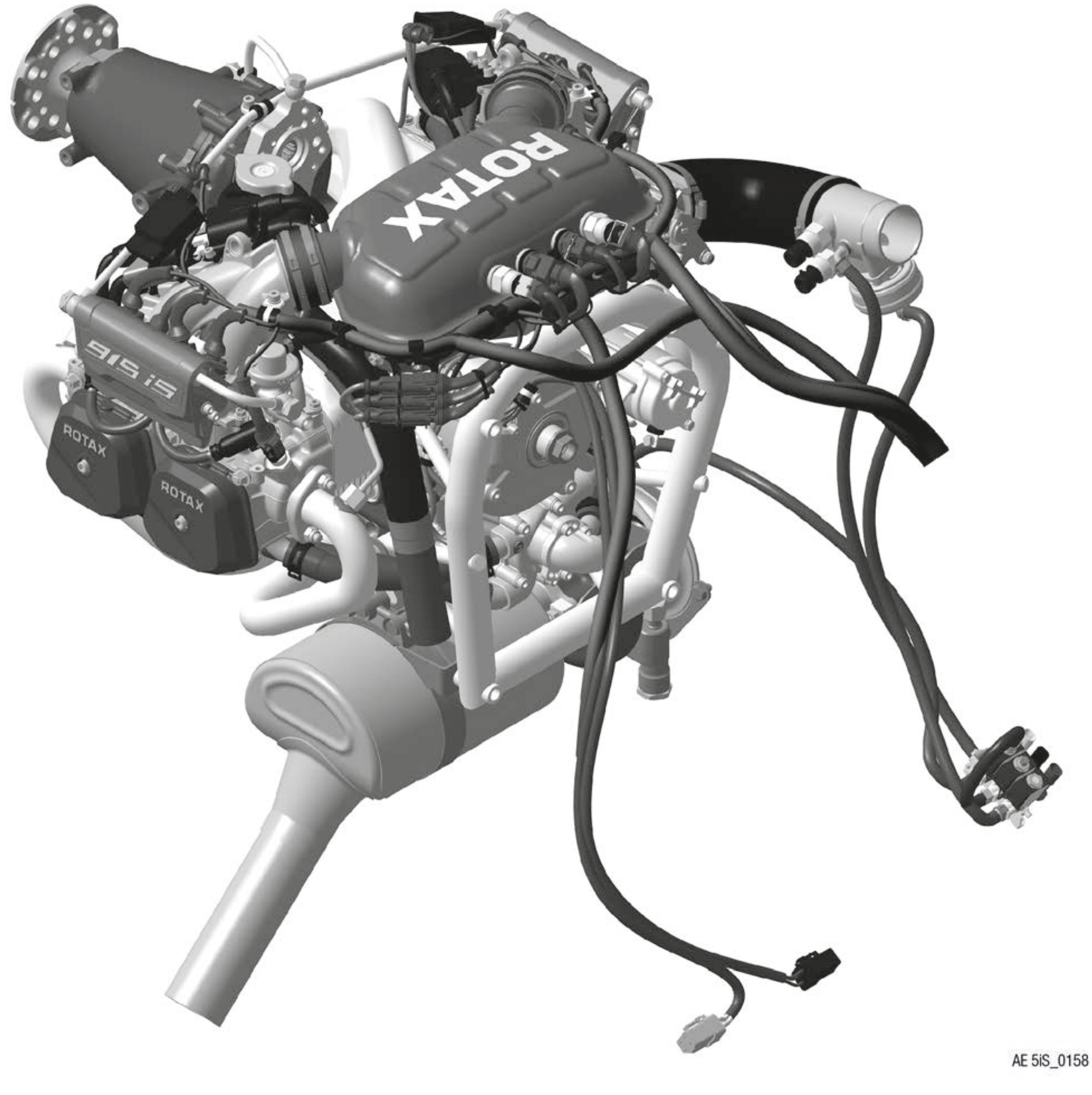


Figure 4.1: Power plant

SPECIAL TOOLS

Description	Part number
Engine lifting kit assy.	876040
Trestle support	877930
Trestle adapter assy.	876050
Socket driver hex. 8 ball head	876240

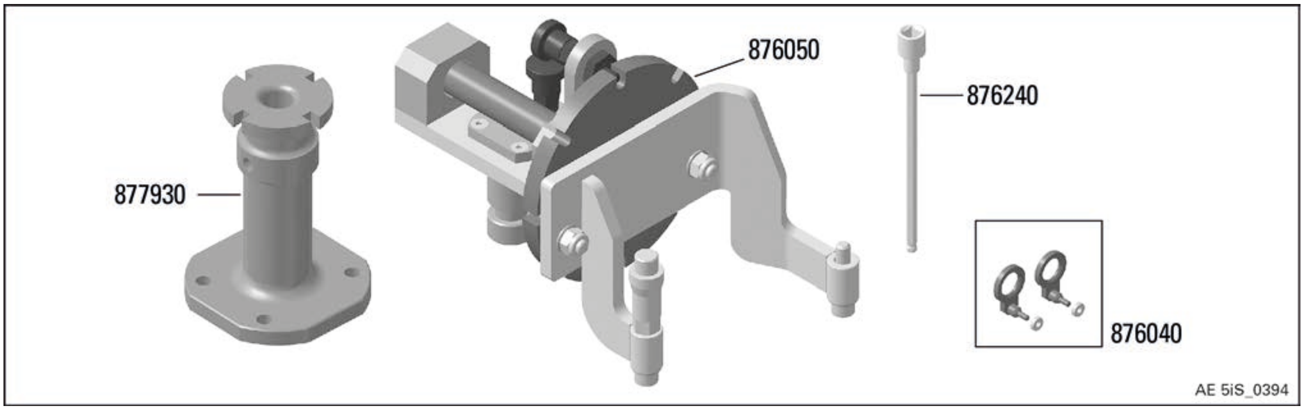


Figure 4.2

INSTALLATION CHECKLIST

The following installation checklist must be copied and filed in during power plant/engine installation.

Installation checklist for power plant assy./engine 915 iS	
Aircraft	
Type	
Serial number	
Registration number	
Manufacturer	
Engine	
Type	
Serial number	
FUSE BOX serial number	
ECU part no. (S/N)	
Manufacturer	BRP-Rotax GmbH&Co KG, 4623 Gunskirchen, Austria
Specifications/version	
Miscellaneous data	
Installation date	
Mechanic (surname and forename)	

Installation-related point	OK	Remark
Control unit (ECU) checked for damage and corrosion. Insulated construction checked.		
Fuse unit (FUSE BOX) checked for damage and corrosion. Fuses checked.		
Fuse unit (FUSE BOX) connections checked for secure connection. See also Chapter 71–00–00 section Power plant..		
Protective coverings removed.		
Fuel filters/prefilters on the aircraft frame side cleaned.		
All fuel tanks and fuel lines cleaned.		

Installation-related point	OK	Remark
See “Documentation of aircraft manufacturer”. See relevant Maintenance Manual Line Chapter 12–20–00 Planned maintenance.		
Checking the engine for contamination and damage. See relevant Maintenance Manual Line 05–00–00 Maintenance.		
Installation of the engine and its components. See also Chapter 71–00–00 section Power plant.		
Control unit (ECU) connections checked for secure connection. Connector lock in position! See also Chapter 71–00–00 section Power plant.		
Routing of wiring harness checked.		
Grounding cable checked according to aircraft manufacturer’s specifications. Allocation checked. See documentation of aircraft manufacturer.		
Fuel pump connection checked. See also Chapter 71–00–00 section Power plant..		
Fuel system checked for leaks. See relevant Maintenance Manual Line Chapter 12–20–00		
Fuel filter checked for blockages. See relevant Maintenance Manual Line Chapter 12–20–00.		
Propeller installed according to the aircraft manufacturer’s and propeller manufacturer’s specifications. See “Documentation of aircraft manufacturer”.		
Lubrication system filled and purged. To do this, see relevant Maintenance Manual Line Chapter 12–10–00 section Adding operating fluids + Chapter 12-20-00 section Purging of oil system.		
Engine test run/functional test. See relevant Maintenance Manual Line Chapter 12–20–00.		

General notes/remarks:
(Please fill in using block capitals!)

Location:______________________________**Date:** __________________________
Signature: _________________________**Print name:** _________________________

GENERAL NOTE

ENGINE PRESERVATION

Storage and preservation requirements for a new engine
The manufacturer BRP-Rotax guarantees satisfactory corrosion protection of the 915 i A Series aircraft engines for at least 12 months from the BRP-Rotax delivery date.
This warranty is subject to the following conditions:

- The engine must be stored in the original packaging delivered by BRP-Rotax.
- The covers must not be removed.
- The engine must be kept in suitable storage (closed, clean and dry).

If the engine is stored for a period longer than 12 months, the following checks must be carried out every 3 months.

Step	Procedure
1	Remove 1 spark plug per cylinder and turn the crankshaft manually through 2 full revolutions.
2	Re-install the spark plug.
3	Visual inspection for rust (e.g. propeller shaft). If rust is found, the engine must be sent to a Rotax authorized overhauling company for inspection.
4	Check fuel injectors for contamination or clogging.

⚠ WARNING

Non-compliance can result in serious injuries or death!
The engine must not be put into operation.

NOTE

The maximum possible storage period of the engine is limited to 24 months.

If this limit is exceeded, following steps are necessary:

- Removal of gearbox and one cylinder
- Visual inspection for possible corrosion on gear set, propeller shaft, clutch, crankshaft, camshaft, con rod, piston rings and the valves
- Replace or function test injectors at Rotax authorized overhaul shop.

NOTE

If there is any corrosion of the components, the engine must be sent to an ROTAX® Authorized Distributors or their independent Service Center.

- Installation of the removed gearbox and cylinder
- Oil change
- Engine test run

Storage and preservation of an engine which has been in operation
Thanks to the special cylinder wall coating, the ROTAX® aircraft engine does not generally need any special anti-corrosion measures.

ATTENTION

Storage is possible up to 12 months if the following steps are observed.

Carry out oil change, see Maintenance Manual Line for the engine type 915 i A Series.

- Seal all openings, exhaust pipe and air filters on the cold engine to prevent contamination and humidity.
- Spray steel parts on the outside with preservation oil.
- If the engine is out of service for longer periods, the whole preservation process must be repeated annually.

RETURN TO SERVICE

See the Maintenance Manual Line for the engine type 915 i A Series.

⚠ WARNING
Non-compliance can result in serious injuries or death! Work on the engine must be carried out by authorised personnel and certified.

Step	Procedure
1	Remove all plugs.
2	Clean the spark plugs with solvent and a plastic brush.
3	If preservation has been carried out less than a year ago, it is not necessary to change the oil again.
4	If the engine has been out of service for more than a year, the 100–hour inspection must be carried out.

TREATING RUST AND SURFACE DAMAGE

During longer out-of-service periods, flash rust can form on various metal parts. In the event of considerable corrosion or severely rusted screws, nuts, washers, bearings, bushings etc. replacement is absolutely necessary.

- Propeller shaft — To prevent surface rust, the flange should be lightly greased, see Chapter 72-00-00.
- For the electric system, see Chapter 74-00-00.

SYSTEM DESCRIPTION

DESCRIPTION OF DESIGN

A ROTAX® 915 i A Series engine consists basically of several main components and add-on assemblies, which are described in more detail in the Operators Manual (chapter 1).

TECHNICAL DATA

ATTENTION

Observe detailed technical data relevant for operation.
See the latest Operators Manual.

OPERATING LIMITS

See the current 915 i A Series Operators Manual, “Operating instructions”.

OPERATING FLUIDS/CAPACITIES

See the current 915 i A Series Operators Manual, “Operating media”.

WEIGHTS

See the current 915 i A Series Operators Manual, “Technical data”.

ENGINE/COMPONENTS, GENERAL

Design	4-cylinder turbocharged engine
Bore	84 mm
Stroke	61.0 mm
Displacement	1352 cm^3
Cylinders	Light alloy cylinder with Nicasil plating
Pistons	Light alloy piston with 3 piston rings
Cylinder head	4 single cylinder heads
Compression	8.2:1
Intake valve	38 mm, valve seat plated
Exhaust valve	32 mm NIMONIC, valve seat stellite-plated
Valve clearance	Automatic valve clearance compensation by means of hydraulic valve tappet
Valve drive	OHV, hydraulic valve tappet, push-rods and rocker arms
Camshaft	Steel, heat- and surface-treated
Crankshaft	Supported in 5 plain bearings, case hardened

Cooling system	Liquid-cooled cylinder heads, ram air cooled cylinders
Lubrication main + suction pump	1) Main oil pump circuit: Dry sump forced lubrication system, trochoid pump driven by the camshaft, oil return by the blow-by gases 2) Suction pump circuit: Extra trochoid pump driven by the camshaft returns oil from the lower oil sump of the turbocharger to the oil tank
Oil pressure	See latest Operators Manual of the respective 915 i A Series engine type.
Oil delivery rate	1) Main oil pump: approx. 9 l/min. at 5500 rpm 2) Suction pump circuit: approx 1.3 l/min. at 5500 rpm
Firing order	1–4–2–3
Spark plugs	12 mm. See Chapter Chapter 74–00–00
Integrated generator	Permanent magnet single-phase generator
Rectifier regulator	12 V 20 A DC
External generator (optional extra)	Full-wave rectifier with 12 V 40 A DC serial regulator
Fuel pumps	2 electric fuel pumps
Starter	Electric starter, 12 V/0.8 kW, 24 V optional
Propeller gearbox	Integrated gearbox with mechanical vibration damping and overload clutch
Gear transmission ratio	2.54
Direction of rotation	Counterclockwise, seen from the front in the direction of the propeller flange
Turbocharger	Exhaust gas turbine with wastegate, pop off valve

SERIAL AND PART NO.

The parts are labelled with serial and part numbers.

NOTE

If additional parts are purchased, part of the serial and part numbering of the aeronautical equipment manufacturer is included.

SERIAL NUMBER

The number system for the serial number consists of a two-digit number block and a four-digit number block with a point separating them.

The first number block of the serial number indicates the year of manufacture, the second is a consecutive number.

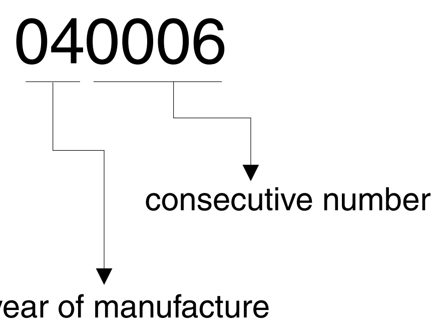


Figure 4.3: e.g. serial number

PART NO.

The part number consists of a simple six-digit number block.

This number block is a consecutive number.

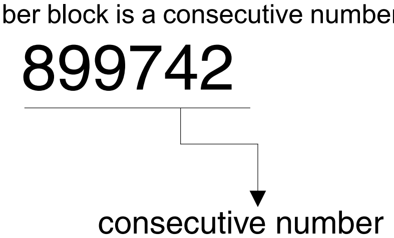


Figure 4.4: e.g. part no.

ENGINE COMPONENTS, ENGINE VIEWS, CYLINDER DESIGNATION AND DEFINITION OF MAIN AXES

PTO	Power take off side
MS	Magneto side
A	Suspension point (for transport)
◕	Center of gravity
P	Zero reference point (starting point for all dimensions) **NOTE** *Allow ± 1 mm on all stated dimensions as manufacturing tolerance*
x, y, z	Coordinate system axes
Cyl. 1	Cylinder 1
Cyl. 2	Cylinder 2
Cyl. 3	Cylinder 3
Cyl. 4	Cylinder 4

Components, engine views

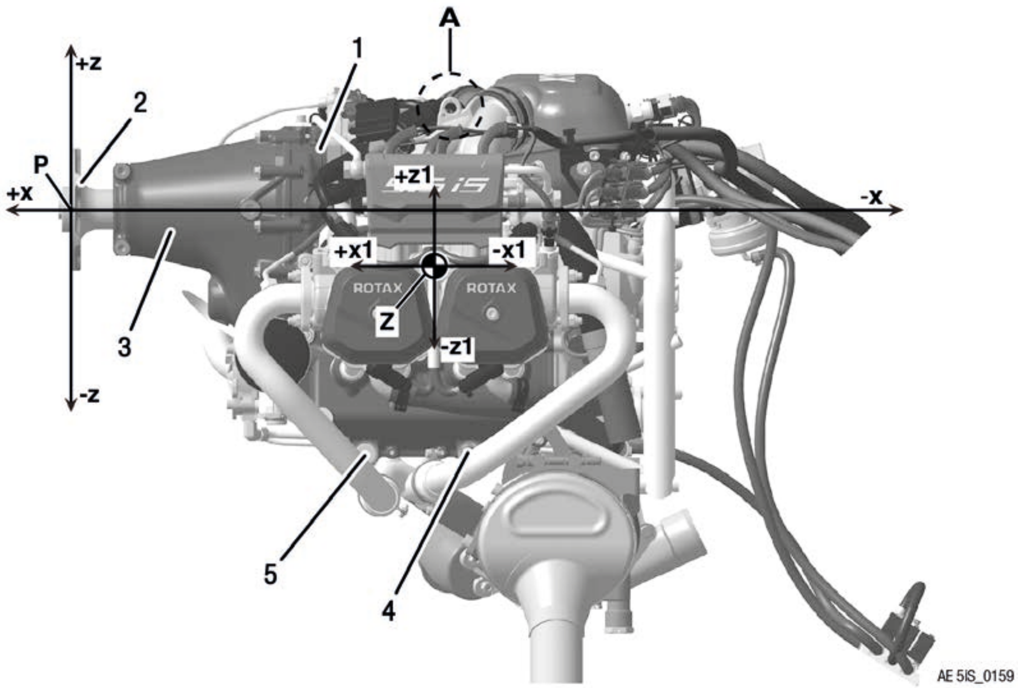


Figure 4.5: Side view

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

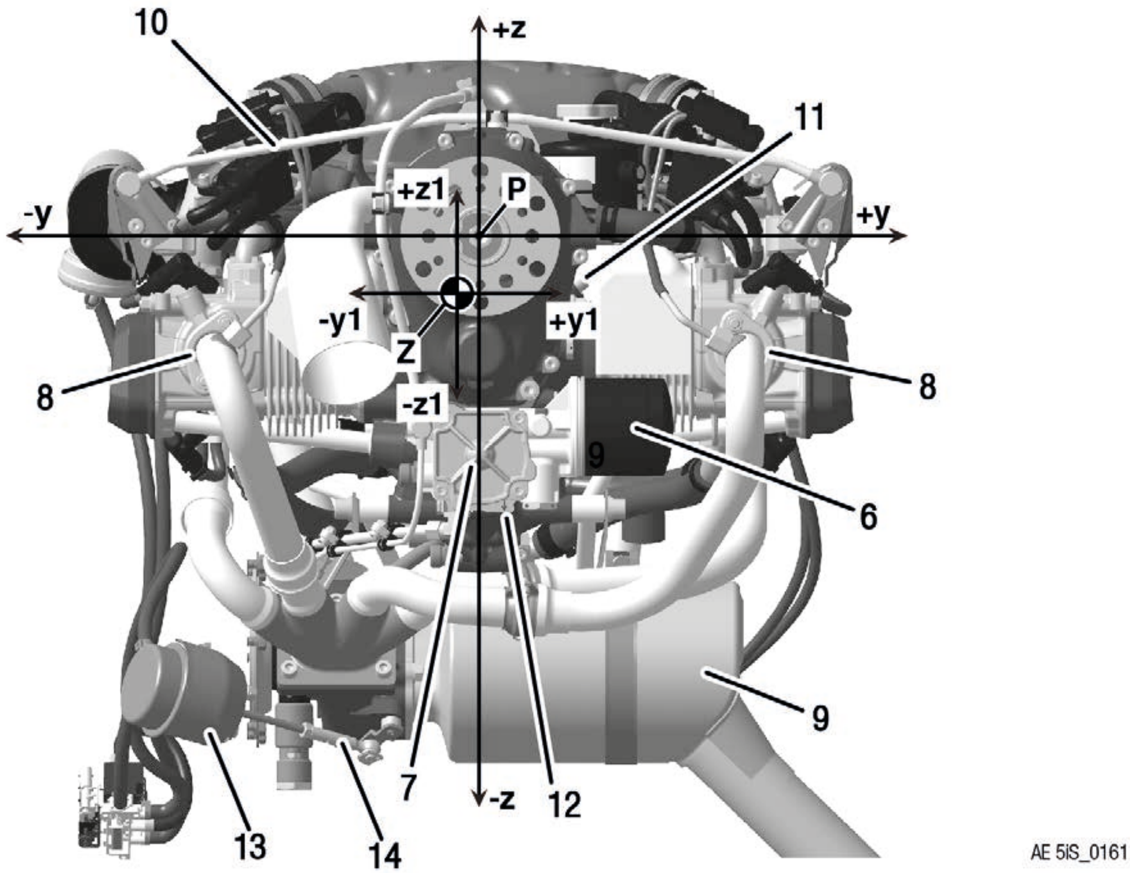


Figure 4.6: front view

6	*Oil filter*	7	*Oil pump*
8	*Exhaust flange*	9	*Muffler assy.*
10	*Fuel line assy.*	11	*Crankshaft locking screw position*
12	*Connection for Turbo oil return*	13	*Wastegate controller*
14	*Wastegate shaft*		

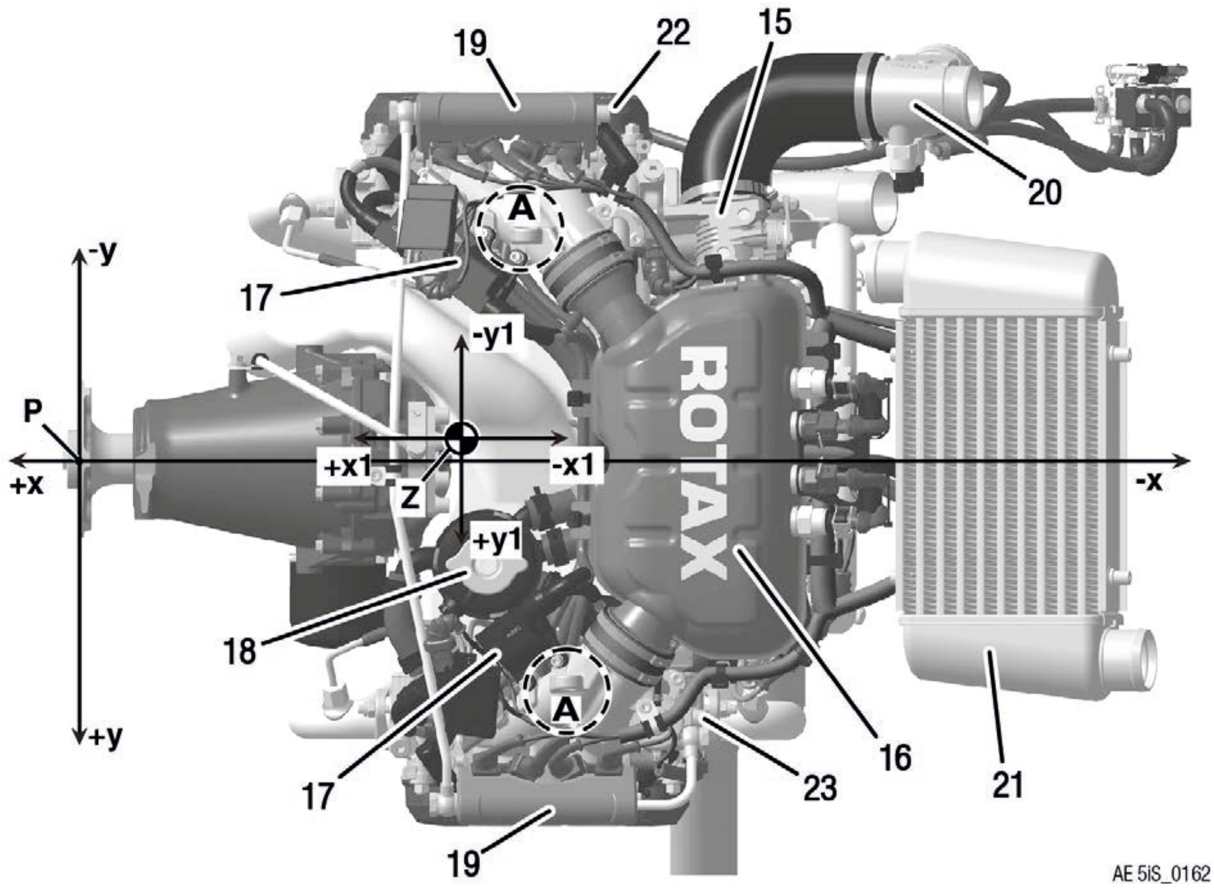


Figure 4.7: top view

15	*Throttle body*	16	*Airbox*
17	*Dual ignition coils*	18	*Expansion tank assy.*
19	*Fuel rail (right, left)*	20	*POP Off valve*
21	*Inter cooler*	22	*Connection for fuel feed line*
23	*Connection for fuel return line*	A	*Attachment points (for engine transport)*

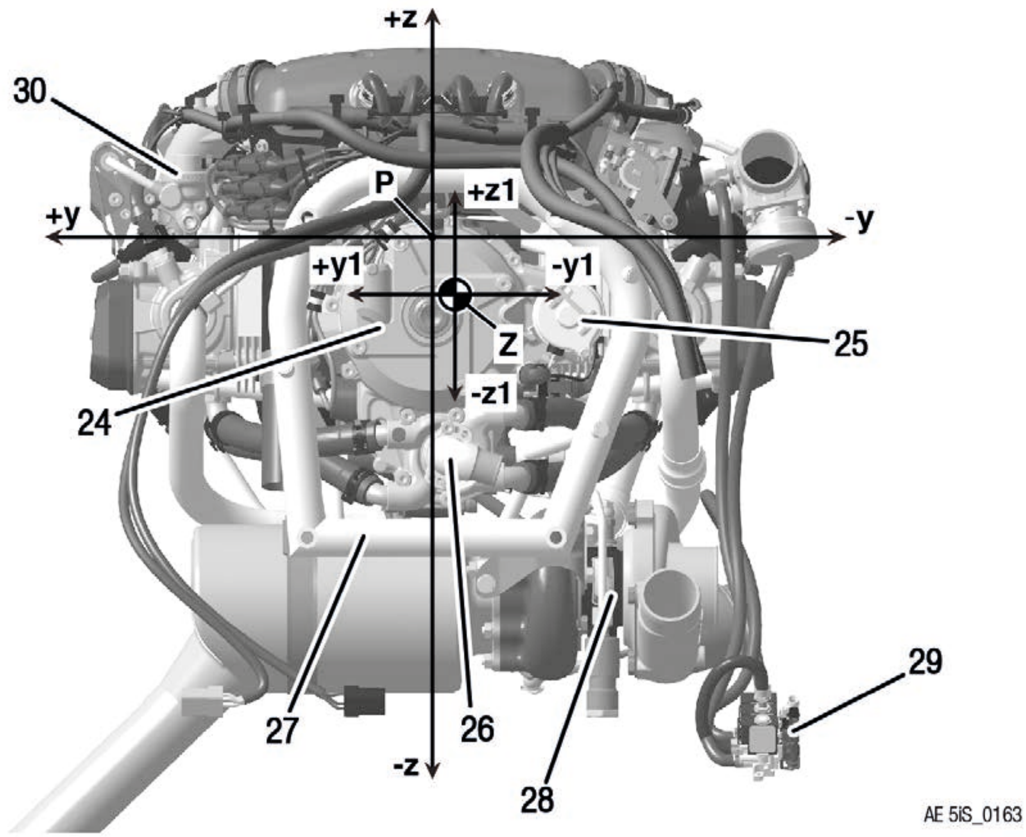


Figure 4.8

24	*Ignition housing*	25	*Electric starter*
26	*Water pump housing*	27	*Engine suspension frame (ring mount)*
28	*Turbocharger assy.*	29	*Solenoid valve (PCV)*
30	*Fuel pressure regulator*		

MAINTENANCE

For maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

POWER PLANT

POWER PLANT — REMOVAL

Preparation

To remove the engine, carry out the following steps. If these steps are included and listed in the instructions of the aircraft manufacturer (see “Documentation of the aircraft manufacturer”), the steps given here have to be treated as additional information.

- Secure the aircraft appropriately
- Switch the ignition OFF
- Disconnect the battery
- Switch the tank selector switch OFF
- Remove cowling
- Disconnect fuel lines
- Drain the residual fuel out of the lines and seal the lines
- Disconnect coolant hoses
- Drain the coolant
- Disconnect oil hoses/lines
- Drain the oil

DISCONNECTING THE SUPPLY LINES TO THE AIRCRAFT

- Disconnect all the supply lines between the engine and the aircraft.

Disconnect external Generator according the aircraft manufacturers instructions.

Step	Procedure
1	Remove the spinner and propeller. See also Chapter 61-00-00.

Disconnect sensors according to the aircraft manufacturer’s instructions.

Starter relay:

Step	Procedure
1	Remove M6 hex. nut along with the 6.4 washer. Pull off Faston connector. **NOTE** *Press the lock to pull off the Faston connector.*
2	Remove the ground screw/bolt.

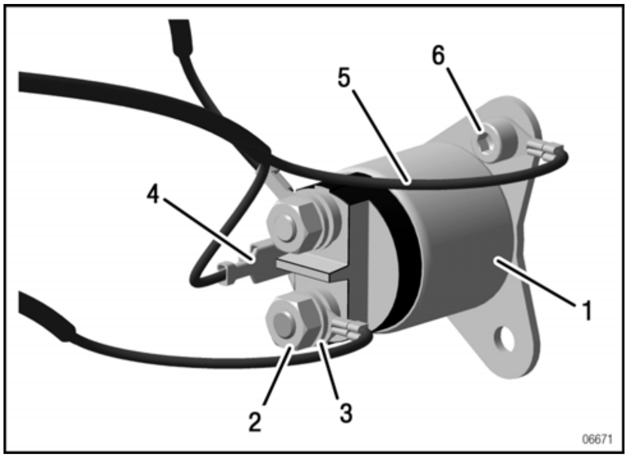


Figure 4.9

1	*Starter relay*	2	*M6 hex. nut*
3	*Washer 6.4*	4	*Faston connector*
5	*Ground wire*	6	*Screw or bolt*

Ambient pressure sensor (AATPS):

Step	Procedure
1	Push in the tab on the top of the connector and at the same time pull the connector out of the connection socket. See Chapter 76–50–00.

Remove sensors according to the aircraft manufacturer's instructions.

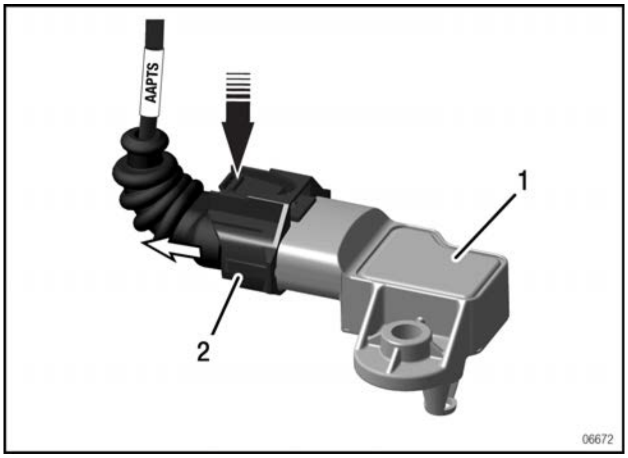


Figure 4.10

1 *Tab* 2 *Connection socket*

Fuse box (FUSE BOX)
See Chapter 76–50–00.

Step	Procedure
1	Remove M5 hex. nut from the ground wire on regulator A.

Remove Fuse box according to the aircraft manufacturer's instructions.

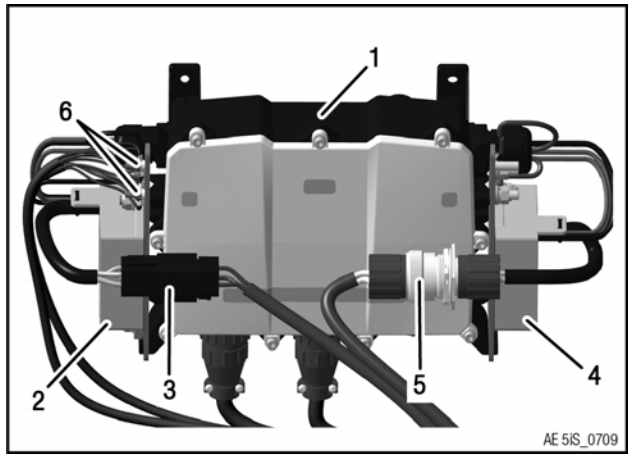


Figure 4.11

1 *FUSE BOX* 2 *Regulator generator A*
3 *Connector regulator A* 4 *Regulator generator B*
5 *Connector regulator B* 6 *Ground wire harness*

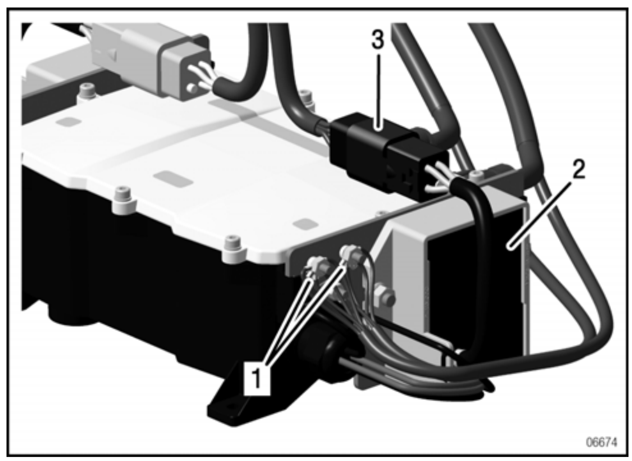


Figure 4.12: TYPICAL

1 *Ground wire* 2 *Regulator generator A*
3 *Connector regulator A*

Step	Procedure
2	Mark the regulator connector before detaching.
3	Push in the tab on the top of the connector and at the same time pull the connector out of the connection socket. **NOTE** *On Amphenol connectors first unscrew and then pull the connector out of the connector socket.*

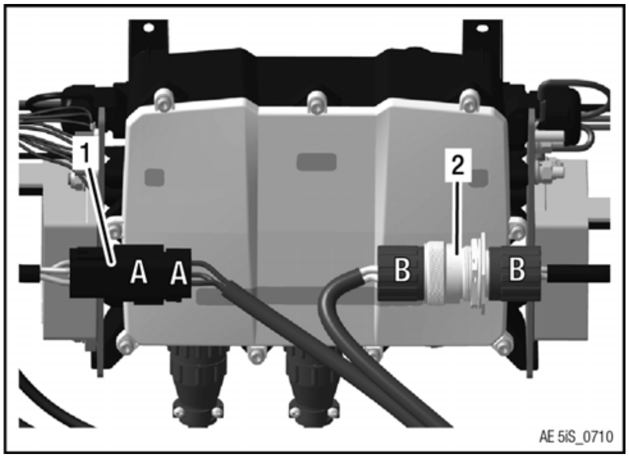


Figure 4.13

1 Connector regulator A 2 Connector regulator B

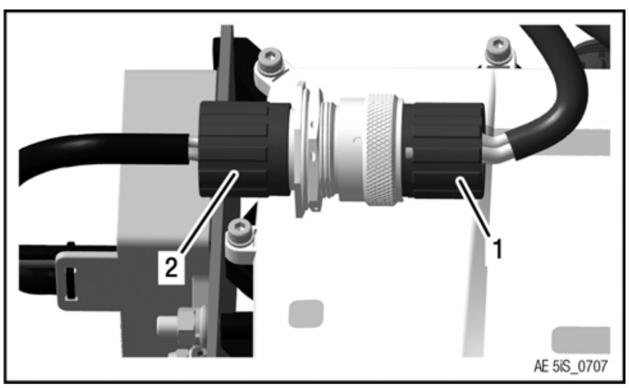


Figure 4.14

1 Amphenol connector 2 Connector socket

Step	Procedure
4	Remove the two round connectors (labelled Lane A, Lane B) of the fuse box. **NOTE** *Loosen the connector cap nut counter-clockwise.*
5	Pull the connectors in the two grooves out of the connector socket.

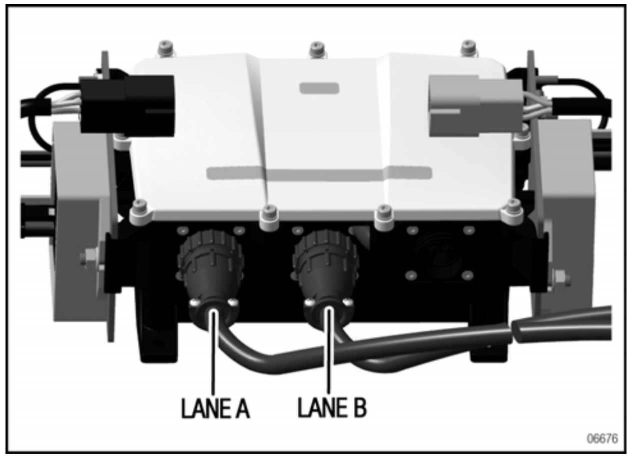


Figure 4.15: TYPICAL

NOTE

Round connectors have different grooves and cannot be mixed.

Fuel pump
See Chapter 73–10–00 section Fuel pump assy. – removal.

Control unit (ECU)

ATTENTION

ECU connectors are limited to 20 mating cycles.
Coupler removal must be logged on label.

See Chapter 76–10–00 section Control unit (ECU).

Step	Procedure
1	Press in the lock so that the clamp can be rotated.
2	Press the clamp down until it latches.

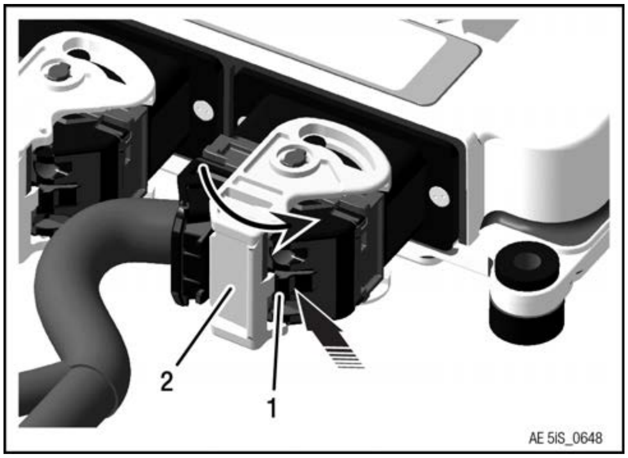


Figure 4.16

1 Lock *2 Lever*

Step	Procedure
3	Detach the couplers (ECU Lane A1, ECU Lane A2 and ECU Lane B).
4	Remove ECU according to the aircraft manufacturer’s instructions.

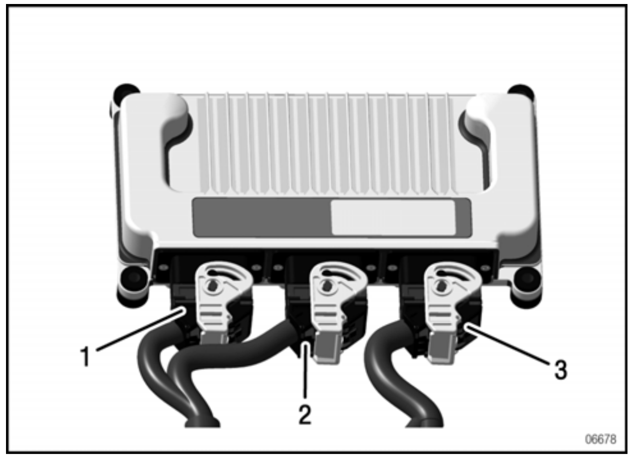


Figure 4.17

1 Coupler (Lane A1) *2 Coupler (Lane A2)*

3 Coupler (Lane B)

REMOVAL OF THE POWER PLANT FROM THE AIRCRAFT

Lift the engine from the aircraft using a crane or similar lifting gear.

⚠ WARNING

Danger of injury due to falling parts!When the engine is removed there is a risk of injury due to the engine or its assemblies falling!
Use ROTAX lift set, no other lifting points allowed. Note center of gravity! Do not walk under the lifted engine!Wear protective footwear!

ATTENTION

Danger of damage to the engine and aircraft!
Before the engine is removed, ensure that all detachable connections between the engine and the aircraft, i.e. hoses, lines, cables, cable ties and clamps have been disconnected and moved out of position so that they do not obstruct removal!

NOTE

Plug all hoses and openings to prevent contamination!

Step	Procedure
1	Fasten the straps properly to the lifting kit and to the lifting gear/crane.

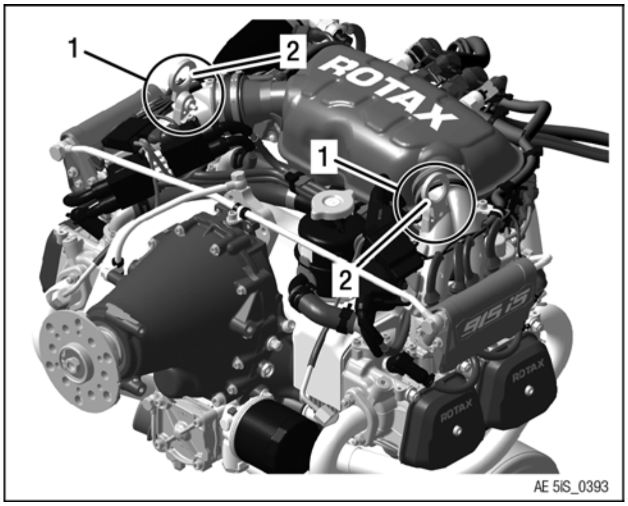


Figure 4.18

1 *Suspension points*	2 *Engine lifting kit assy part no: 876040*

Step	Procedure
2	Slowly tighten the straps by moving the crane upwards.
3	Loosen the screw connections between the engine suspension and the fire wall.
4	Using the crane, gradually move the engine vertically and carefully into the horizontal position to take the weight from the engine suspension frame bolts.
5	Completely loosen the screw connections between the engine suspension and the fire wall.
6	Lift the engine out of the aircraft, clean it and prepare it.

INSTALLATION

ENGINE — INSTALLATION

As well as the instructions given, the installation graphics with the major dimensions are useful.

⚠ WARNING

Danger of injury due to falling parts! When the engine is installed there is a risk of injury due to the engine or its assemblies falling!
Only use permitted lifting gear and special tools for this work! Fasten the lifting gear only to the transport brackets. Note center of gravity! Do not walk under the lifted engine! Wear protective footwear!

ATTENTION

Danger of damage to the engine!
If the fuel system has not been cleaned sufficiently, irregularities in the injecting system and malfunctions of its components can result!

- Clean the whole fuel system (including the fuel filters, all the fuel tanks and fuel lines on the aircraft frame side) according to the instructions of the aircraft and aeronautical equipment manufacturers to remove dirt before the fuel lines of the engine are installed.
- Clean the whole coolant system (including all the coolant tanks, and lines on the aircraft frame side) according to the instructions of the aircraft and aeronautical equipment manufacturers to remove dirt before the coolant lines of the engine are installed.

ATTENTION

Danger of damage to the power plant and aircraft!
All precautions specified by the aircraft manufacturer in its documentation must be followed!

Preparation

- Secure the aircraft appropriately
- Complete the installation checklist
- Install the fuse box (FUSE BOX) if removed
- Install the control unit (ECU)

NOTE

Must have be electrically isolated. No grounding to engine or aircraft frame!

ATTENTION

Danger of damage to the engine and aircraft!
Before the engine suspension frame screws are installed, ensure that all detachable connections between the engine and the aircraft, i.e. hoses, lines, cables, cable ties and clamps have been disconnected and moved out of position so that they do not obstruct installation!

INSTALLATION OF THE POWER PLANT IN THE AIRCRAFT

Lift the engine into the aircraft using a crane or similar lifting gear.

Step	Procedure
1	Fasten the straps properly to the suspension points and to the lifting gear/crane.
2	Slowly tighten the straps by moving the crane upwards.
3	Using the crane or a similar lifting gear, position the engine slowly and carefully on the installation points of the engine suspension frame fastening on the fire wall of the aircraft.
4	Install the screw connections of the engine suspension to the fire wall according to the aircraft manufacturer's instructions and tighten them diagonally from each other.
5	Reduce the tension of the installation position of the engine by lowering it slightly and tighten the four screw connections likewise diagonally from each other according to the tightening torque values of the aircraft manufacturer.
6	Remove the lifting gear.

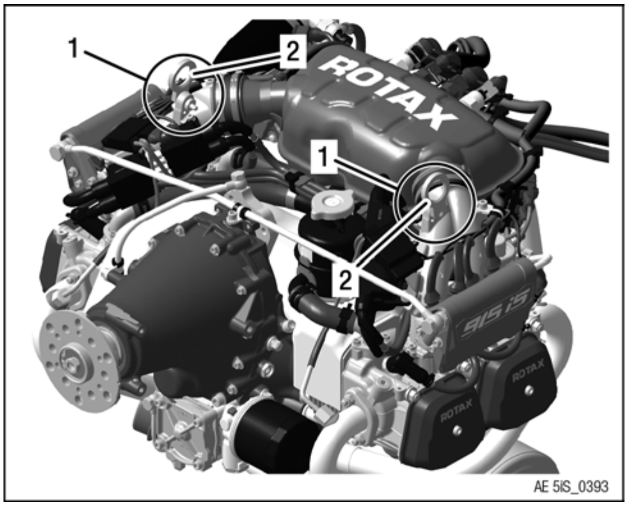


Figure 4.19

1	*Suspension points*	2	*Special Tools: Engine lifting kit assy part no: 876040*

CONNECTING THE SUPPLY LINES TO THE AIRCRAFT

Connecting electrical connectors, fuel lines, oil hoses, water hoses between the engine and the aircraft.

The supply lines are connected and disconnected the same way. See Chapter 71–00–00 section Removal.

ENGINE SUSPENSION FRAME

REMOVAL OF THE ENGINE SUSPENSION FRAME

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

Preparation

- Remove the coolant hoses (feed and return) according to the aircraft manufacturer's instructions. See Chapter 72–30–00 section Cylinder head.
- Remove the water pump housing. See Chapter 75–00–00.
- Remove muffler and turbocharger if necessary. See Chapter 78-10-00 section Muffler removal and Chapter 78-20-00 section Turbocharger assy. removal

Step	Procedure
1	After the Allen screws (1x M10x110, 2x M10x50 and 1x M10x35) have been removed along with their lock washers, the engine suspension frame can be removed.

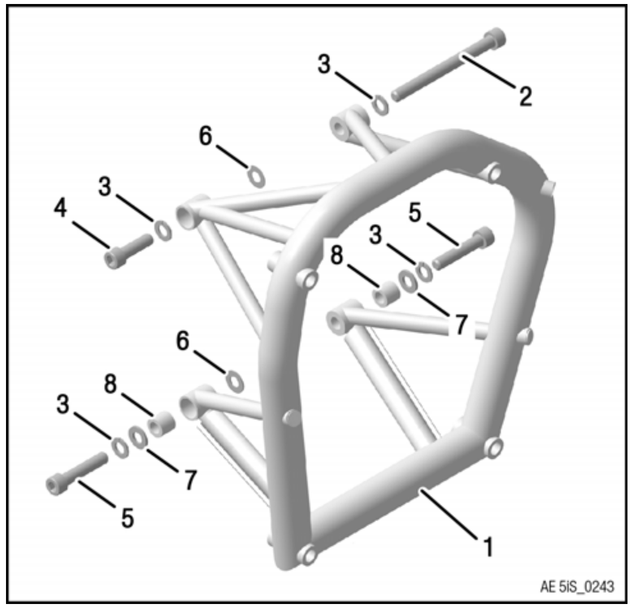


Figure 4.20

1	*Engine suspension frame*	2	*Allen screw M10x110*
3	*Lock washer A10*	4	*Allen screw M10x35*
5	*Allen screw M10x50*	6	*Thrust washer 10.1/20/ 5.0*
7	*Washer 10.5*	8	*Spacer*

ATTENTION

On the left-hand side (cylinders 2/4), thrust washers can be installed for tension-free assembly. Use as required.
Do not lose them!

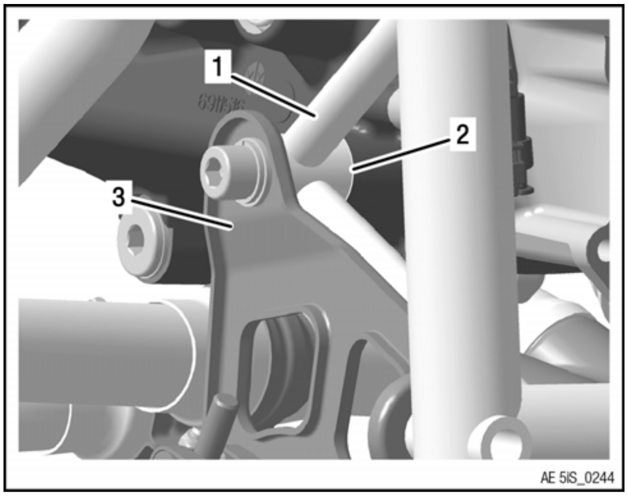


Figure 4.21

1	*Engine suspension frame*	2	*Thrust washer 10.1/20/ 1.0*
3	*Exhaust bracket*		

ATTENTION

Do not damage the temperature sensor and EGT temperature sensor on cylinder 4!

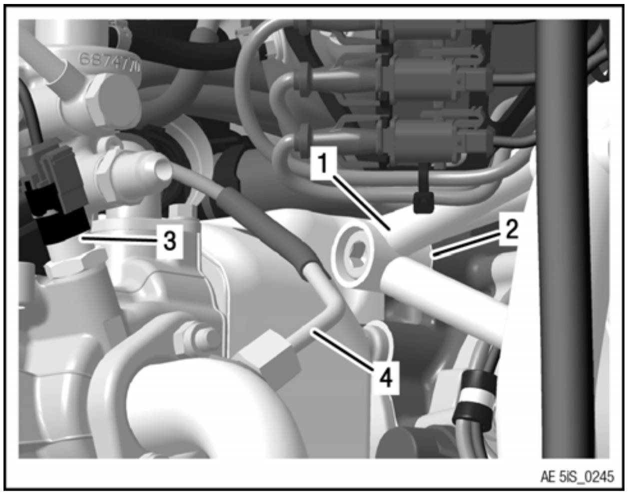


Figure 4.22

1	*Engine suspension frame*	2	*Allen screw M10x50*
3	*Temperature sensor (coolant)*	4	*EGT temperature sensor*

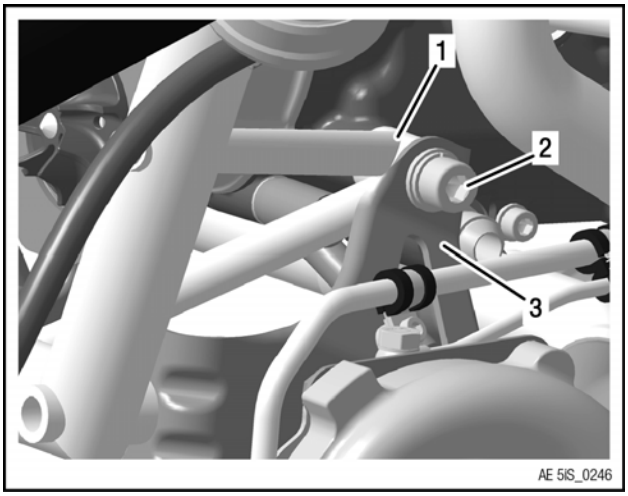


Figure 4.23

1	*Engine suspension frame*	2	*Allen screw M10x50*
3	*Exhaust bracket*		

ATTENTION

Remove air filter!

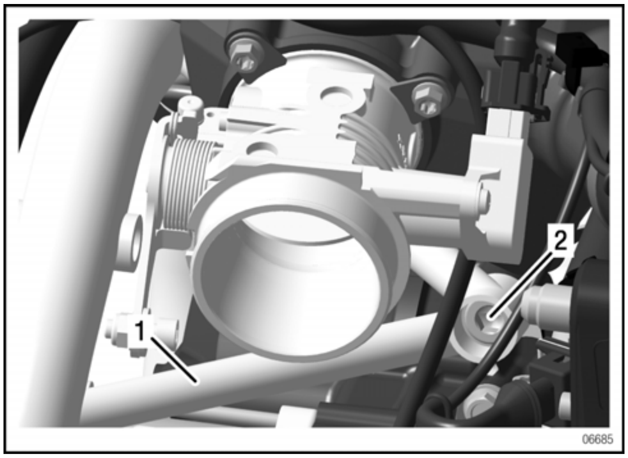


Figure 4.24

1	*Engine suspension frame*	2	*Allen screw M10x110*

INSPECTION

ENGINE SUSPENSION FRAME CHECK

Step	Procedure
1	All components must be visually inspected.

NOTE

Detailed visual inspection of the engine suspension frame in the vicinity of all welded connections between the tube and the struts.

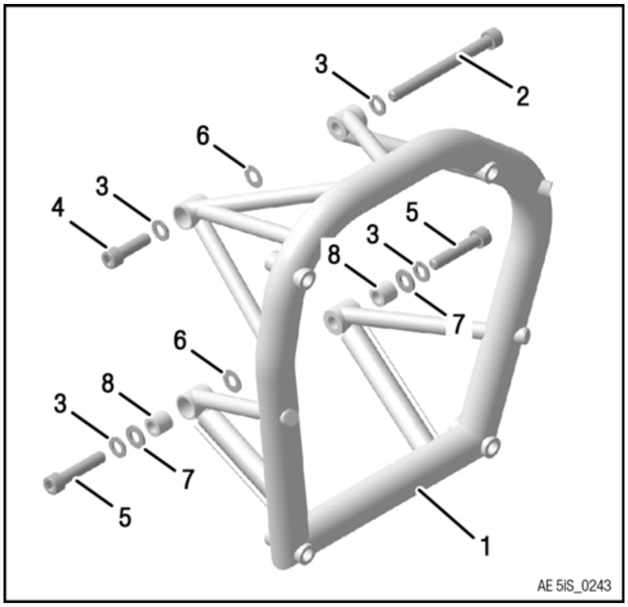


Figure 4.25

1	*Engine suspension frame*	2	*Allen screw M10x110*
3	*Lock washer A10*	4	*Allen screw M10x35*
5	*Allen screw M10x50*	6	*Thrust washer 10.1/20/ 5.0*
7	*Washer 10.5*	8	*Spacer*

NOTE

If necessary, a transfer flight to a repair company is permissible, as long as not more than one tube or strut is not more than 50% detached. If it is completely detached, immediate replacement is necessary.

INSTALLATION

INSTALLATION OF THE ENGINE SUSPENSION FRAME

ATTENTION

The engine suspension frame must be installed in a tension-free manner. Space out the engine suspension frame with thrust washers, as necessary to fill any gap.

NOTE

The Allen screws M10x110 must conform to strength class 10.9.

The engine suspension frame are installed and removed in the same way. See Removing the engine suspension frame.

NOTE

Tightening torque of the hex screws 1x M10x110, 2x M10x50 and 1x 10x35 is 60 Nm (44 ft. lb.), all of them must be secured with LOCTITE 243.

FINISHING WORK

- Install the water pump. See Chapter 75–00–00.
- Install the coolant hoses. See Chapter 75–00–00.

Chapter: 72–00–00
ENGINE

TOPICS IN THIS CHAPTER

This section describes the maintenance of the ROTAX® 915 i A Series engine. The description is divided into subsections and explanations of system functions.

Subject	Section
Engine	Chapter 72-00-00
Propeller gearbox	Chapter 72-10-00
Engine block	Chapter 72-20-00
Cylinder head	Chapter 72-30-00

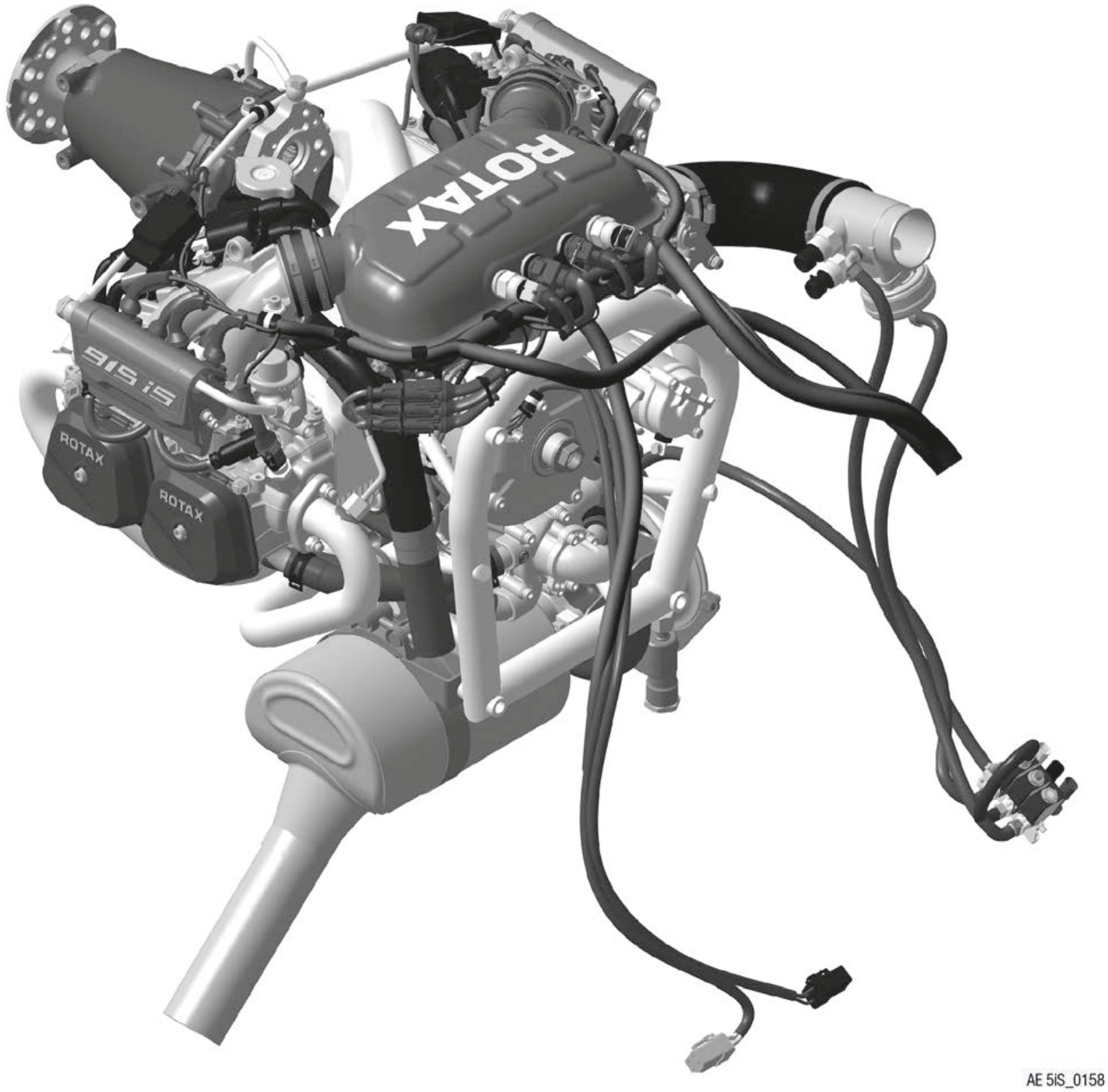


Figure 5.1: Engine

SYSTEM DESCRIPTION

The 915 i A Series engine is a 4-cylinder, four-stroke, horizontally opposed engine with manifold injection. This engine has liquid cooled cylinder heads and ram air cooled cylinders; this engine also has a fully redundant, electronic engine management system (EMS) including fuel injection, map-controlled ignition etc. Dry sump forced lubrication ensures constant oil pressure.

SAFETY INSTRUCTION

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

⚠ WARNING

Risk of injury due to spring-loaded parts!

ATTENTION

Ensure that the ignition is switched off!Disconnect the battery!Prevent the engine from being unintentionally switched on!

NOTE

Precautions for escaping oil must be taken at the installation site.

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Chapter: 72–10–00
PROPELLER GEARBOX

TOPICS IN THIS CHAPTER

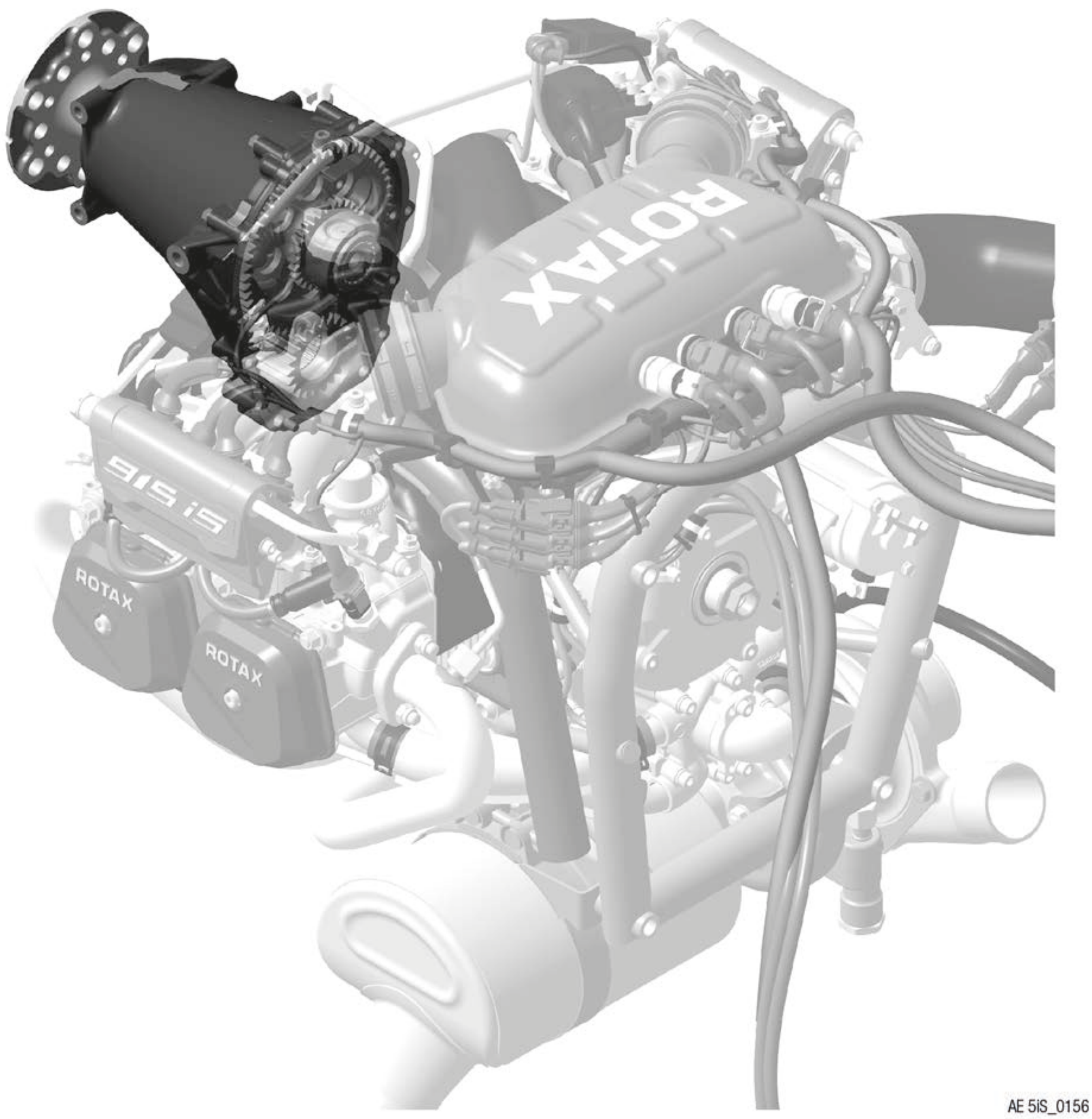


Figure 6.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Hot air gun	n.a.
Hand operated hydraulic press	n.a.
Socket wrench assy. 41x12.5	877445
Handle for insertion jig	877650
Puller assy.	877660
Extractor assy.	877615
Press-in jig	276000
Press-out mushroom	276002
Pull stud	276004
Socket wrench AF 46	276006
Centering ring	276950
Insertion jig	276952
Centering plate	276954
Centering plate	276956
Support plate	276958
Twist tool	276962
Insertion jig	276964
Insertion jig	276966
Retaining ring tool	276968
Insertion sleeve	276972
Insertion jig	276974

Thread bolt M8x50	240880
Hand operated hydraulic press	n.a.

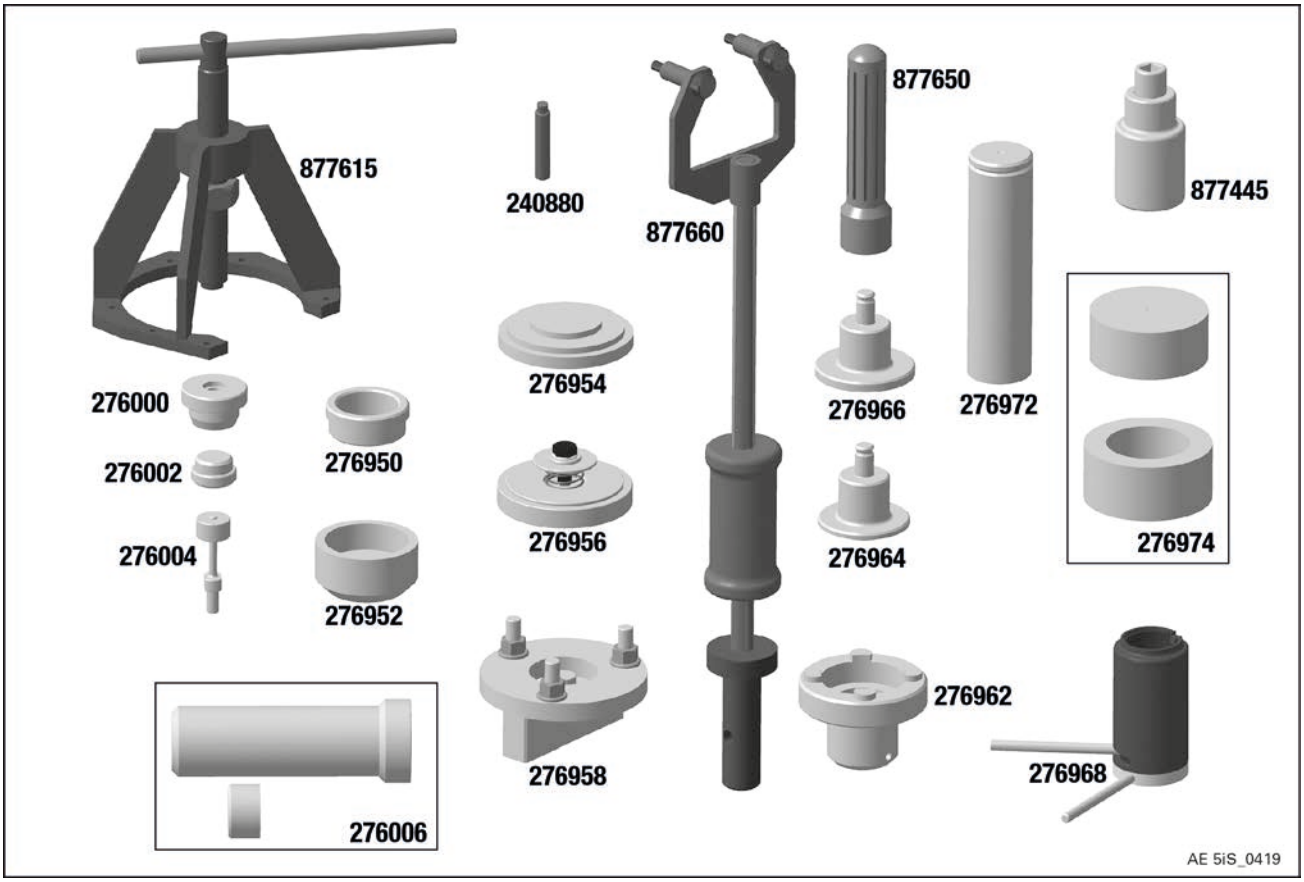


Figure 6.2

SERVICE PRODUCTS

Description	Part number
Engine oil	n.a.
LOCTITE 243	897651
LOCTITE 603	899789
LOCTITE 648	899788
LOCTITE 7063	n.a
LITHIUM-BASE GREASE	897330
LOCTITE 5910	899791
LOCTITE ANTI SEIZE 8151	297434

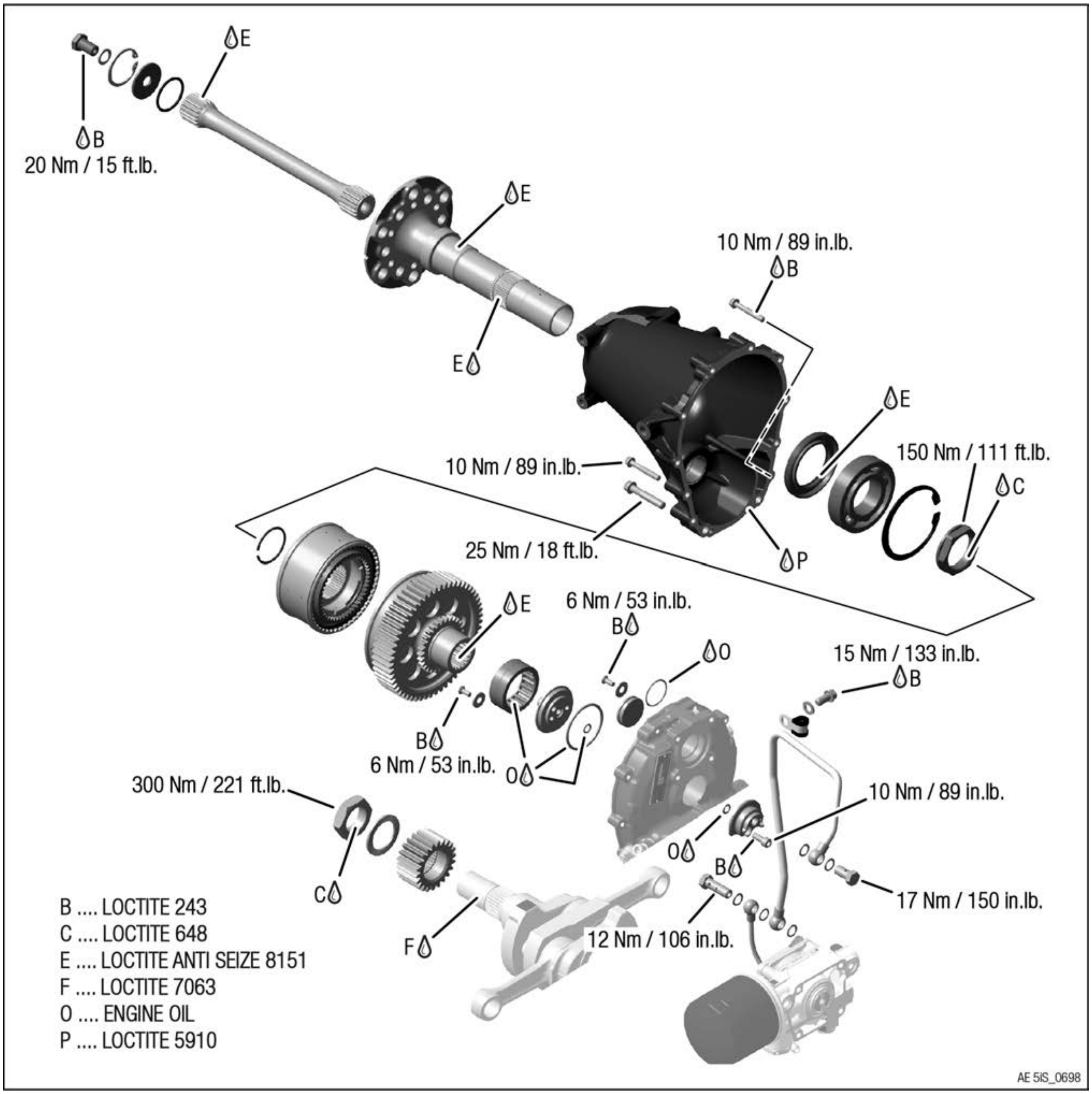

E
B
20 Nm / 15 ft.lb.
E
10 Nm / 89 in.lb.
B
E
E
10 Nm / 89 in.lb.
150 Nm / 111 ft.lb.
C
25 Nm / 18 ft.lb.
P
E
6 Nm / 53 in.lb.
B
O
15 Nm / 133 in.lb.
B
B
6 Nm / 53 in.lb.
O
300 Nm / 221 ft.lb.
10 Nm / 89 in.lb.
O
B
17 Nm / 150 in.lb.
C
F
12 Nm / 106 in.lb.
B .... LOCTITE 243
C .... LOCTITE 648
E .... LOCTITE ANTI SEIZE 8151
F .... LOCTITE 7063
O .... ENGINE OIL
P .... LOCTITE 5910
AE 5iS_0698

Figure 6.3

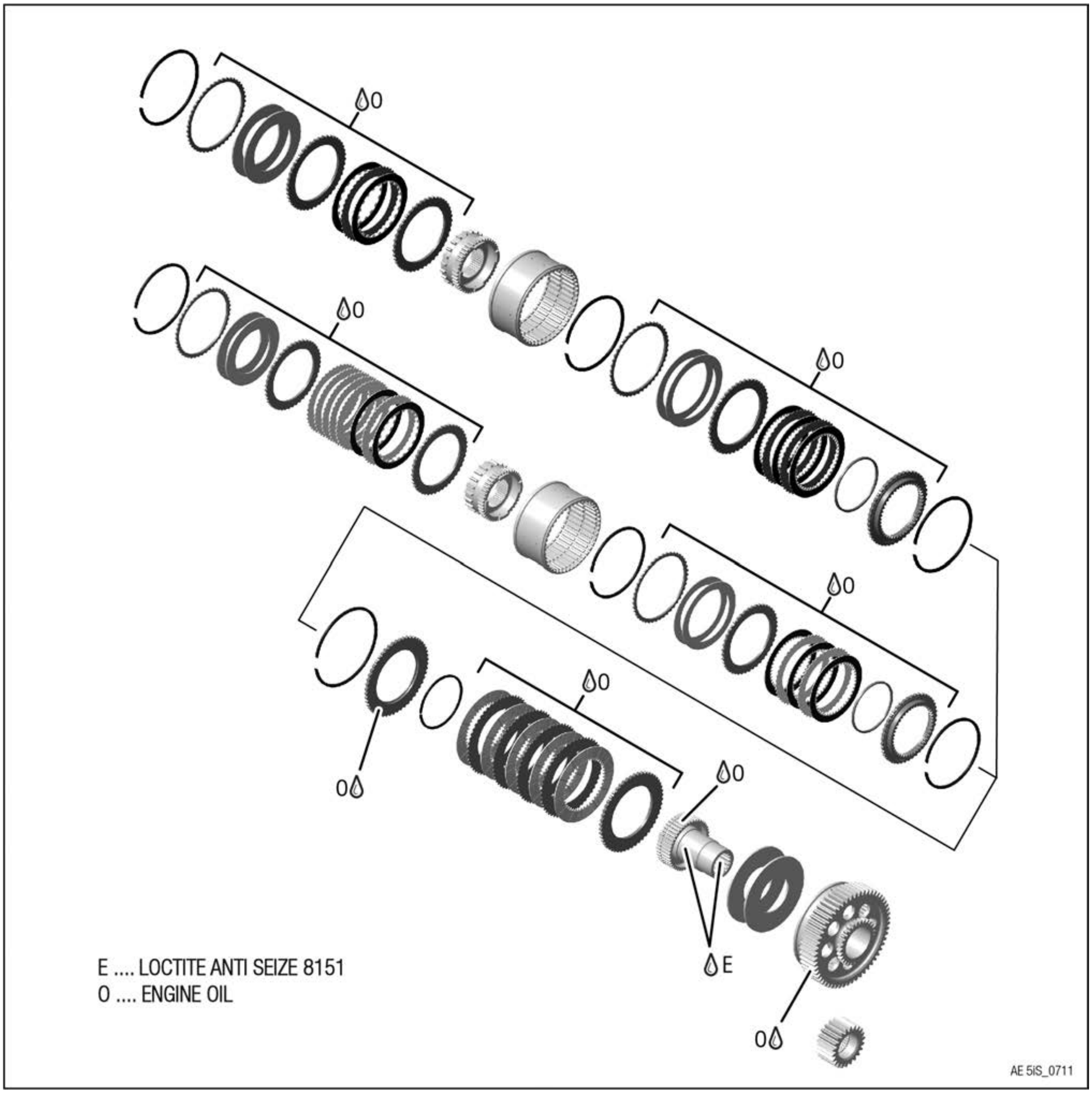


Figure 6.4

SYSTEM DESCRIPTION

The propeller shaft is driven by the crankshaft by means of a spur gear unit. Gear ratio Crankshaft : propeller shaft 2.54 : 1
The power transmission from the crankshaft to the propeller consists of: overload clutch, damper clutch and torsion shaft. The damper clutch and torsion shaft absorbs vibrations and/or shocks caused by engine running and/or the propeller. The overload clutch protects the crankshaft in case of a propeller strike.

SAFETY INSTRUCTIONS

⚠ **WARNING**

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

⚠ **WARNING**

During work on the engine there is a risk of life-threatening injuries from the propeller and rotating parts in the engine!
Ensure that the ignition is switched off!
Disconnect the battery
Prevent the engine from being unintentionally switched on!

CONNECTIONS FOR DISPLAY SYSTEMS

Follow the instructions in the Installation Manual regarding connections for instrumentation.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

For removal of the propeller gearbox, see the relevant Maintenance Manual Line for the respective engine type 915 i A Series.

Preparation
Before the propeller gearbox is removed, the gearbox oil line assy. must be removal.

GEARBOX OIL LINE ASSY – REMOVAL

Step	Procedure
1	Loosen banjo bolts M10x1x19 with two sealings rings on both sides of the gearbox and oil pump housing.
2	Loosen the hex./torx-flange screw M8x16 form the cable clamp and remove the gearbox oil line assy.

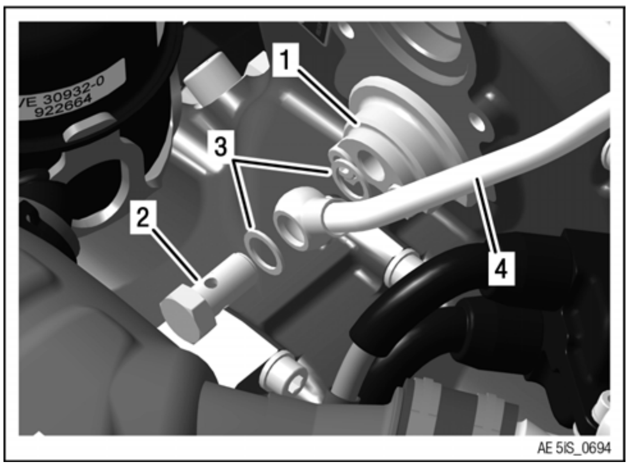


Figure 6.5

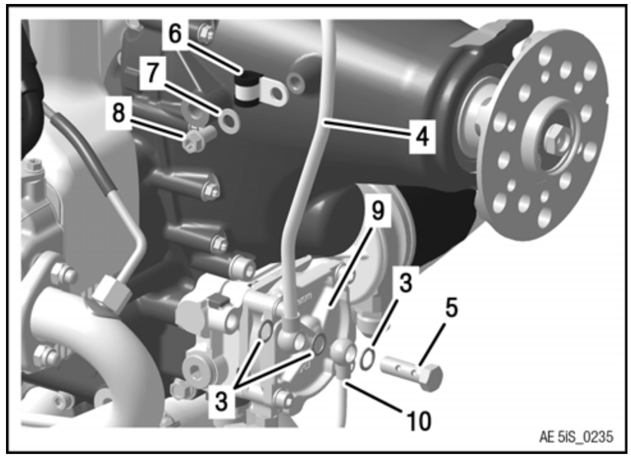


Figure 6.6

1	*Oil inlet flange adaptor*	2	*Banjo bolt M10x1x19*
3	*Sealing rings A 10x14*	4	*Gearbox oil line assy.*
5	*Banjo bolt M10x1x34*	6	*Cable clamp 8/M8*
7	*Lock washer A8*	8	*Hex./Torx-flange screw M8x16*
9	*Oil pump housing*	10	*Turbo pressure oil line*

TORSION SHAFT— REMOVAL

NOTE

If the clutches can not be removed, then remove the torsion shaft first.

Step	Procedure
1	Remove the clutches.

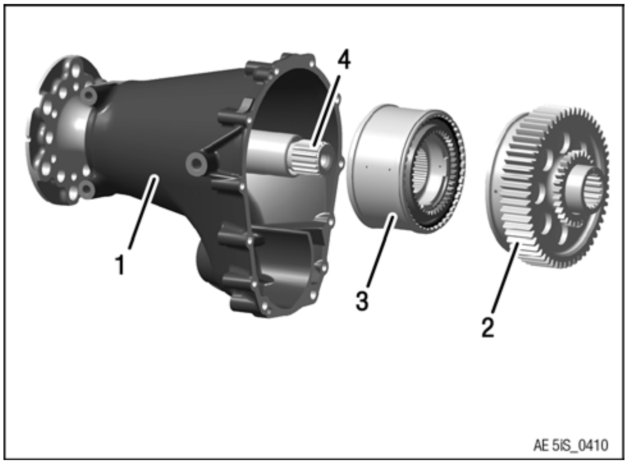


Figure 6.7

1 *Propeller gearbox*
2 *Overload clutch assy.*
3 *Damper clutch assy.*
4 *Torsion shaft*

Step	Procedure
2	Remove the hex. screw M12x20 with washer.
3	Remove the retaining ring with circlip pliers. Remove the sealing washer and the O-ring.

CONFIGURATION 3

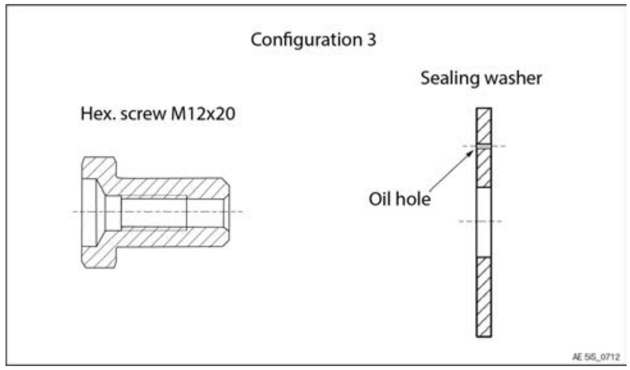


Figure 6.8

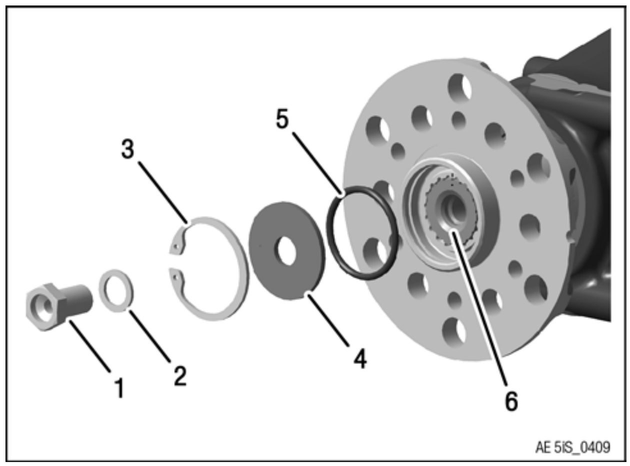


Figure 6.9

1 *Hex. screw M12x20*
2 *Washer*
3 *Retaining ring*
4 *Sealing washer*
5 *O-ring*
6 *Torsion shaft*

CONFIGURATION 2

ATTENTION

Difference to Configuration 3
– Torsion shaft with oil groove
– Sealing washer without hole
– Hex. screw M12x20 with oil hole

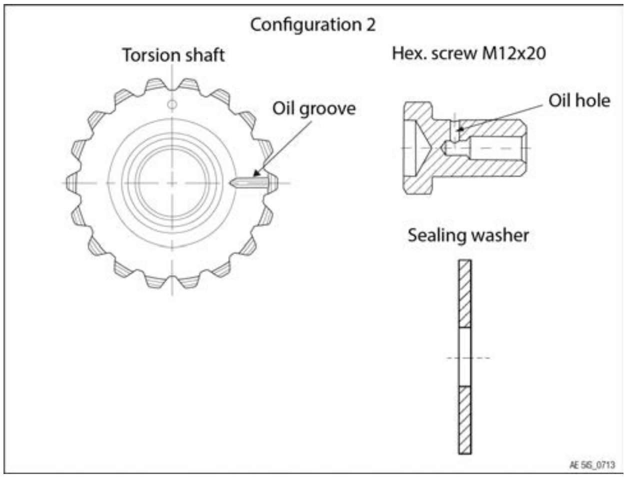


Figure 6.10

Step	Procedure
4	Carefully knock out the torsion shaft with a suitable punch.

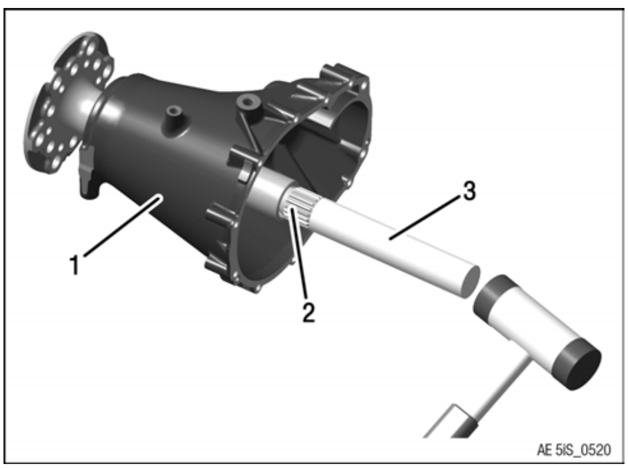


Figure 6.11

1 Propeller gearbox
2 Torsion shaft
3 Plug tool

DISASSEMBLY

DISASSEMBLY OF THE PROPELLER GEARBOX

Step	Procedure
1	The propeller flange must be fixed to the support plate part no. 276958. The plate should be fixed in a bench vise.
2	Remove the retaining ring with tool part no. 276968.

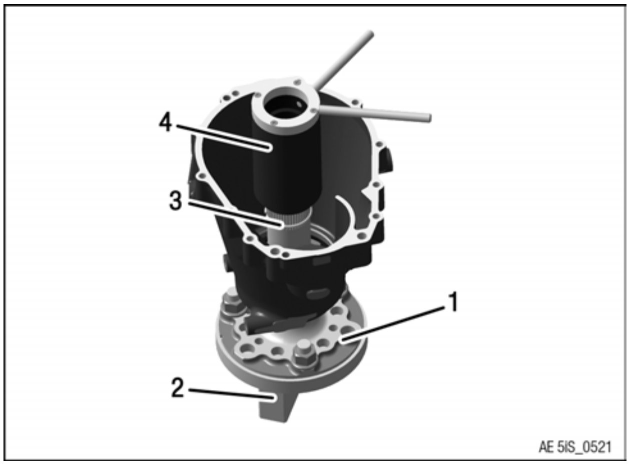


Figure 6.12

1	*Propeller flange*	2	*Support plate part no. 276958*
3	*Retaining ring*	4	*Retaining ring tool*

Step	Procedure
3	Loosen the collar nut M40x1.5 (left hand thread) for receiving axial thrust of the propeller shaft using the deep socket wrench part no. 276006. **NOTE** *The collar nut is secured with LOCTITE 648.* *For removal, warm up the collar nut with a hot air gun.*

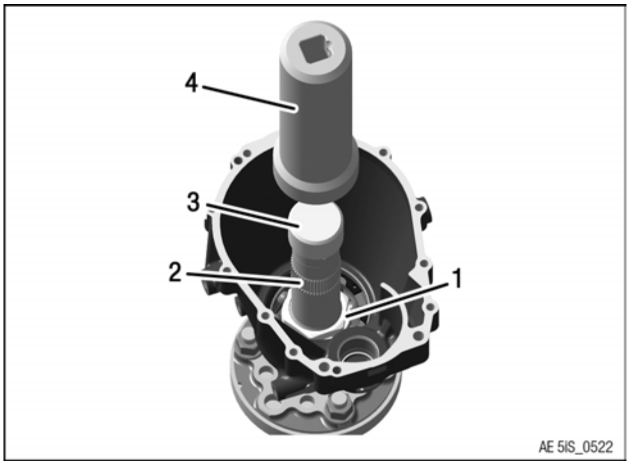


Figure 6.13

1	*Collar nut*	2	*Propeller shaft*
3	*Protective mushroom*	4	*socket wrench part no. 276006*

REMOVAL OF THE PROPELLER SHAFT

ATTENTION

If the propeller shaft is removed, the oil seal and ball bearing must be replaced!

Step	Procedure
1	Fix the support plate part no. 276958 in a bench vise and place the gearbox housing on it.
2	Press out the propeller shaft with the extractor part no. 877615.

ATTENTION

Damage to the machined inner diameter of the propeller shaft possible.
The protection piece (press-out mushroom) must be used.

NOTE

Alternatively, the hand press can also be used to press out the propeller shaft.

Step	Procedure
3	Plug the press-out mushroom part no. 276002 into the propeller shaft end and screw the extractor onto the gearbox housing with six M6 Allen screws.
4	Place the pull-in spindle into the extractor support and screw the M24x1.5 hex. nuts onto the spindle from the inside.
5	Held with the spanner, the propeller shaft is pushed out of the gearbox housing by turning the spindle clockwise.

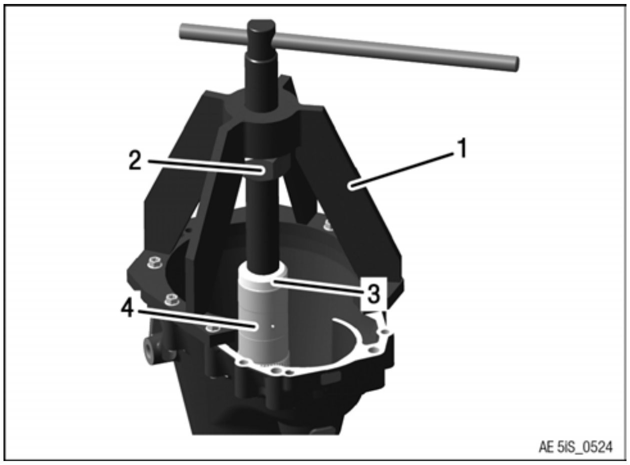


Figure 6.14

1	*Extractor*	2	*M24x1.5 hex. nut*
3	*Press-out mushroom*	4	*Propeller shaft*

REMOVAL OF THE BALL BEARING AND OIL SEAL

After the propeller gearbox has been removed, the propeller shaft bearing in the gearbox and the oil seal must be replaced.

Step	Procedure
1	Remove the retaining ring with the circlip pliers.

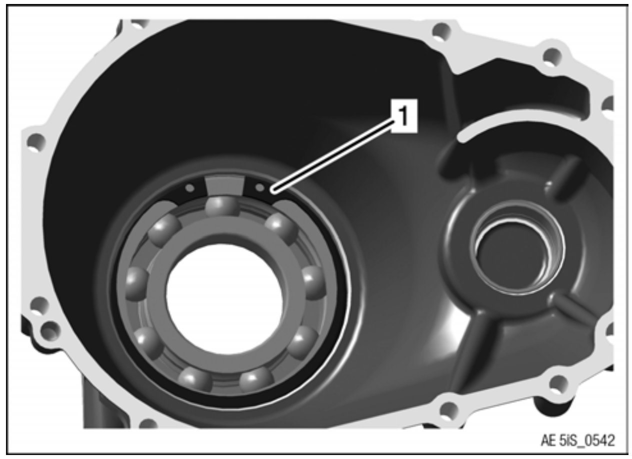


Figure 6.15

1 *Retaining ring*

ATTENTION

The shaft seal will be damaged in this process and must therefore be replaced.

Step	Procedure
2	Heat the gearbox housing about 100 to 120 °C and press-out the ball bearing together with the oil seal using a suitable punching tool.

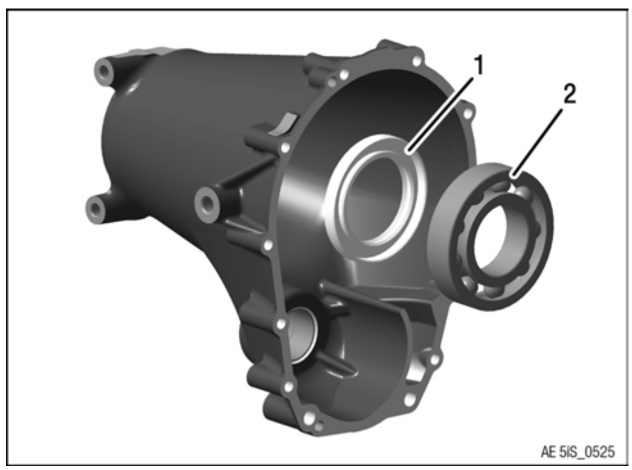


Figure 6.16

1	*Oil seal*	2	*Ball bearing*

REMOVAL OF THE BLINDING SHIM

CONFIGURATION 2

Step	Procedure
1	Loosen the countersunk screw M5x12 include the trust washer for the blinding shim fastening.
2	Press the blinding shim out towards the gearbox with a suitable insertion jig.

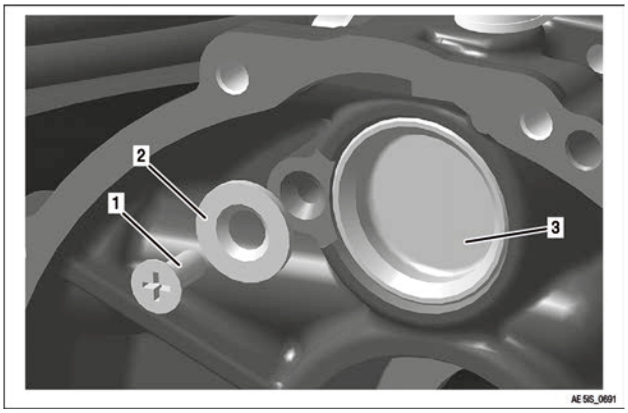


Figure 6.17

1 Countersunk screw M5x12 *2 Thrust washer*
3 Blinding shim

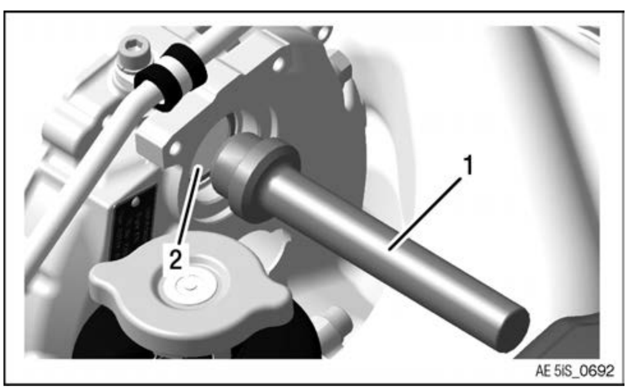


Figure 6.18

1 Insertion jig part no. 276332 *2 Blinding shim*

REMOVAL OF THE OIL INLET FLANGE

CONFIGURATION 2

Step	Procedure
1	Loosen 2 Allen screws M6x16 for the oil inlet flange fastening.
2	Remove the oil inlet flange with the two O-rings behind it.

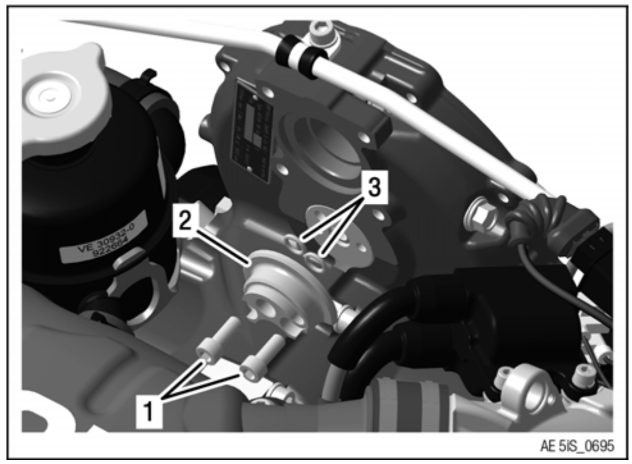


Figure 6.19

1 Allen screws M6x16 *2 O-rings*
3 Oil inlet flange

REMOVAL OF THE NEEDLE BEARING

Preparation – CONFIGURATION 2 AND 3

- Remove the governor flange according to the instruction in section Governor flange — removal.

Step	Procedure
1	Loosen M5x12 hex. screw with thrust washer from the engine block.

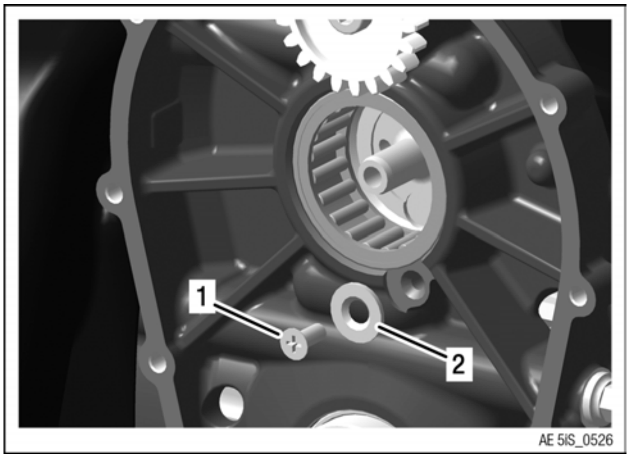


Figure 6.20: TYPICAL

1 M5x12	*2 Thrust washer*

Step	Procedure
2	Mount press-in jig part no. 276000 to the needle bearing.
3	Install the threaded pin of special tool part no. 276004 through the plunger and the oil inlet flange. Fix it with the knurled nut on the other side.

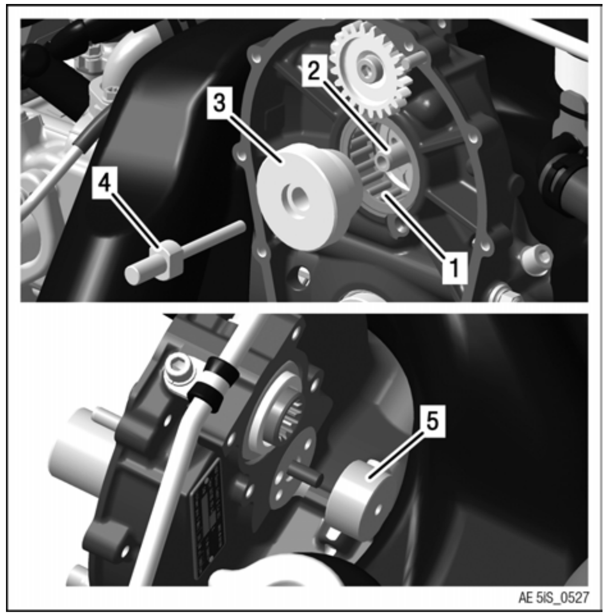


Figure 6.21: TYPICAL

1 Needle bearing	*2 Oil inlet flange*
3 Press-in jig part no. 276000	*4 Threaded pin of tool 276004*
5 Knurled nut of tool 276004	

Step	Procedure
4	Install extractor part no. 877615 with 6 screws onto the propeller gearbox.
5	Screw extractor spindle and threaded pin of special tool part no. 276004 together.

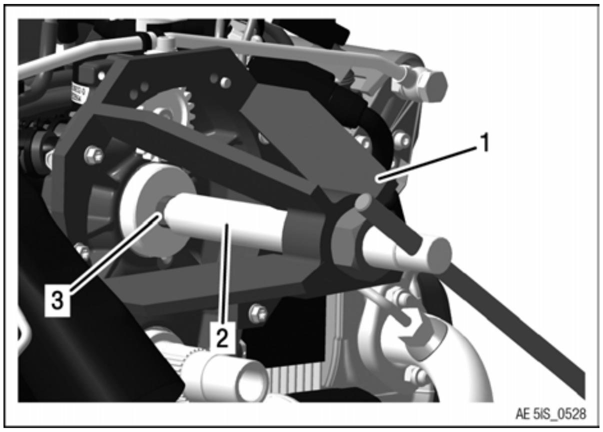


Figure 6.22: TYPICAL

1	*Extractor part no. 877615*	2	*Extractor spindle*
3	*Threaded pin of tool 276004*		

Step	Procedure
6	Remove the needle bearing and oil inlet flange by turning the extractor spindle.
7	Remove the O-ring.

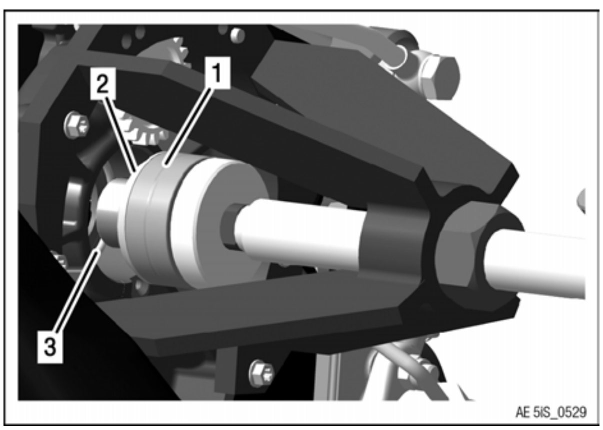


Figure 6.23: TYPICAL

1	*Needle bearing*	2	*Oil inlet flange*
3	*O-ring*		

DISASSEMBLY OF THE OVERLOAD CLUTCH ASSY.

For disassembly and assembly use a hand operated hydraulic press or similar.

Step	Procedure
1	Insert overload clutch into the insertion jig part no. 276974.

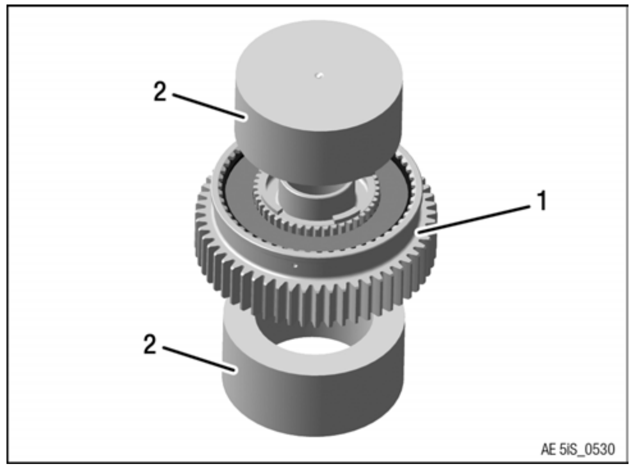


Figure 6.24

1	*Overload clutch*	2	*Insertion jig part no. 276974*

Step	Procedure
2	Press clutch assy. with insertion jig part no. 276974 until the circlip is free for removal.
3	Remove the circlip using a small screwdriver.

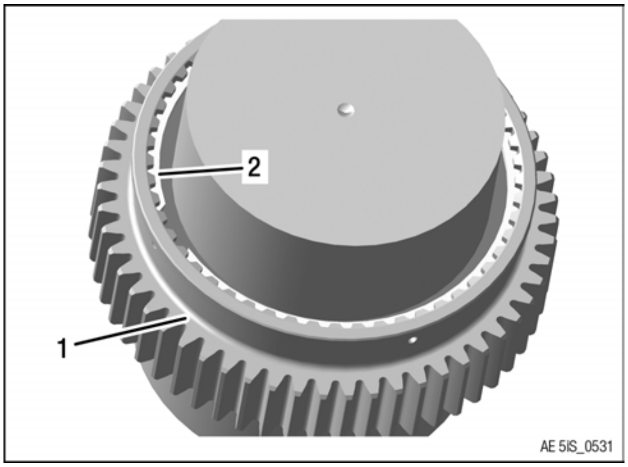


Figure 6.25

1	*Clutch assy.*	2	*Circlip*

Step	Procedure
4	After removing the circlip, remove the clutch assy.

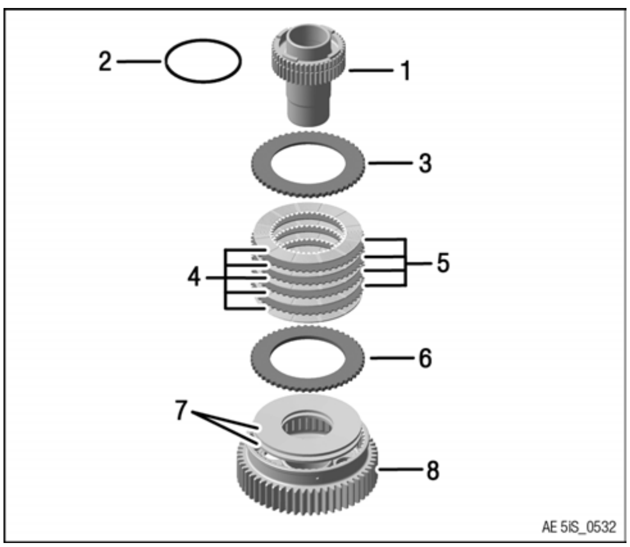


Figure 6.26

1	*Intermediate shaft*	2	*Circlip*
3	*Steel friction plate 4 mm*	4	*Steel friction plate 1.8 mm*
5	*Steel friction plate 1 mm*	6	*Steel friction plate 4 mm*
7	*Disk spring*	8	*Gear*

NOTE

Remove circlip only if necessary.

DISASSEMBLY OF THE DAMPER CLUTCH ASSY.

For disassembly and assembly use a hand operated hydraulic press or similar.

ENGINE SIDE / OVERLOAD CLUTCH SIDE

Step	Procedure
1	Place the damper clutch (large chamfer - engine side) on the centering plate part no. 276954 and insert the centering ring part no. 276950.

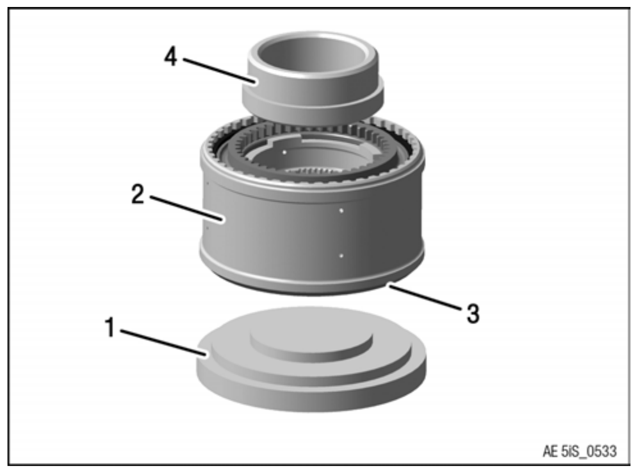


Figure 6.27: TYPICAL

1	*Centering plate 276954*	2	*Damper clutch*
3	*Large chamfer - propeller side*	4	*Centering ring 276950*

Step	Procedure
2	Press clutch assy. with insertion jig part no. 276952 until the retaining ring is free for removal.
3	To remove the retaining ring take a pin with a diameter of max. 3 mm (0.12 in.) and push it through the existing bore on clutch drum. Then remove the retaining ring using a small screwdriver.

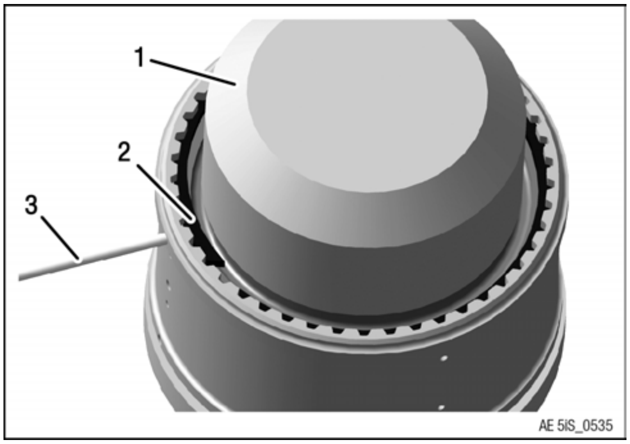


Figure 6.28: TYPICAL

1 *Insertion jig 276952*
2 *Retaining ring*
3 *Pin*

Step	Procedure
4	Now the damper clutch on propeller side can be disassembled.

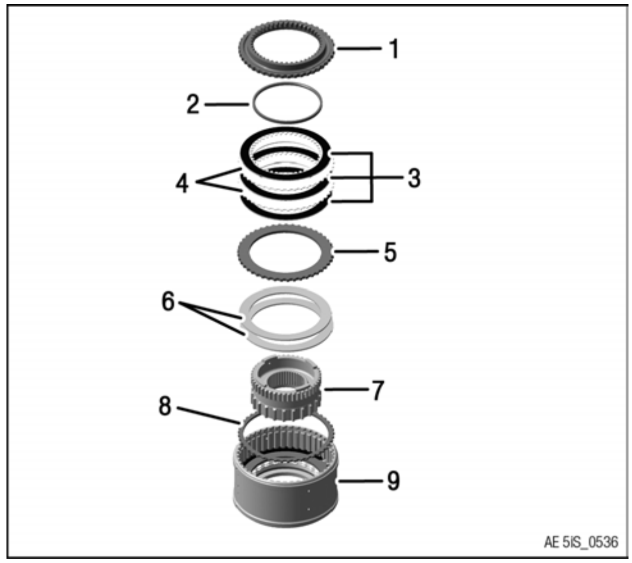


Figure 6.29: TYPICAL

1 *Driving collar*
2 *Spacer ring*
3 *Friction plate 1.54 mm*
4 *Steel friction plate 1 mm*
5 *Steel friction plate 3 mm*
6 *Disk spring*
7 *Clutch hub*
8 *Support ring*
9 *Clutch drum*

PROPELLER SIDE

Step	Procedure
1	Place the damper clutch (propeller side) on the centering plate part no. 276954 and insert the centering ring part no. 276950.

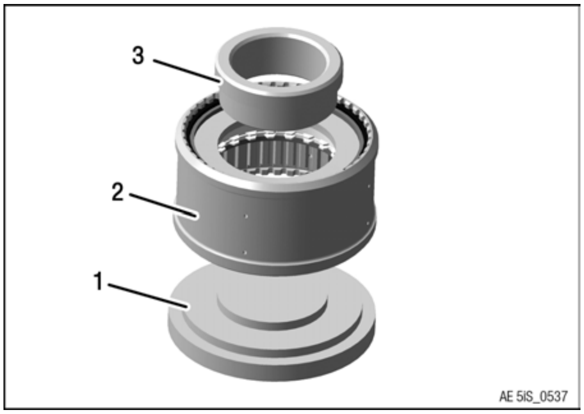


Figure 6.30: TYPICAL

1 Centering plate 276954 *2 Damper clutch*

3 Centering ring 276950

Step	Procedure
2	Press clutch assy. with insertion jig part no. 276952 until the circlip ring is free for removal.
3	To remove the circlip take a pin with a diameter of max. 3 mm (0.12 in.) and push it through the existing bore on clutch drum. Then remove the retaining ring using a small screwdriver.

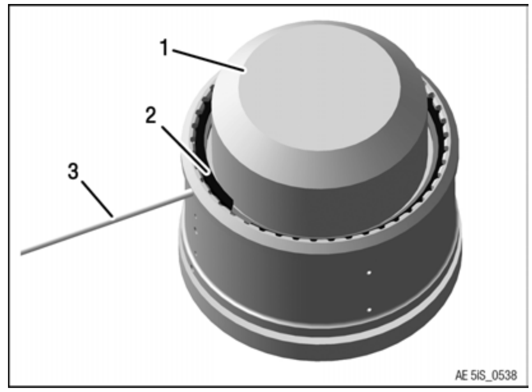


Figure 6.31: TYPICAL

1 Insertion jig *2 Circlip ring*

3 Pin

Step	Procedure
4	Now the damper clutch on propeller side can be disassembled.

NOTE

Remove circlip only if necessary.

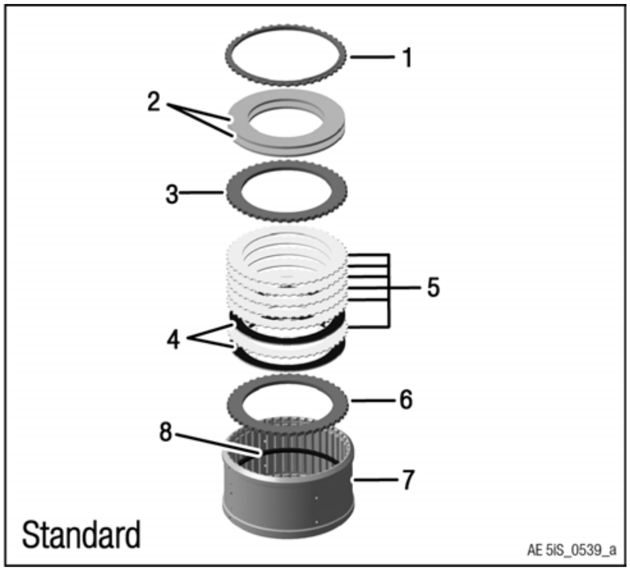


Figure 6.32: TYPICAL

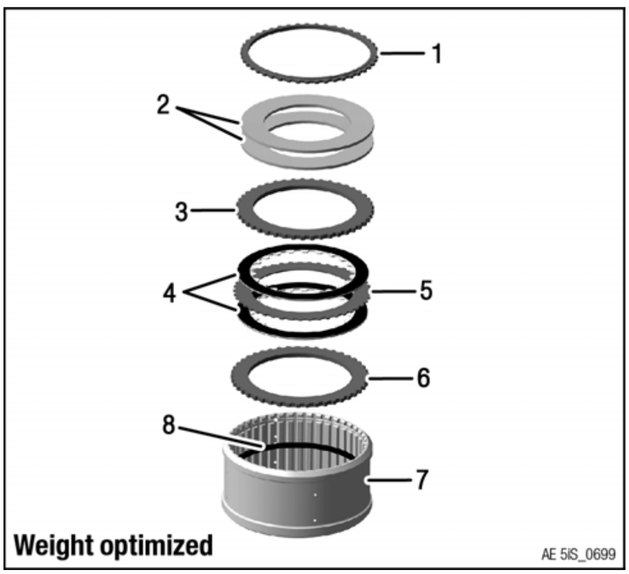


Figure 6.33

1	*Support ring*	*2*	*Disk spring*
3	*Steel plate 3 mm*	*4*	*Friction plate 1.54 mm*
5	*Steel plate 1 mm*	*6*	*Steel plate 3 mm*
7	*Clutch drum*	*8*	*Circlip*

INSPECTION

PROPELLER GEARBOX SINGLE PARTS CHECK

Preparation

- Clean all parts carefully.

GEAR COVER ASSY. CHECK

Step	Procedure
1	Inspect the gear cover for cracks.

NOTE

Only carry out in the case of prop strike!

Step	Procedure
2	Inspect gear cover for damage. • Depressions and scratches outside flat and sealing surfaces up to a maximum of 0.5 mm in depth and 2 mm in diameter are permissible. • Traces of corrosion and pitting outside sealing surfaces up to a maximum of 0.3 mm in depth and 2 mm in diameter are permissible.
3	Inspect contact surfaces for Allen screws. • Indentations up to a maximum of 0.2 mm are permissible. • Bumps up to a maximum of 0.2 mm are permissible.

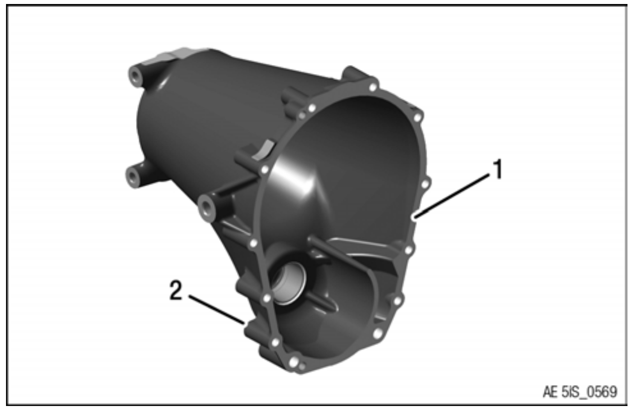


Figure 6.34

1 Flat sealing surface *2 Contact surface*

Step	Procedure
4	Inspect that the bearing bushing for supporting the crankshaft in the gear cover is secure and measure dimension (GB01). See Chapter 72-10-00 section Wear limits.

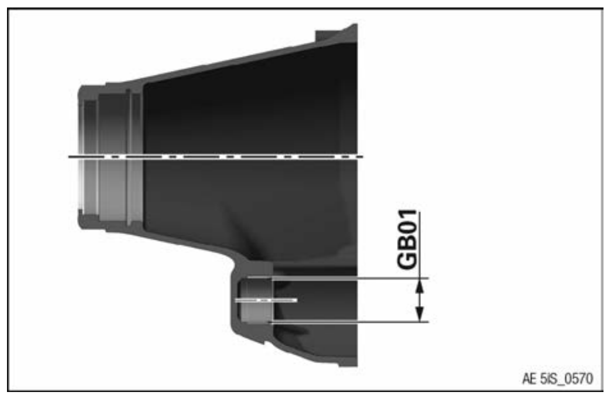


Figure 6.35: Bearing bushing

PROPELLER SHAFT — CHECK

ATTENTION

The entire propeller shaft including fastening bores must be free from corrosion; there must be no fretting corrosion at the bearing points.

Step	Procedure
1	Measure bearing seat. See Chapter 72-10-00 section Wear limits (GB02 and GB03)
2	Roll the propeller shaft and check for run-out. Check the axial runout of the propeller flange. See Chapter 72-10-00 section Wear limits (GB04)
3	Check the oil seal running surface.
4	Check the groove for the retaining ring and spline for wear and damage.
5	Check oil seal running surface for scratches and wear.

NOTE

The ball bearing must have an interference fit between the outer ring and the gearbox housing, and between the inner ring and the propeller shaft. See Chapter 72-10-00 section Wear limits.

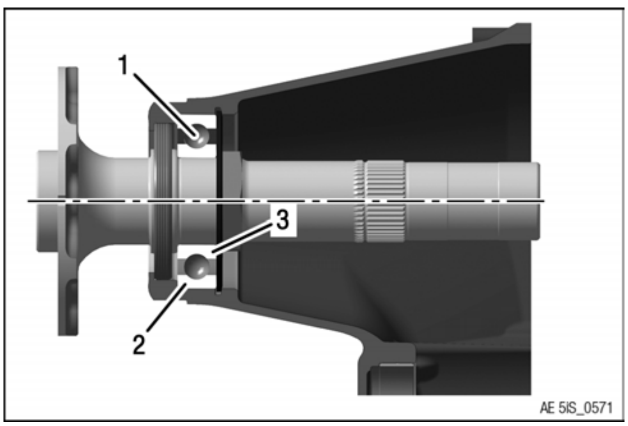


Figure 6.36

1 Ball bearing
2 Outer ring
3 Inner ring

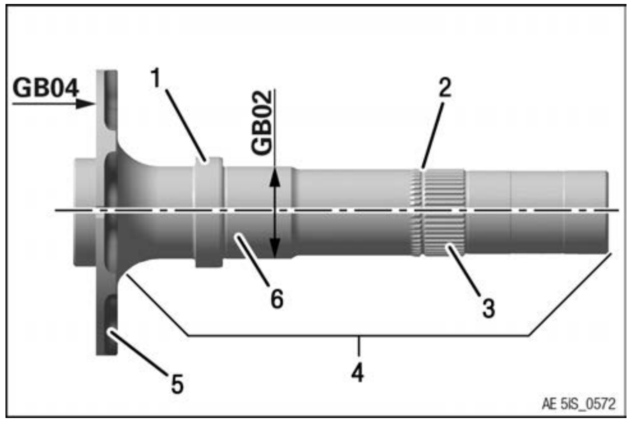


Figure 6.37

1 Oil seal running surface
2 Groove for retaining ring
3 Gear-tooth system
4 Propeller shaft
5 Propeller flange
6 Ball bearing seat GB02

Treatment of corrosion damage and surface damage on the propeller flange.
See Chapter 72-10-00 section Wear Limits
The flange of the propeller shaft is susceptible to flash rust. After the propeller shaft has been covered with an adhesive plastic tape or a plastic tube, the propeller flange can be treated with a blasting medium.

ATTENTION
To apply the protective paint, carefully cover the flange surface, fastening bores and the propeller shaft.

To prevent corrosion damage, the rear of the propeller flange should be coated with a layer of anti-corrosion paint.
In the event of more severe corrosion damage which has affected the material, the propeller shaft must be replaced.

OVERLOAD CLUTCH — CHECK

Step	Procedure
1	Check the overload clutch visually for damage and wear.
2	Check the overload clutch visually for any deposits (e.g. lead from AVGAS).
3	Measure GB03, see Chapter 72-10-00 section Wear limits.

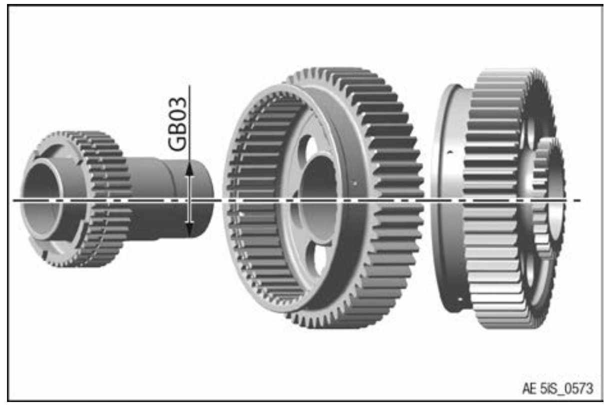


Figure 6.38

Step	Procedure
3	Check the steel friction plates and the sinter friction plates for wear and discoloration (heat).
4	Measure the thickness of the steel friction plates and the sinter friction plates (GB17); see Chapter 72-10-00 section Wear limits.
5	Check disc springs (GB18), see Chapter 72-10-00 section Wear limits.

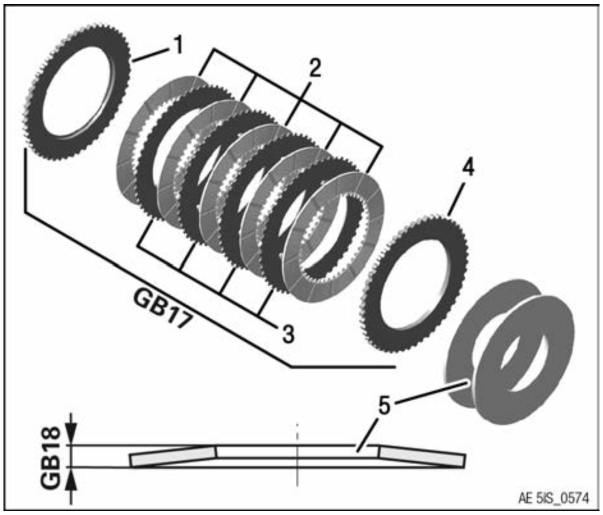


Figure 6.39

1	*Steel friction plate 3.0 mm*	2	*Sintered friction plate 1.54 mm*
3	*Steel friction plate 1.0 mm*	4	*Steel friction plate 3.0 mm*
5	*Disc spring*		

DAMPER CLUTCH — CHECK

Step	Procedure
1	Check the damper clutch visually for damage and wear.
2	Check the damper clutch visually for any deposits (e.g. lead from AVGAS)

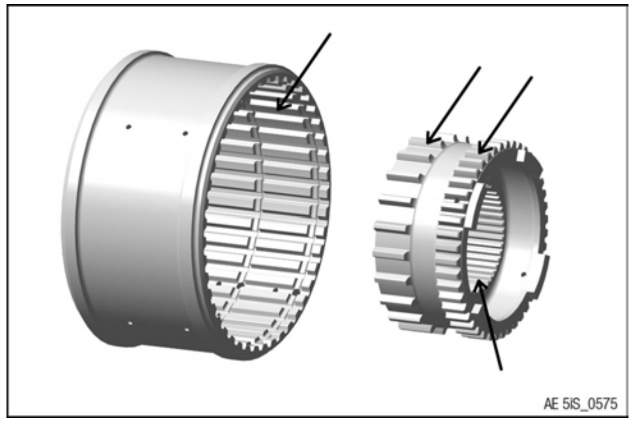


Figure 6.40

Step	Procedure
3	Check the steel friction plates and sinter friction plates for wear and discoloration (heat).
4	Measure the thickness of the steel friction plates and the sinter friction plates (GB19 +GB22); see Chapter 72-10-00 section Wear limits.
5	Check disc springs (GB20-21), see Chapter 72-10-00 section Wear limits.

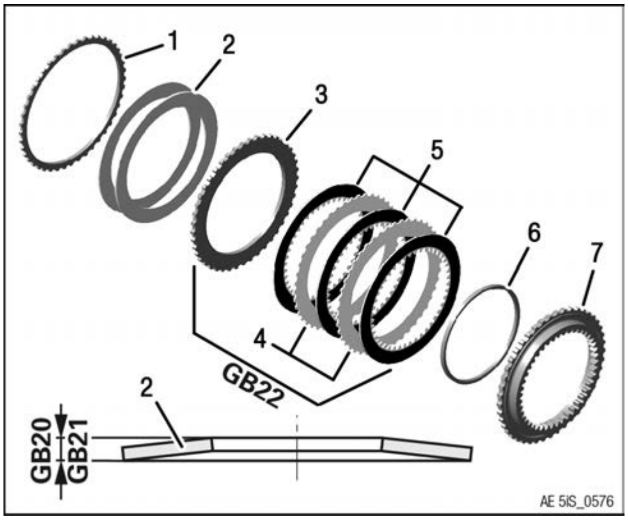


Figure 6.41

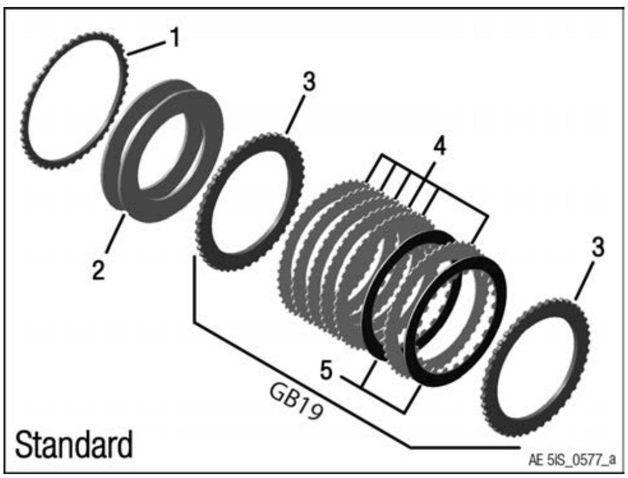


Figure 6.42

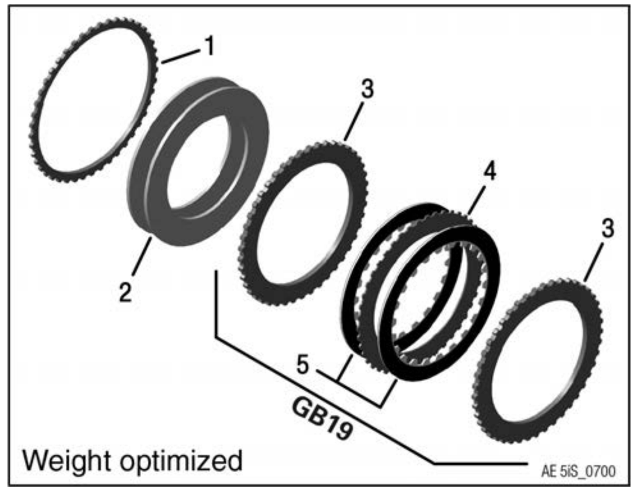


Figure 6.43

1	*Support ring*	*2*	*Disc springs*
3	*Steel plate 3 mm*	*4*	*Steel plate 1 mm*
5	*Sintered friction plate 1.54 mm*	*6*	*Spacer ring*
7	*Driving collar*		

TORSION BAR - CHECK

ATTENTION

Torsion bar must not be reworked.

Step	Procedure
1	Check for corrosion and damage, if necessary exchange complete torsion bar.

CHECKING THE SPLINES

There are 4 essential splined shaft connections in the gearbox.

1. Propeller shaft to damper clutch.
2. Torsion shaft to propeller shaft.
3. Torsion shaft to overload clutch.
4. Crankshaft to drive gear GB 07 / GB23.

To check the splines, determine the tooth widths at the tip circle of the respective inner or outer gear-tooth system. The smallest value in each case is significant.

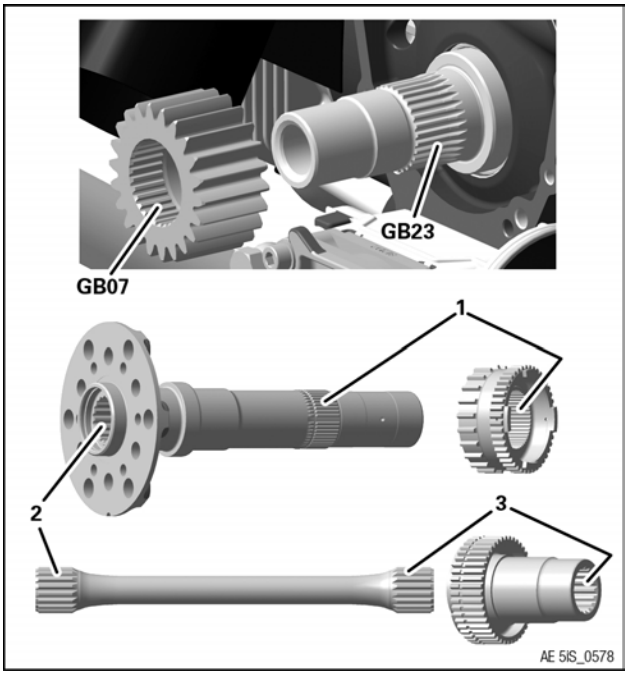


Figure 6.44

Step	Procedure
1	Check crankshaft to drive gear, see Chapter 72-10-00 section wear limits.
2	Check the splines of propeller shaft, torsion bar, overload clutch and damper clutch visually for damage and wear. If the tooth flank is worn, replace the part. The spline pair propeller shaft and damper clutch has clearance from new.

NOTE

The torsion bar must have tight fit into propeller shaft and overload clutch.

GEAR SET CHECK (GEARS)

The gear set is checked to identify any damage to the gear-tooth system.

ATTENTION

Check all the tooth flanks for any damage or pitting.

NOTE

*If the gearbox is installed, it is also possible to check the gear set using an endoscope. This must be done in such a manner that an **exact assessment** of the tooth flanks is possible and requires experience.*

Pitting

Pitting is damage which is attributable to fatigue of the material. As far as is known today, this is caused when the Hertzian stress permissible for the material in question is exceeded, the tangential stress on the surface (friction stress) and temperature stress. As well as the material and the heat treatment of it, the surface quality and structure, surface treatment and lubricant (viscosity at operating temperature and additives) are also important.

NOTE

The likely location of pitting formation is the dedendum flank of the driving gear. Therefore, begin by checking the drive gear.

Pitting in the gearbox
Pitting in the gearbox can cause high-frequency vibrations. This vibration can cause several problems as it is transferred via the engine to the connected parts:

- Wear on the gearbox (gear profile and contact faces)
- External accessories
- Wear on the exhaust system
- Leaking of the sealing surface of the crankcase

NOTE

This vibration can be detected with a dynamic engine analysis; these are units which are also used to balance propellers. If the propeller cannot be balanced suspect pitting of the gear.

PITTING, GENERAL INFORMATION

NOTE

*When pitting occurs it is necessary to distinguish between **tolerable initial pitting** and **flake pitting**. To make the assessment easier for you, see the following assessment tips.*

Pitting is the breaking off of more or less small, flat material particles from the active tooth flank. Whereas tooth breakage results in failure of the gearbox, this is not the case for pitting damage. There are in this case different stages of damage.

Rate of development
The rate of development depends on the lubricant and amount of stress. The pitting surface can become so large that the remaining undamaged flank can no longer transfer the load. During further operation the gear-tooth system is then completely destroyed.

NOTE

Fine pitting or pitted areas hardly affect the running behavior of the gear-tooth system at all.

The rule is however pitting damage which increases over time.
A distinction can be made according to the size, type and number of pitting, as follows.

- Slight pitting (initial pitting)
- Destructive pitting
- Flake pitting (large-area flank fractures)

SLIGHT PITTING

Features:
Individual small pits (up to approx. 0.5% of the flank area) or pore-like areas of pitting, generally only present in the dedendum area of the flank. This pit formation can cease during the operating phase of the gearbox.

Causes:
Locally high stresses in gears which have not yet run in can result in isolated pits. The adjustable running-in wear which results in these areas being relieved of stress, as a result of which the formation of pits can cease. Similarly, changed operating conditions can prevent pits which have already formed from developing.

Conclusion:
These pits are not important for safe operation. The gear set can still be used.

NOTE

The illustrations are sometimes not very informative due to fine pitting or the printing process. If in doubt, consult technical literature or contact the ROTAX® Authorized Distributor or their independent Service Centers.

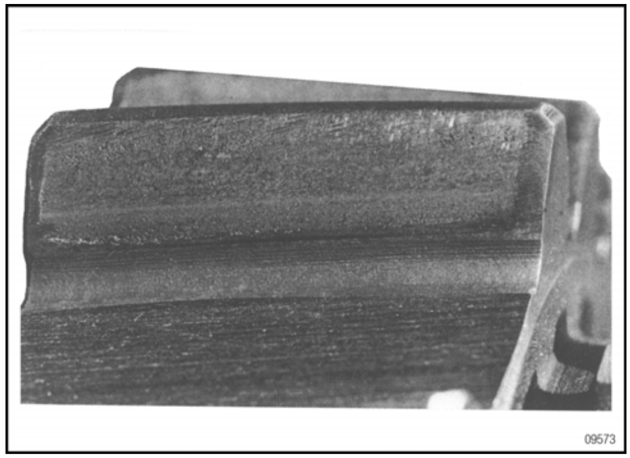


Figure 6.45: Magnification: approx. 2x

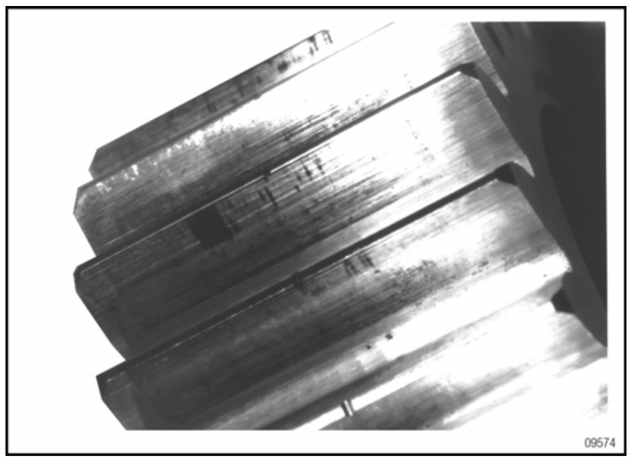


Figure 6.46: Magnification: approx. 1.5x

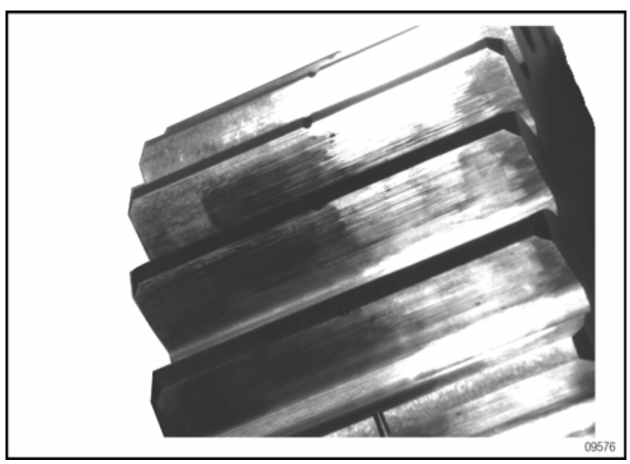


Figure 6.47: Magnification: approx. 1.5x

DESTRUCTIVE PITTING

Features:
Extensive flank fractures, generally occurring as zones of pitting. The bottom of the fracture generally has a mussel-shaped structure. The total pitting area can be so great that the running smoothness is noticeably affected and/or the remaining flank area which still bears the load is rapidly destroyed by wear etc.

Causes:
Pitting is attributable to the fatigue of the material due to combined stresses from compression and sliding. They are triggered when the material strength is exceeded locally. Essential influences on pit strength are: oil viscosity and oil temperature.

Conclusion:
Pitting of up to 5% of the flank area is permissible if the individual flank fractures do not exceed a size (greatest longitudinal extent) of 0.5 mm. Otherwise the gear set must be replaced.

ATTENTION

The whole gear set must always be replaced. Dog hubs or drive gears must not be replaced individually.

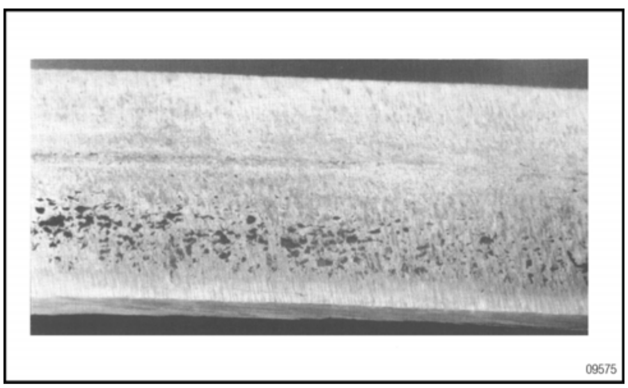


Figure 6.48: Magnification approx. 5x.

Pitted area in the dedendum flank region of a spur gear.

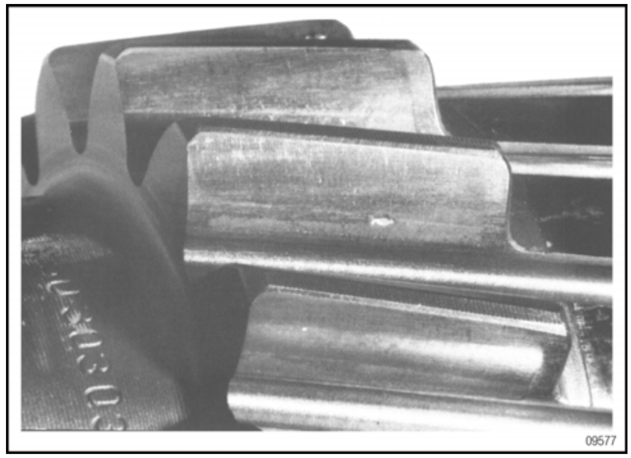


Figure 6.49: Magnification approx. 1.5x.

Pit formation in the dedendum region of a spur gear tooth system

FLAKE PITTING (LARGE-AREA FLANK FRACTURES)

See the following figures.

Features:
A large-area, triangular flank fracture emanating from a micropitting zone or a fine line of pits in the tooth dedendum. The fracture area has a relatively constant depth. Further cracks can run obliquely over the flank from the fracture. The damage sometimes extends into the addendum region, which results in breakage of the tooth tip.

ATTENTION

If flake pitting is found, the gear set must be replaced.

Max. permissible pitting or flake pitting. See Destructive pitting.

ATTENTION

The whole gear set must always be replaced. Gears must not be replaced individually.

Causes:
This pattern of damage generally occurs at low operating oil viscosities and/or high oil temperatures. Apart from these, the same causes apply as for pitting.

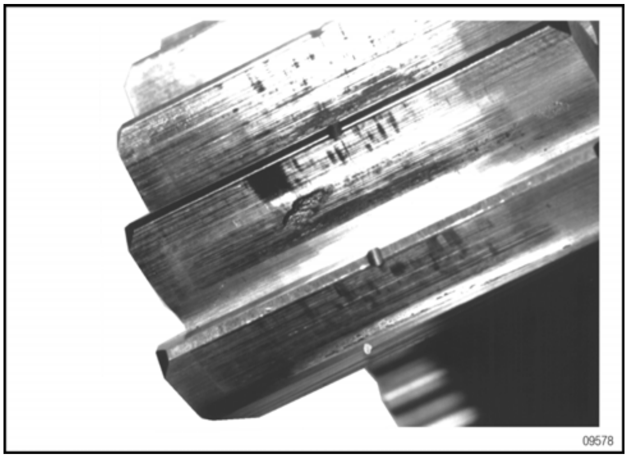


Figure 6.50: Magnification approx. 2x.

Triangular flake pitting

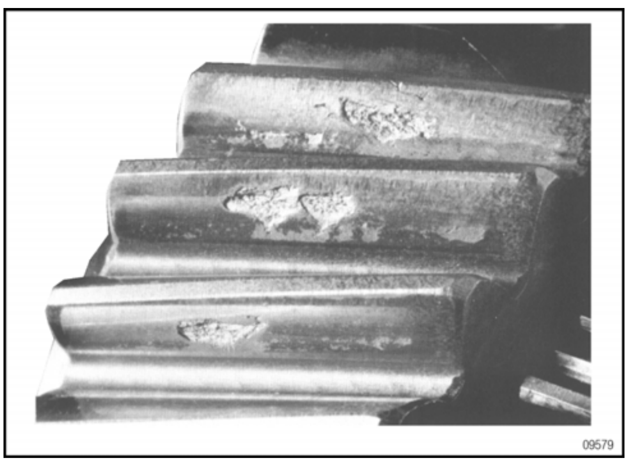


Figure 6.51: Magnification approx. 2x.

Triangular flake pitting

WEAR LIMITS

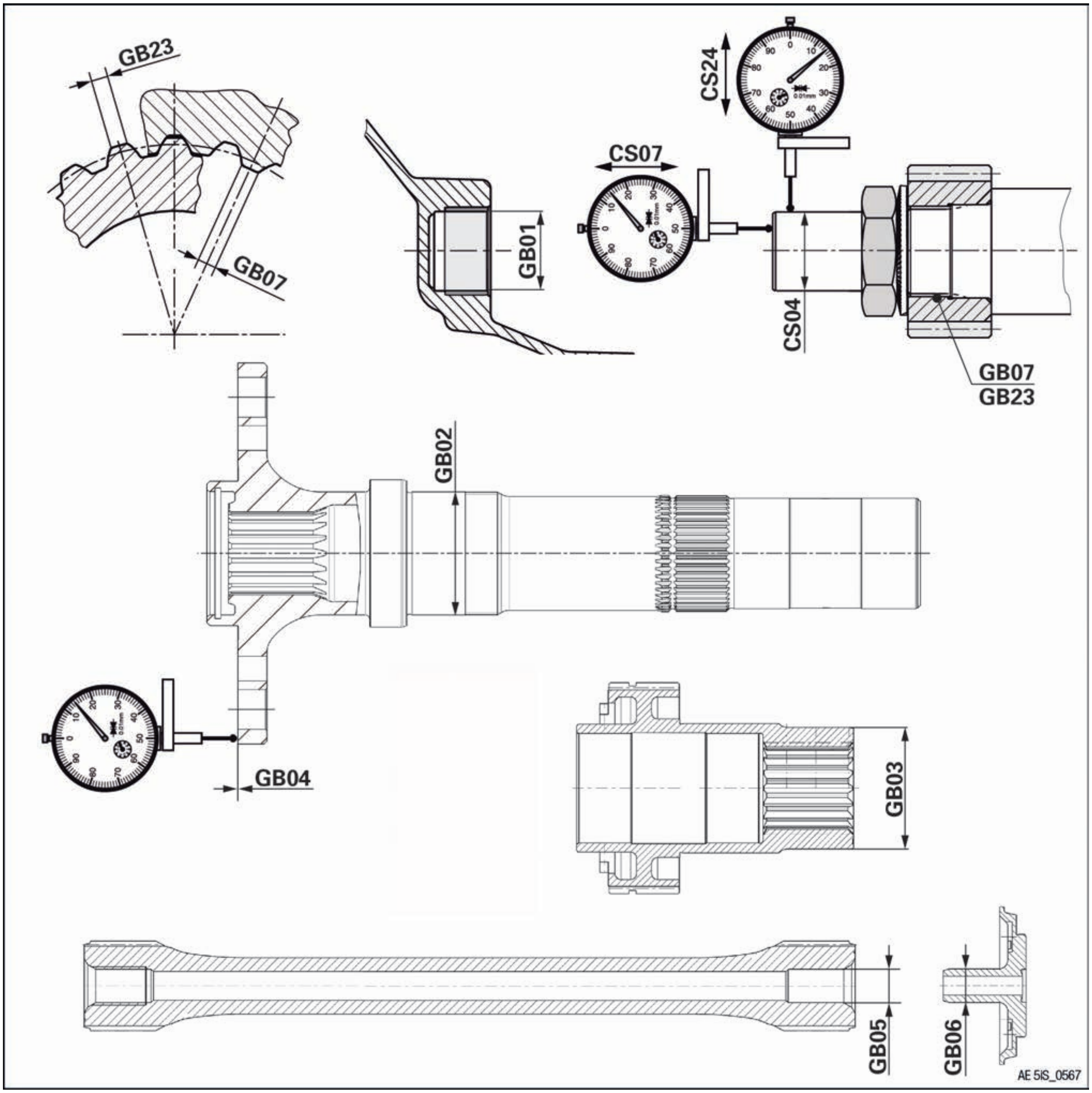


Figure 6.52

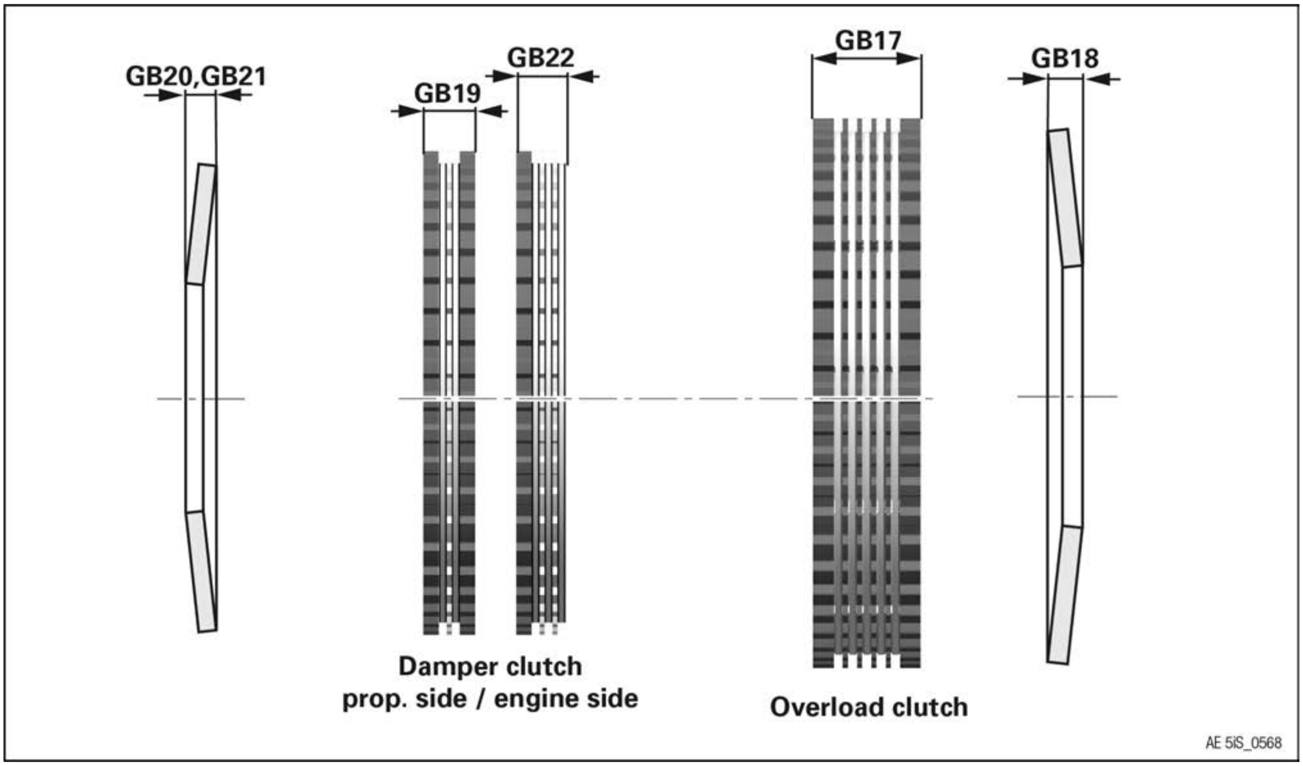


Figure 6.53

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Propeller gearbox							
1. Bearing bushing in gear cover							
Bore crankshaft	GB01	28.04 mm 1.1039 in.	28.05 mm 1.1044 in.	28.10 mm 1.1063 in.	28.07 mm 1.1051 in.	current replaced	
Radial clearance	GB01/ CS04	0.04 mm 0.0016 in.	0.06 mm 0.0025 in.	0.12 mm 0.0047 in.	0.09 mm 0.0035 in.	current replaced	
2. Propeller shaft							
Shaft diameter 40 mm	GB02	40.009 mm 1.5751 in.	40.020 mm 1.5755 in.	40.001 mm 1.5748 in.	40.005 mm 1.5750 in.	current replaced	

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Radial run-out, propel-ler flange at Ø 122 mm	GB04	0.000 mm 0.000 in.	0.050 mm 0.0020 in.	0.060 mm 0.0024 in.	0.055 mm 0.0022 in.	current replaced	
3. Intermediate shaft							
Shaft diameter 40 mm	GB03	39.989 mm 1.5744 in.	40.000 mm 1.5748 in.	39.970 mm 1.5736 in.	39.980 mm 1.5740 in.	current replaced	
4. Torsion shaft							
Bore at rear end of tor-sion shaft	GB05	11.00 mm 0.4331 in.	11.02 mm 0.4339 in.			current replaced	
Journal di-ameter at oil inlet flange	GB06	10.935 mm 0.4305 in.	10.960 mm 0.4315 in.			current replaced	
Radial clearance, bore/journal	GB05/ GB06	0.040 mm 0.0016 in.	0.084 mm 0.0033 in.	0.160 mm 0.0063 in.	0.122 mm 0.0048 in.	current replaced	
5. Crankshaft							
Crankshaft axial clearance	CS07	0.08 mm 0.0031 in.	0.32 mm 0.0126 in.	0.50 mm 0.0197 in.		current replaced	
Crankshaft out of round assembled in crank-case, drive gear mounted	CS24	0.000 mm 0.0000 in.	0.060 mm 0.0024 in.	0.080 mm 0.0031 in.		current replaced	
Shaft diameter 28 mm	CS04	27.990 mm 1.1019 in.	28.000 mm 1.1024 in.	27.950 mm 1.1004 in.		current replaced	
6. Tooth profile							
Crankshaft	GB23	0.95 mm 0.037 in.	1.00 mm 0.037 in.	0.80 mm 0.031 in.	0.88 mm 0.034 in.	current replaced	

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Drive gear	GB07	0.95 mm 0.037 in.	1.00 mm 0.037 in.	0.80 mm 0.031 in.	0.88 mm 0.034 in.	current replaced	
7. Gear set							
Drive gear pitting up to 5% of flank area	GB14	0.0 %	0.0 %	5.0 %	2.5 %	current replaced	
Dog gear pitting up to 5% of flank area	GB15	0.0 %	0.0 %’	5.0 %	2.5 %	current replaced	
8. Overload clutch							
Height of clutch plates (4 frict., 5 steel 1mm, 2 steel thrust wash-er plates 4mm)	GB17	20.49 mm 0.807 in.	21.51 mm 0.847 in.	18.50 mm 0.728 in.	19.50 mm 0.768 in.	current replaced	
Free height of disc springs	GB18	6.50 mm 0.256 in.	6.80 mm 0.268 in.	6.00 mm 0.236 in.	6.25 mm 0.246 in.	current replaced	

9. Damper clutch							
Height of clutch plates prop-side 1 (3 frict, 2 steel, 1mm, 1 steel 3mm)	GB22	9.30 mm 0.575 in.	9.94 mm 0.613 in.	8.90 mm 0.350 in.	9.10 mm 0.358 in.	current replaced	
Free height of disc springs prop-side	GB20	3.34 mm 0.131 in.	3.55 mm 0.140 in.	3.10 mm 0.122 in.	3.22 mm 0.127 in.	current replaced	

Standard Height of clutch plates engine-side (2 frict, 6 steel 1mm 2 steel 3mm)	GB19	14.60 mm 0.575 in.	15.56 mm 0.613 in.	14.10 mm 0.555 in.	14.35 mm 0.565 in.	current replaced	
Weight optimized Height of clutch plates prop-side (2 frict, 1 steel 1mm 2 steel 3mm)	GB19	9.80 mm 0.386 in.	10.36 mm 0.408 in.	9.30 mm 0.366 in.	9.55 mm 0.376 in.	current replaced	
Free height of disc springs en-gine-side	GB21	4.72 mm 0.186 in.	4.95 mm 0.195 in.	4.30 mm 0.169 in.	4.50 mm 0.177 in.	current replaced	

ASSEMBLY

Preparation

⚠ WARNING
Danger of severe burns and scalds! Wear heat resistant gloves!

- Heat the gearbox housing with hot air (or in an oven) to approx. 100 to 120 °C (212 to 248 F°).

INSTALLATION OF THE BALL BEARING

Step	Procedure
1	Press the oil seal AS 48x72x8 into the gearbox housing (from inside) using insertion jig part no. 877650 and press-in mushroom part no. 276964.

NOTE

Lubricate sealing lips with engine oil.

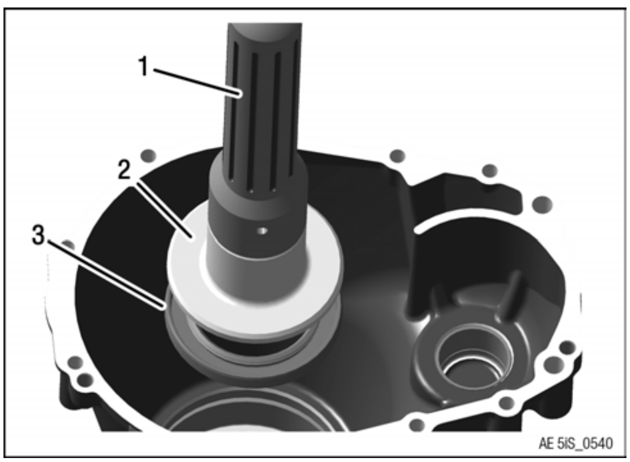


Figure 6.54

1 Insertion jig 877650 *2 Press-in mushroom 276964*

3 Oil seal

Step	Procedure
2	Insert the ball bearing (balls must be visible - cage facing the propeller side) into the gearbox housing using insertion jig. part no. 877650 and press-in mushroom part no. 276966.

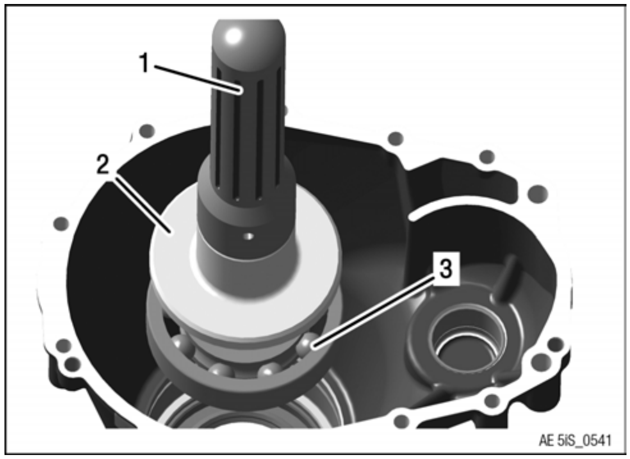


Figure 6.55

1 Insertion jig 877650 *2 Press-in mushroom 276966*

3 Ball bearing

Step	Procedure
3	Install the retaining ring with circlip pliers.

NOTE

Place the circlip in the groove with the sharp edge pointing away from bearing.

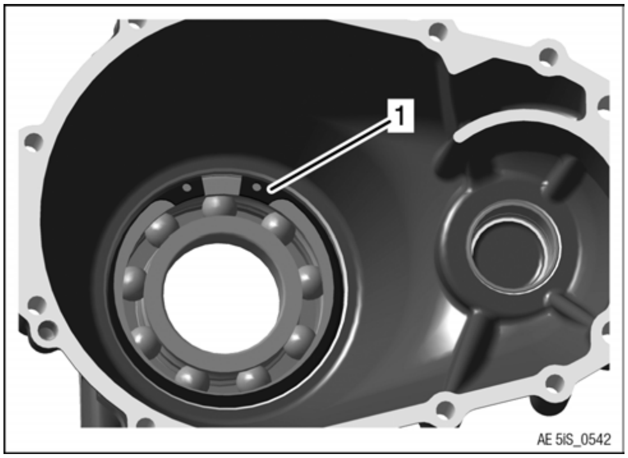


Figure 6.56

1 Retaining ring

PROPELLER SHAFT — INSTALLATION

Preparation

- Use a hand operated hydraulic press or similar.
- Place the propeller shaft with the gearbox housing placed on it onto a suitable flat support.
- Lubricate the propeller shaft with LOCTITE ANTI SEIZE on the bearing seat.

Step	Procedure
1	Press propeller shaft into gearbox housing using the special tool part no. 276972. **NOTE** *Do not use high forces for propeller shaft installation, only press-in with the special tool part no. 276972.*

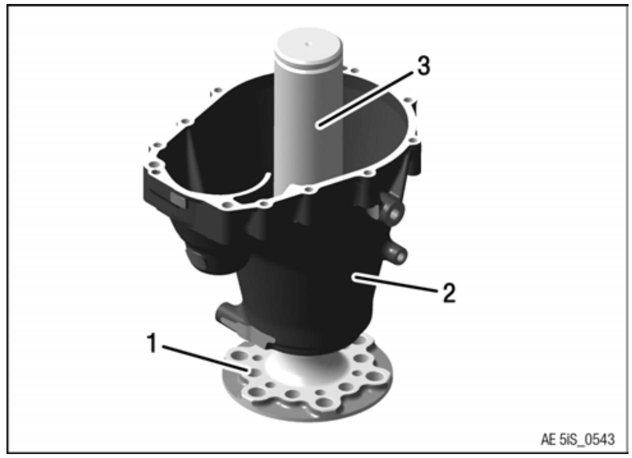


Figure 6.57

1 Propeller shaft *2 Propeller gearbox*

3 Special tool 276972

Step	Procedure
2	Install gearbox on support plate part. no. 276958, fix both in the bench vice.
3	Secure M40x1.5 collar nut with LOCTITE 648 and tighten it. with a special tool part no. 276006. Tightening torque 150 Nm (111 ft.lb.).

NOTE

Do not forget to mount the protection mushroom on propeller shaft.

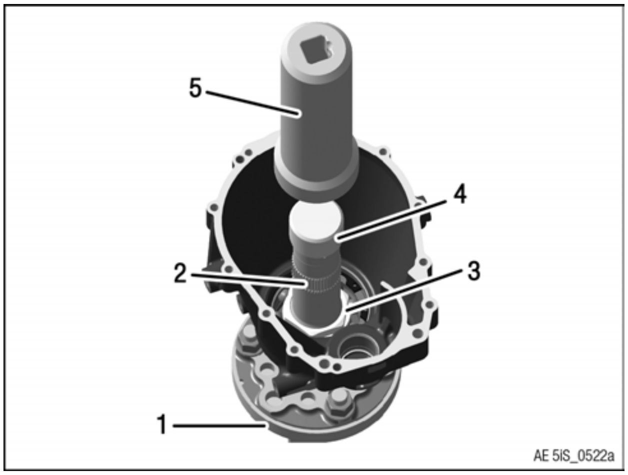


Figure 6.58

1	*Support plate*	*2*	*Propeller shaft*
3	*M40x1.5 collar nut*	*4*	*Protection mushroom*
5	*Special tool 276006*		

Step	Procedure
4	Install the retaining ring A38 on the propeller shaft with special tool part no. 276968.

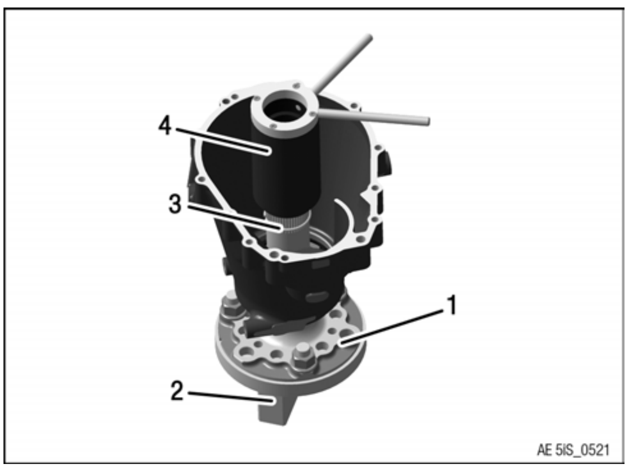


Figure 6.59

1	*Propeller shaft*	*2*	*Support plate*
3	*Retaining ring*	*4*	*Special tool 276968*

TORSION SHAFT — INSTALLATION

ATTENTION

Difference to Configuration 3
– Torsion shaft with oil groove
– Sealing washer without oil hole
– Hex. screw M12x20 with oil hole

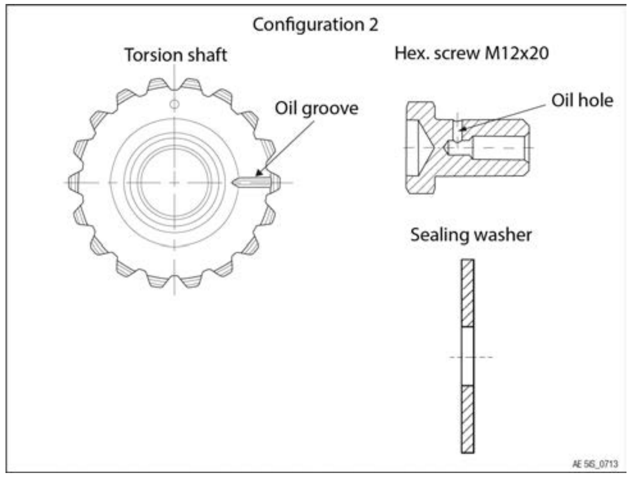


Figure 6.60

Step	Procedure
1	Lubricate the torsion shaft with LOCTITE ANTI SEIZE.
2	Position of the teeth is defined with two marks, see following figure.
3	Install the torsion shaft into the propeller gearbox (propeller shaft).

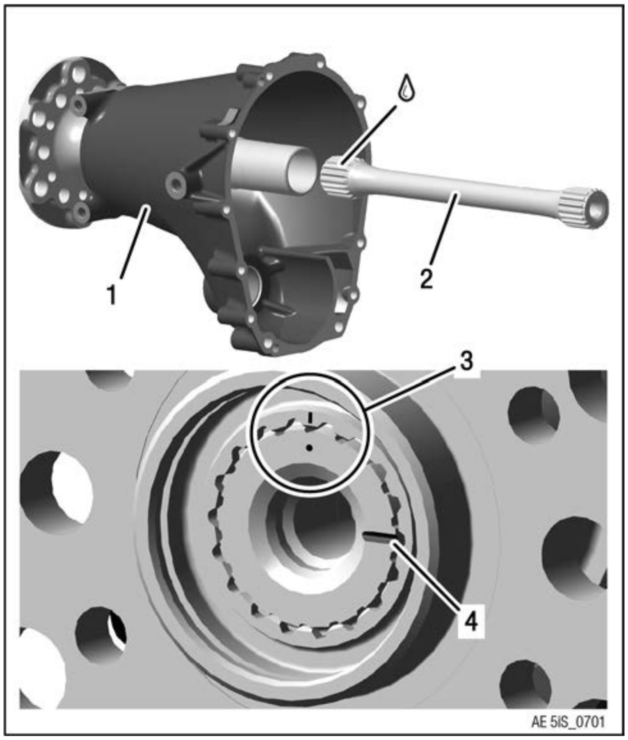


Figure 6.61

1	*Gearbox housing*	2	*Torsion shaft*
3	*Marking*	4	*Oil groove (Configuration 2)*

Step	Procedure
4	Install O-ring, sealing washer (with sharp edge showing upwards) and retaining ring.
5	Hand tighten the hex. screw M12x20 with washer.

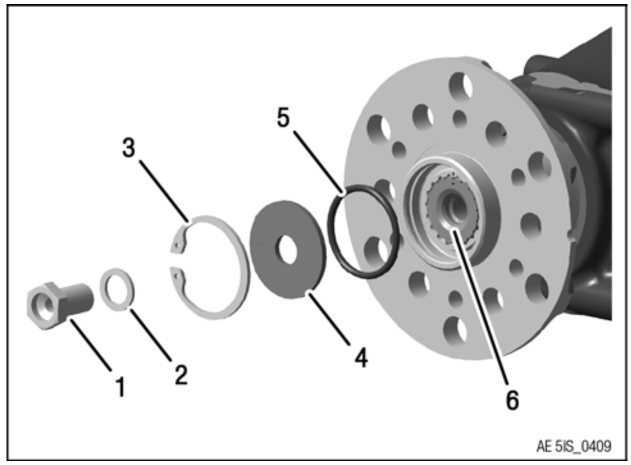


Figure 6.62: TYPICAL

1	*Hex. screw M12x20*	2	*Sealing ring A12*
3	*Retaining ring*	4	*Sealing washer*
5	*O-ring*	6	*Torsion shaft*

ATTENTION

Observe which configuration you have!
On configuration 3 sealing washer must have a small oil hole (lubrication bore).

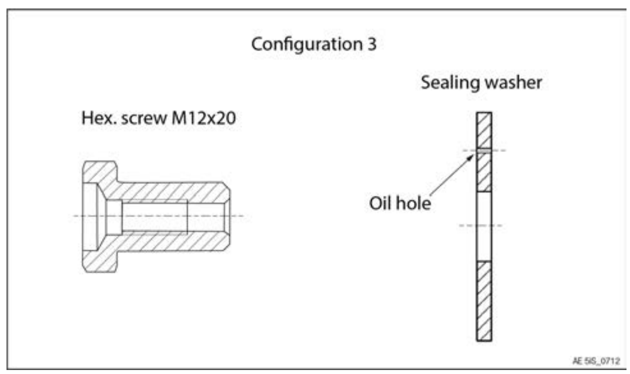


Figure 6.63

ASSEMBLY OF THE OVERLOAD CLUTCH ASSY.

NOTE

Use a hand operated hydraulic press or similar.

NOTE

Lubricate all components with engine oil before assembly.

Step	Procedure
1	Lay overload clutch assy. on the insertion jig part no. 276974.

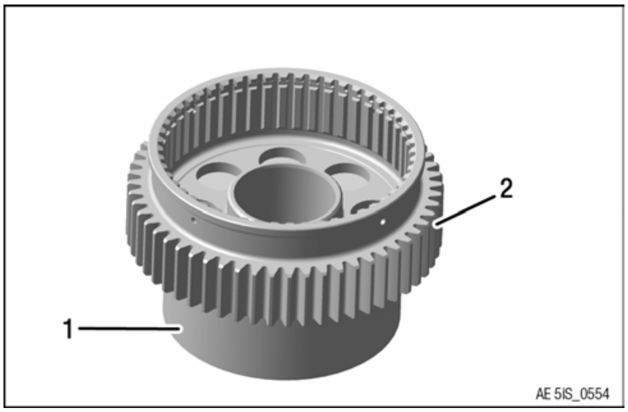


Figure 6.64

1	*Insertion jig*	2	*Overload clutch assy.*

Step	Procedure
2	Assemble clutch package as shown in following figure. **NOTE** *Install disc springs contrary to each other.*

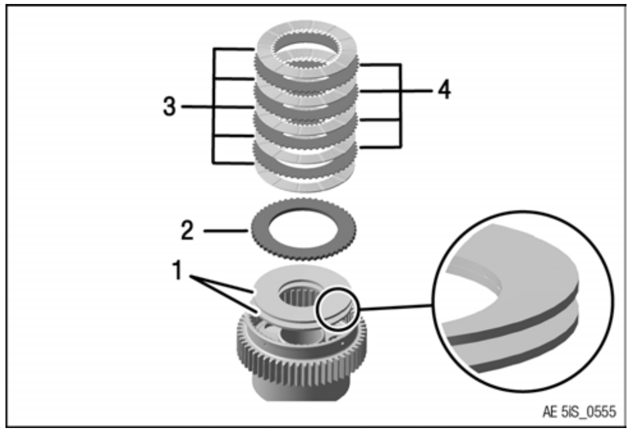


Figure 6.65

1	*Disc springs (contrary)*	2	*Steel friction plate 3mm*
3	*Sintered friction plates (5 pcs.)*	4	*Steel friction plates 1mm(4 pcs.)*

Step	Procedure
3	Align the friction plates with auxiliary tool (self-made pin).

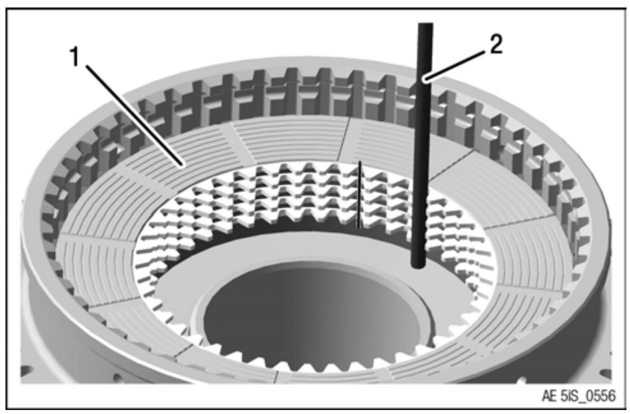


Figure 6.66

1	*Friction plates*	2	*Auxiliary tool (self-made pin)*

Step	Procedure
4	Install clutch hub. Check if support ring is installed.
5	Install steel friction plate 4 mm with groove facing to the bottom.

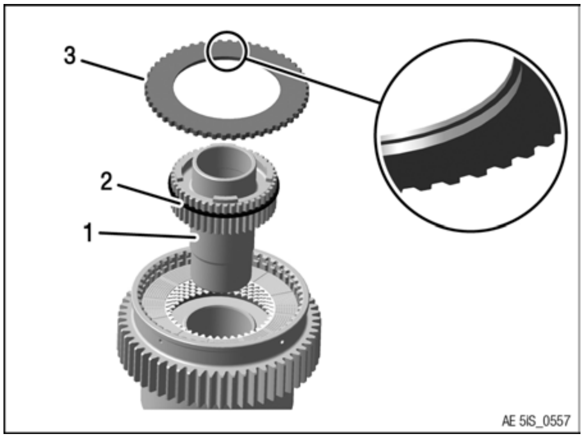


Figure 6.67

1 Clutch hub *2 Support ring*

3 Steel friction plate 4 mm

Step	Procedure
6	Insert centering ring part no. 276950.
7	Press damper clutch assy. with insertion jig part no. 276952.
8	Insert circlip and release damper clutch assy.

NOTE

Check the alignment of clutch hub once again. It must be free to move.

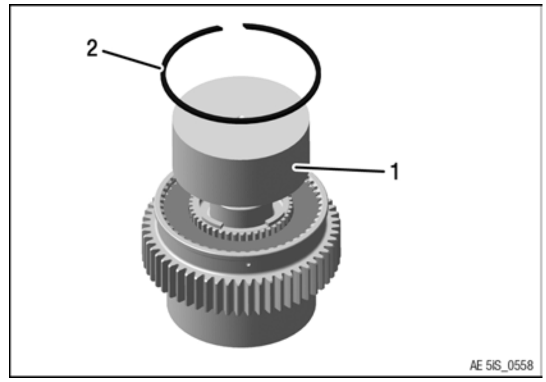


Figure 6.68

1 Insertion jig *2 Support ring*

ASSEMBLY OF THE DAMPER CLUTCH ASSY.

NOTE

Use a hand operated hydraulic press or similar.

NOTE

Before assembly, lubricate all components with engine oil.

Step	Procedure
1	Check if retaining ring is installed and lay the clutch drum on the centering plate. **NOTE** *Begin with damper clutch assy. (big chamfer) on propeller side.*
2	Insert the clutch hub loosely into the clutch drum (for aligning the friction plates).

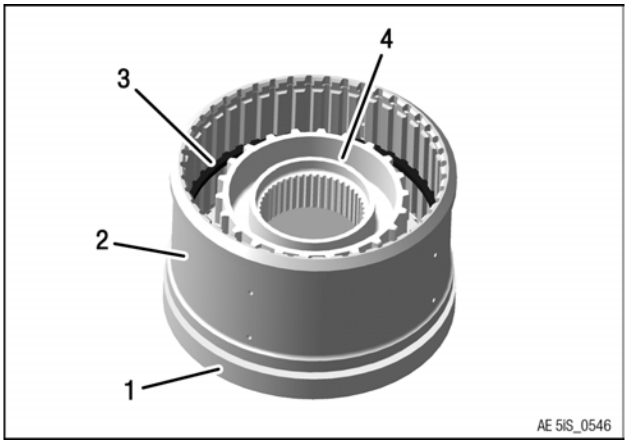


Figure 6.69

1	*Big chamfer*	2	*Clutch drum.*
3	*Retaining ring*	4	*Clutch hub*

Step	Procedure
3	Assemble clutch package as shown in following figure. **NOTE** *Observe the correct position of the support ring (projection is facing to the top).* **NOTE** *Install disc springs contrary to each other.*

STANDARD VERSION

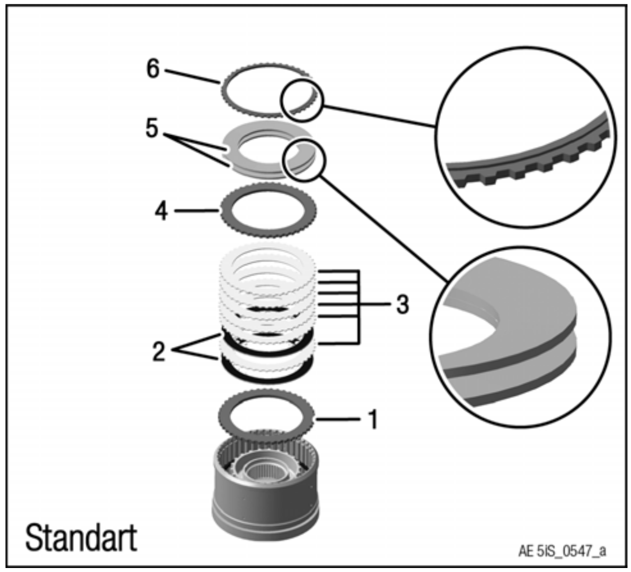


Figure 6.70

1	*Steel plate 3 mm*	2	*Sintered friction plates 1.54 mm (2 pcs.)*
3	*Steel plates 1 mm (5 pcs.)*	4	*Steel friction plate 3 mm*
5	*Disc springs (contrary)*	6	*Support ring*

WEIGHT OPTIMIZED VERSION

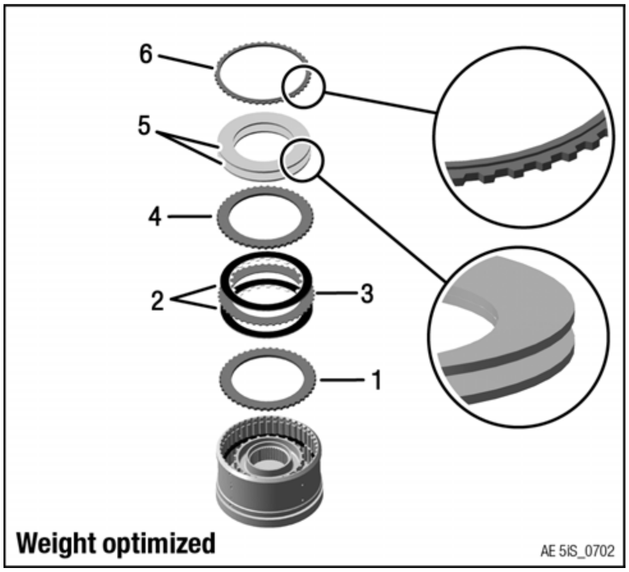


Figure 6.71

1	*Steel friction plate 3 mm*	2	*Sintered friction plates (2 pcs.)*
3	*Steel friction plates 1 mm (5 pcs.)*	4	*Steel friction plate 3 mm*
5	*Disc springs (contrary)*	6	*Support ring*

Step	Procedure
4	Remove clutch hub. **NOTE** *Friction plates have to be in perfect alignment with each other.*

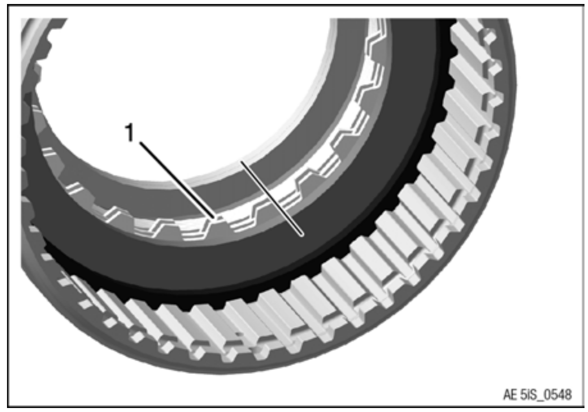


Figure 6.72: TYPICAL

1 *Friction plates*

Step	Procedure
5	Insert centering ring part no. 276950.
6	Press damper clutch assy. with insertion jig part no. 276952.
7	Insert circlip and release damper clutch assy. **NOTE** *Check the alignment of friction plates once again.*

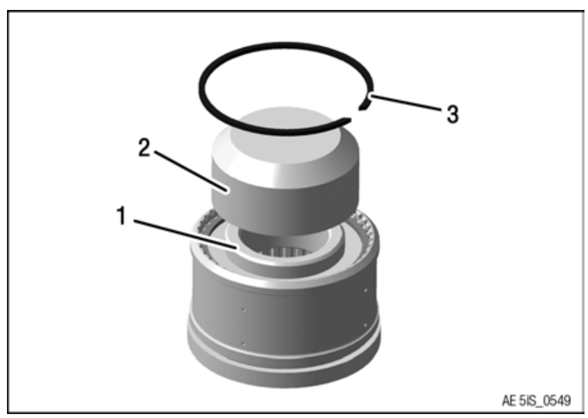


Figure 6.73: TYPICAL

1	*Centering ring*	2	*Insertion jig*
3	*Circlip*		

Step	Procedure
8	Lay clutch drum on centering plate part no. 276956 and install the clutch hub.

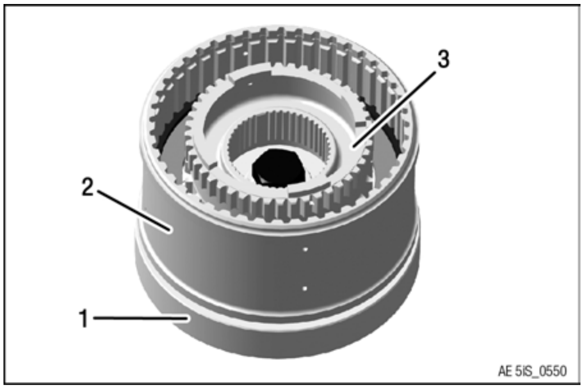


Figure 6.74: TYPICAL

1	*Centering plate*	*2*	*Clutch drum*
3	*Clutch hub*		

Step	Procedure
9	Assemble clutch package as shown in following figure. **NOTE** *Observe the correct position of the support ring (projection is facing to the bottom).* **NOTE** *Install disc springs contrary to each other.*

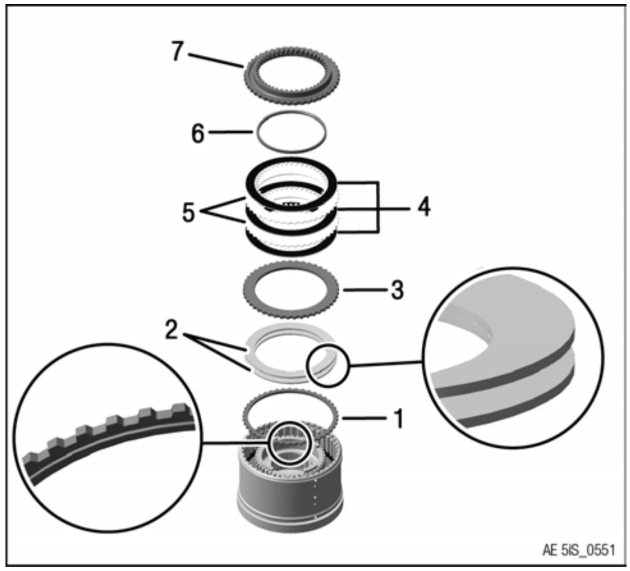


Figure 6.75: TYPICAL

1	*Support ring*	*2*	*Disc springs (contrary)*
3	*Steel friction plate 3 mm*	*4*	*Sintered friction plates (3 pcs.)*
5	*Steel friction plates 1 mm (2 pcs.)*	*6*	*Spacer ring*
7	*Driving collar*		

Step	Procedure
10	Check position of clutch hub and align with damper clutch assy.

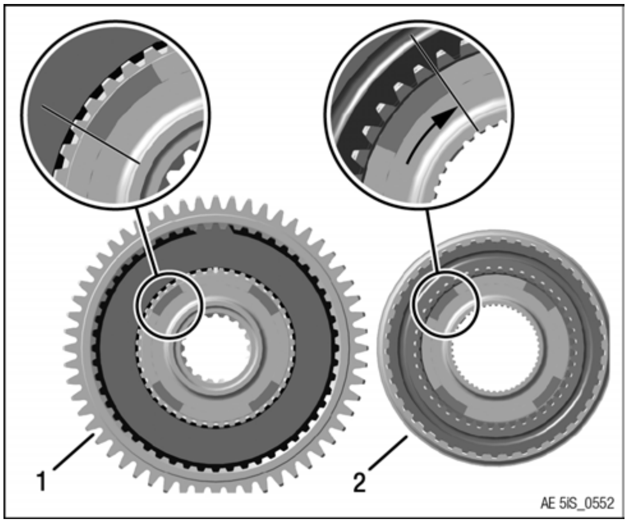


Figure 6.76

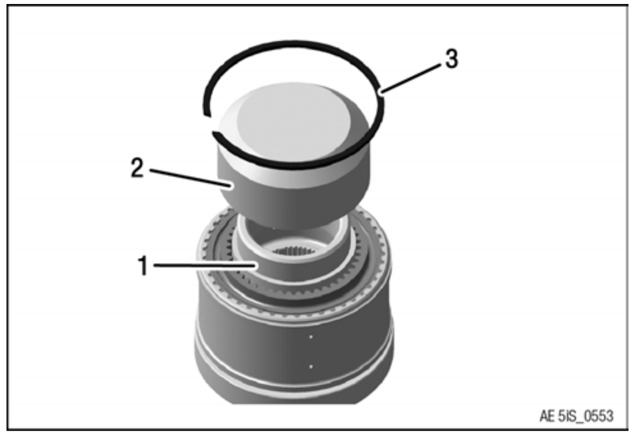
1 Overload clutch *2 Damper clutch assy.*

Step	Procedure
11	Insert centering ring part no. 276950.
12	Press damper clutch assy. with insertion jig part no. 276952.

ATTENTION

The upper disk spring must not slip into the groove of the retaining ring. Otherwise disk spring will be damaged during compression of the clutch.

Step	Procedure
13	Insert circlip and release damper clutch assy. **NOTE** *Check the alignment of clutch hub once again. It must be free to move.*



1 Clutch hub *2 Insertion jig*
3 Circlip

Figure 6.77: TYPICAL

ASSEMBLY OF THE PROPELLER GEARBOX ASSY.

Damper clutch— installation

Step	Procedure
1	Install the whole gearbox to support plate part no. 276958 and fix both in a bench vice.
2	Lubricate the propeller shaft with LOC-TITE ANTI SEIZE on the gear-tooth.
3	Install damper clutch into the housing.

NOTE

There is only one position to install the damper clutch. It is indexed through the splines of the propeller shaft.

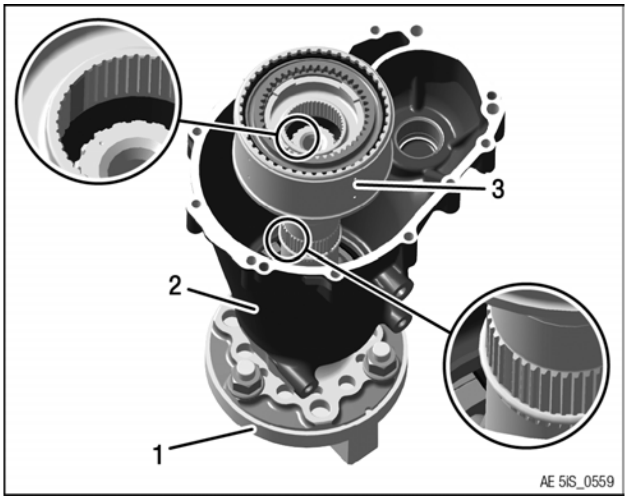


Figure 6.78

1	*Support plate part no. 276958*	*2*	*Gearbox*
3	*Damper clutch assy.*		

Overload clutch — installation

Step	Procedure
1	Lubricate LOCTITE ANTI SEIZE on the gear-tooth.
2	Install overload clutch so, that the marks of torsion bar and carrier of the clutch are properly aligned.

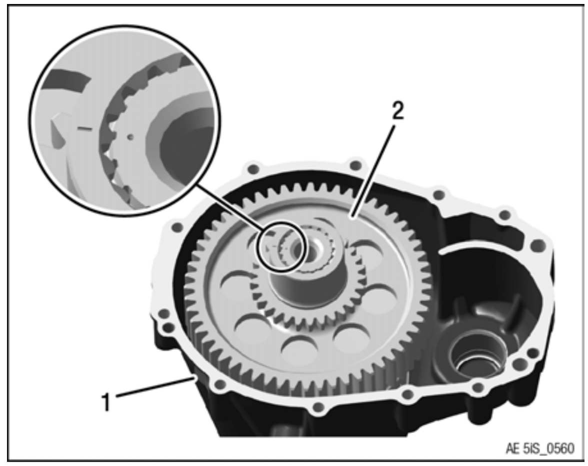


Figure 6.79

1	*Gearbox*	*2*	*Overload clutch*

Step	Procedure
3	If the clutch can not be completely pushed on, turn it with the special tool part no. 276962 and push it to the end stop. **NOTE** *If necessary, use a soft-faced hammer (light hammer blows only).*

NOTE

When all steps are done correctly, then the outer teeth of the overload clutch align with the sealing surface of the gear housing. If incorrect, the overload clutch will be raised over the sealing. In this case it needs to be investigated, which pairing is mounted wrong and it has to be fixed.

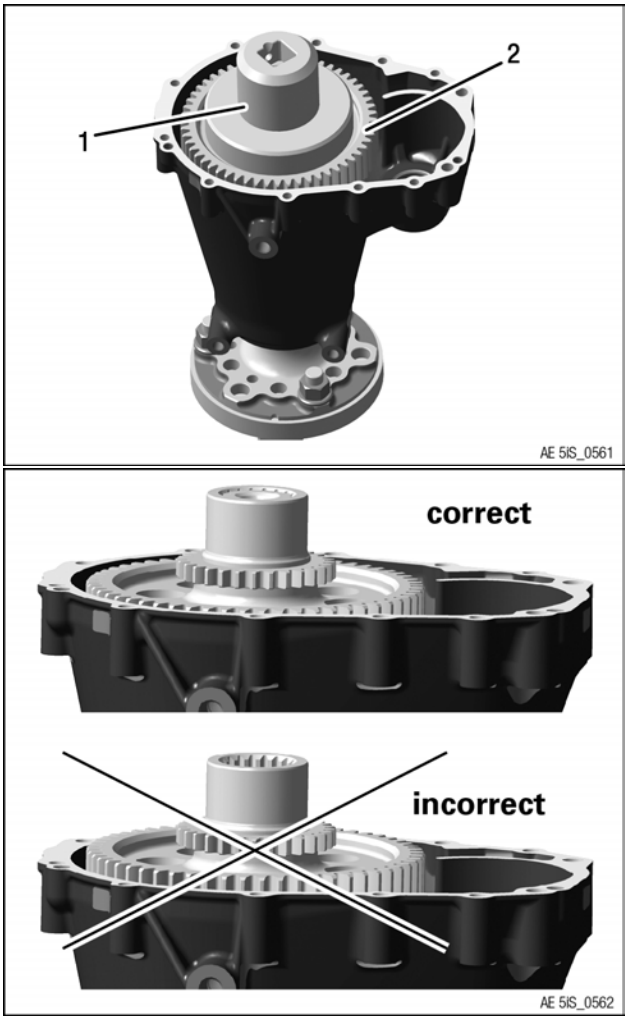


Figure 6.80

1 Special tool 276962 *2 Overload clutch*

INSTALLATION

BLINDING SHIM – INSTALLATION

CONFIGURATION 2

Step	Procedure
1	Install the O-ring 26.7x1.8 in the blinding shim.
2	Apply LOCTITE 5910 where the O-ring contacts the crankcase splitting line.
3	Install the blinding shim with the full side into the crankcase. Secure the blinding shim with countersunk screw M5x12 including the thrust washer with LOCTITE 243 and tighten it. Tightening torque 5 Nm (44 in.lb.).

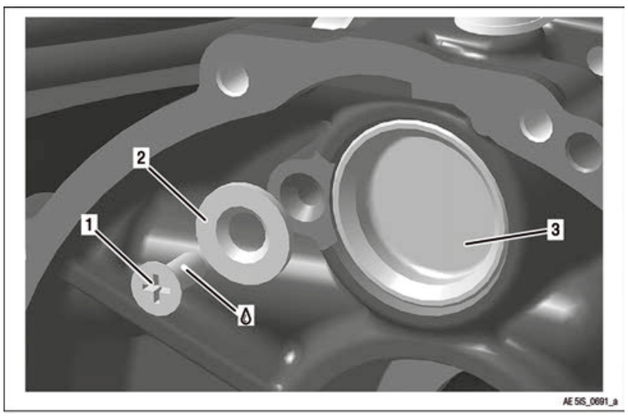


Figure 6.81

1	*Countersunk screw M5x12*	*2*	*Thrust washer*
3	*Blinding shim*		

OIL INLET FLANGE— INSTALLATION

CONFIGURATION 3

Step	Procedure
1	Lubricate a new O-ring with engine oil and push it into the crankcase with the oil inlet flange.

NOTE

Ensure that the two M6 threads must be horizontal and scavenge oil hole on upper position. See following Figure.

Step	Procedure
2	Install the governor flange with two M6x20 Allen screws and the oil inlet flange with two M6x16 Allen screws lightly at first for better positioning. See also Chapter 61–20–00.

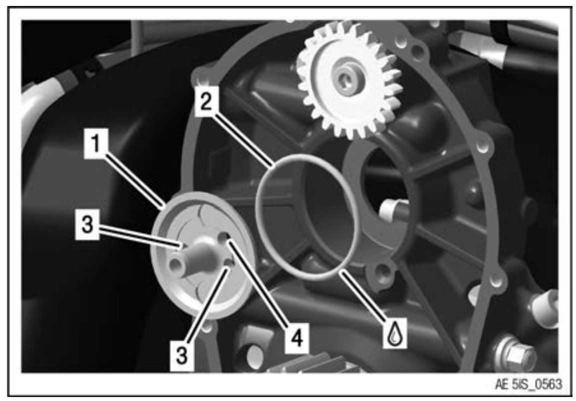


Figure 6.82

1	*Oil inlet flange*	*2*	*O-ring*
3	*M6 threaded bores*	*4*	*Scavenge oil hole*

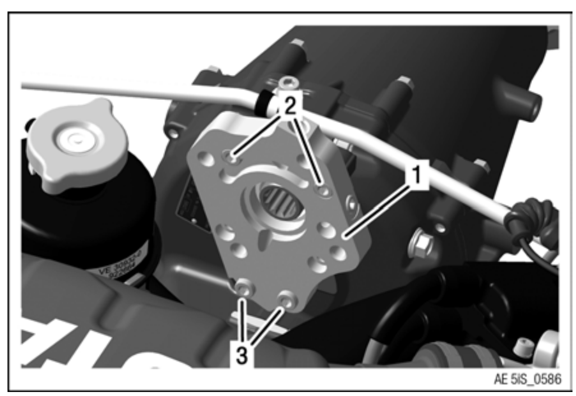


Figure 6.83

1	*Governor flange*	*2*	*M6x20 Allen screws*
3	*M6x16 Allen screws*		

CONFIGURATION 2

Step	Procedure
1	Lubricate a new O-ring with engine oil and push it into the crankcase with the oil inlet flange.

NOTE

Ensure that the two M6 threads must be horizontal and scavenge oil hole on upper position. See following Figure.

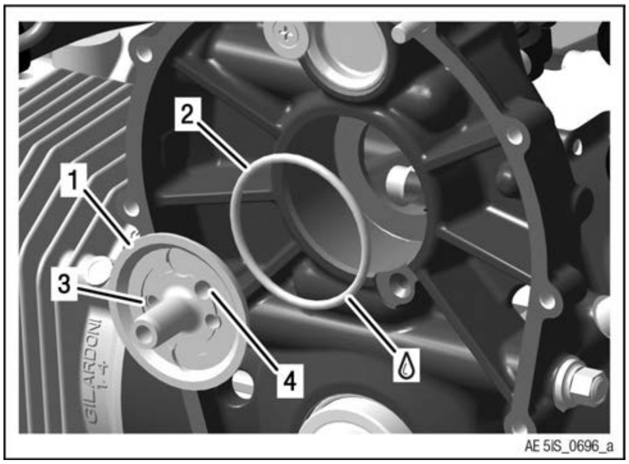


Figure 6.84

1 Oil inlet flange *2 O-ring*

3 M6 threaded bores *4 Scavenge oil hole*

Step	Procedure
2	Lubricate new two O-rings 7x2 with engine oil and install into the oil inlet flange.
3	Align the oil inlet flange. Install the oil inlet flange adaptor with two Allen screws M6x16 and secure with LOCTITE 243 into the crankcase. Tightening torque 10 Nm (89 in.lb).

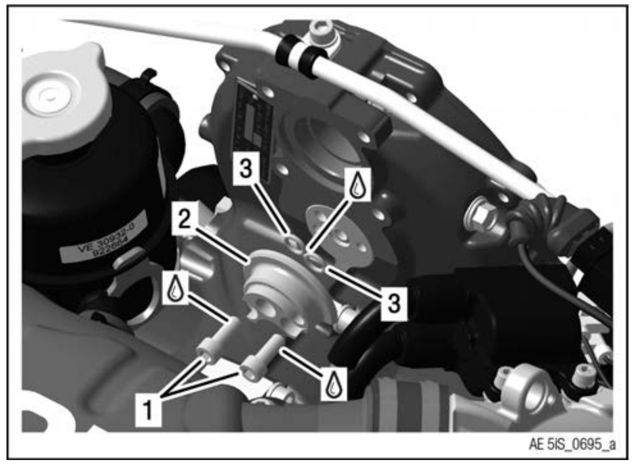


Figure 6.85

1 Allen screws M6x16 *2 Oil inlet flange adaptor*

3 O-rings 7x2

NEEDLE BEARING – INSTALLATION

CONFIGURATION 3 AND 2

Step	Procedure
1	Install the extractor part no. 877615 onto the crankcase, place the press-in mushroom part no. 276000 in the needle bearing, put it on the centring and press it with the spindle into the crankcase as far as it will go. **NOTE** *Lubricate needle bearing on outer diameter.*

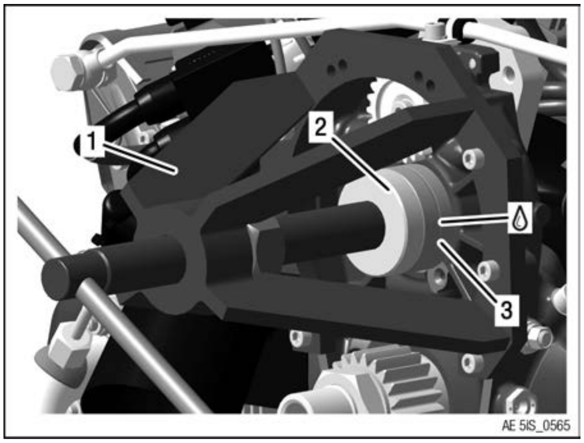


Figure 6.86: TYPICAL

1	*Extractor part no. 877615*	*2*	*Press-in mushroom part no. 276000*
3	*Needle bearing*		

Step	Procedure
2	Secure M5x12 countersunk screw including the retaining washer with LOCTITE 243 and tighten it. Tightening torque 5 Nm (44 in.lb.).

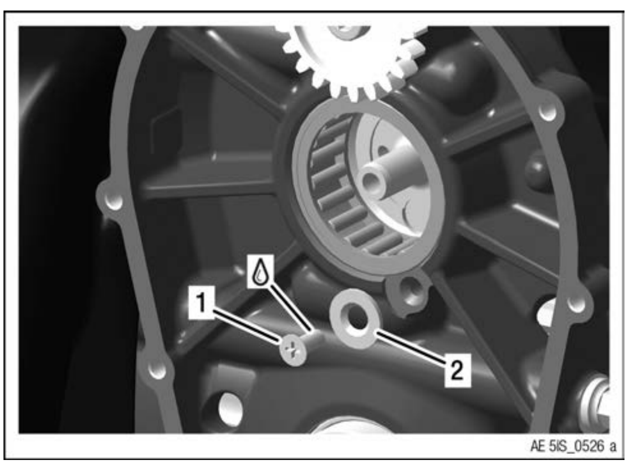


Figure 6.87: TYPICAL

1	*M5x12 countersunk screw*	*2*	*Washer*

CONFIGURATION 2

Step	Procedure
3	Install oil inlet flange adaptor with two new O-rings 7x2.
4	Tighten 2 Allen screws M6x16 from the oil inlet flange adaptor with LOCTITE 243. Tightening torque 10 Nm (89 in.lb.).

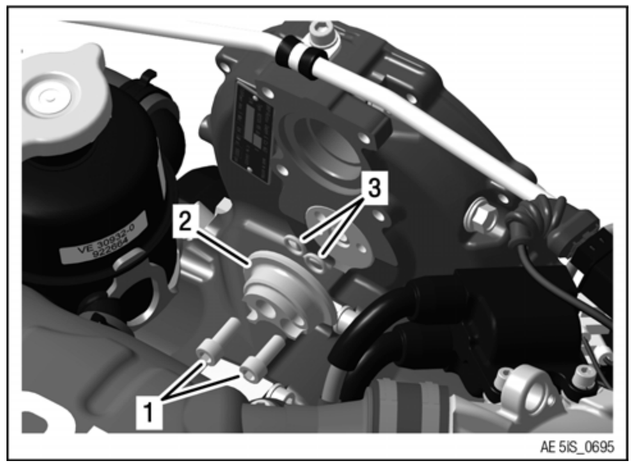


Figure 6.88

1	*Allen screws M6x16*	*2*	*Oil inlet flange adaptor*
3	*O-rings 7x2*		

GEARBOX OIL LINE ASSY – INSTALLATION

CONFIGURATION 2

For configuration 3 see Chapter 61-20-00.

Step	Procedure
1	Install banjo bolts M10x1x19 with two sealings rings on oil inlet flange adaptor. Tightening torque 17 Nm (150 in.lb).
2	Install banjo bolt M10x1x34 into oil pump housing. Tightening torque 12 Nm (106 in.lb).
3	Fasten the gearbox oil line assy. with the cable clamp using the hex. /torx. screw M8x16 and LOCTITE 243. Tightening torque 15 Nm (133 in.lb).

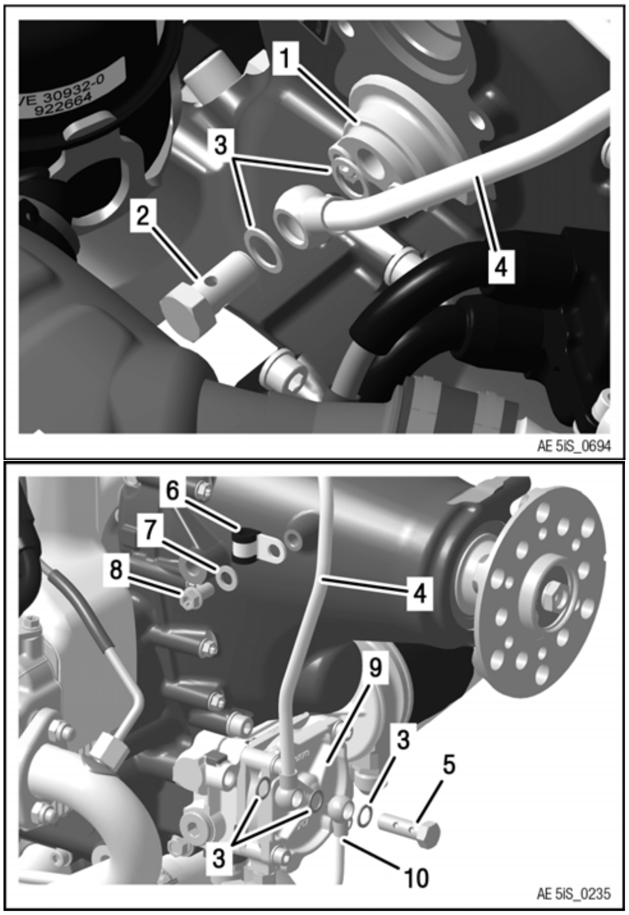


Figure 6.89

1	*Oil inlet flange adaptor*	2	*Banjo bolt M10x1x19*
3	*Sealing rings A 10x14*	4	*Gearbox oil line assy.*
5	*Banjo bolt M10x1x34*	6	*Cable clamp 8/M8*
7	*Lock washer A8*	8	*Hex./Torx-flange screw M8x16*
9	*Oil pump housing*	10	*Turbo pressure oil line*

FINISHING WORK

Install gearbox assy., see relevant Maintenance Manual Line for the engine type 915 i A Series Chapter 05-50-00.

Install gearbox oil line assy.. See relevant Maintenance Manual Line for the engine type 915 i A Series Chapter 05-50-00.

Fill with operating fluids or check filling levels. See relevant Maintenance Manual Line for the engine type 915 i A Series Chapter 12-10-00 section Adding operating fluids.

Carry out an engine test run. See relevant Maintenance Manual Line for the engine type 915 i A Series.

- After the engine test run, check the engine and gearbox for leaks.

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Chapter: 72–20–00
ENGINE BLOCK

TOPICS IN THIS CHAPTER

SPECIAL TOOLS

Description	Part number	
Hot air gun	n.a.	
Puller	877375	Non certified part
Seeger ring pliers	n.a.	
Free wheel gear axial clearance measuring fixture	n.a.	
38x20 insert for SW32 hex. nut, magneto side crankshaft	876070	Non certified part
A 20x12.5 reducing socket	877460	Non certified part
Protection mushroom	877419	Non certified part

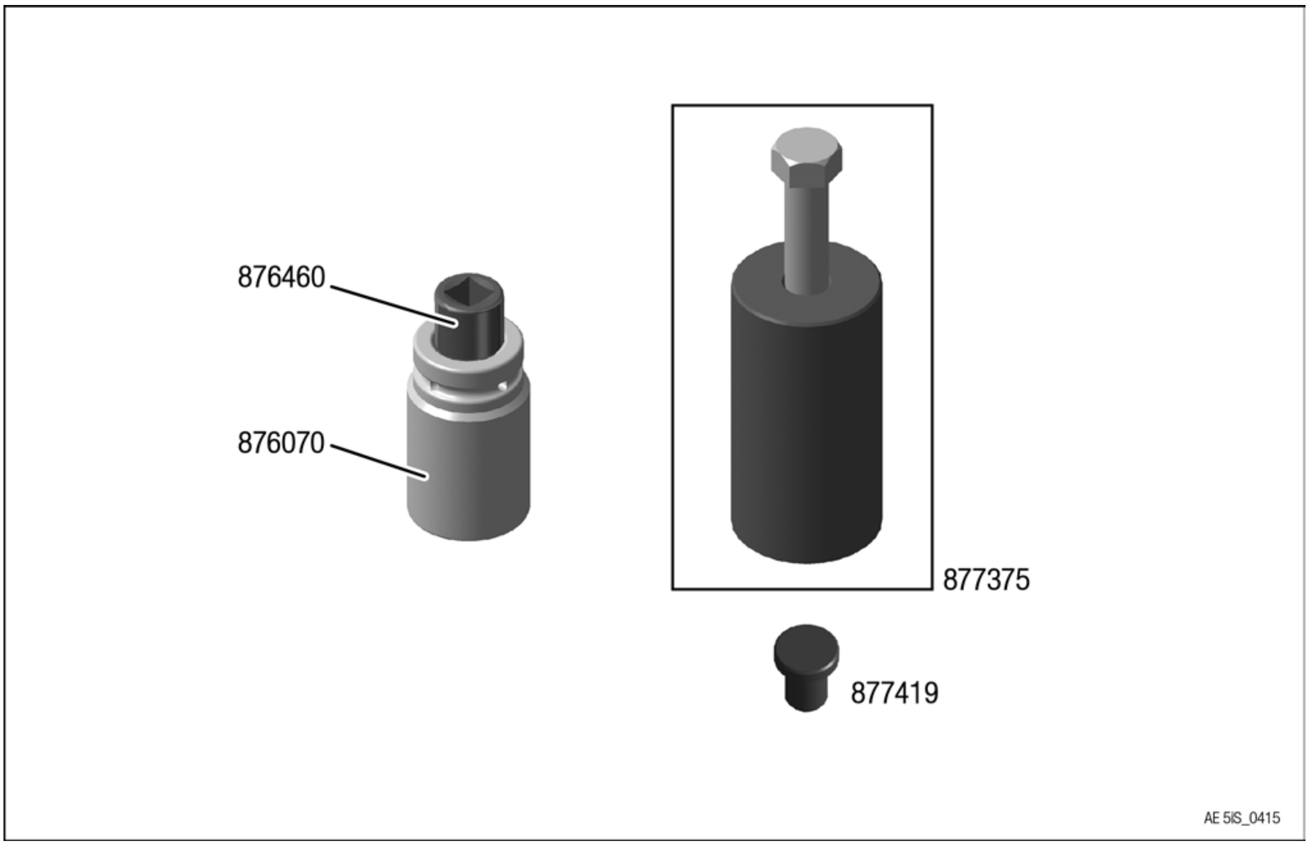

Figure 7.1

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE 8151	297434
LOCTITE 7063	898450
LOCTITE 603	899789
Engine oil	n.a.

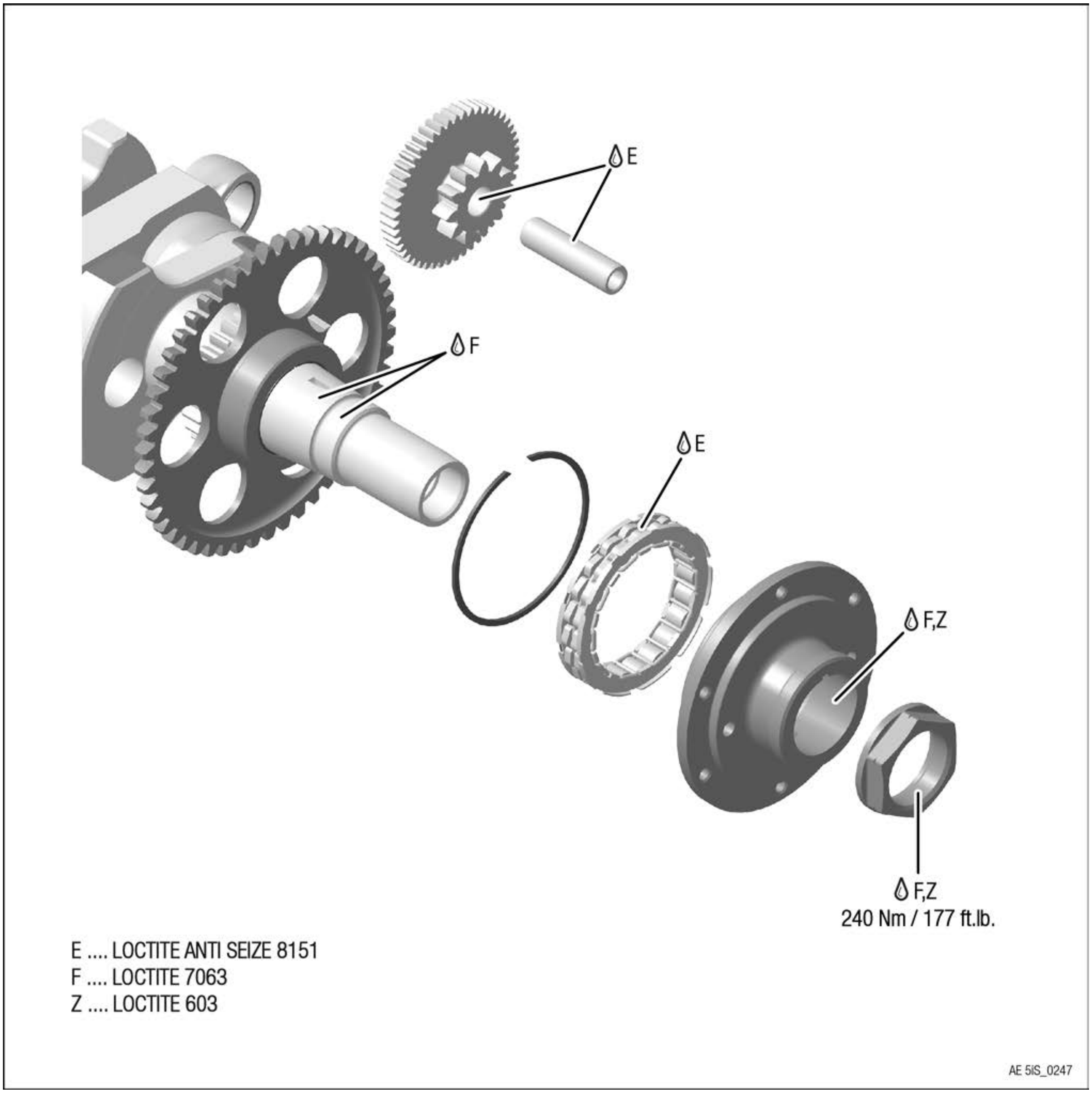

Figure 7.2: Engine block

GENERAL NOTE

This section only describes work relating directly to repairing the engine block and its assemblies. Note the cross-references to maintenance work and work on other assemblies which is necessary when working on the engine block.

SAFETY INSTRUCTIONS

⚠ WARNING
Danger of severe burns and scalds! Always allow the engine to cool down to ambient temperature before starting any work.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

SPRAG CLUTCH

Before the sprag clutch is removed, the work described below must be carried out to identify any further faults in the engine block and rectify them as part of repair work.

ATTENTION

If these checks are omitted, it may be necessary to dismantle the cylinder head again to rectify any faults after it has been repaired.

General visual inspection. See Maintenance Manual Line for the engine type 915 i A Series.

Engine cleaning. See Maintenance Manual Line for the engine type 915 i A Series.

Carry out an engine test run. See Maintenance Manual Line for the engine type915 i A Series.

SPRAG CLUTCH — REMOVAL

Preparation

ATTENTION

Prevent the ingress of debris particles into all disconnected lines and connections.
Use appropriate protective coverings.

- Remove the electric starter. See Chapter 80-00-00 section Electric starter.
- Remove the ignition housing and fly wheel. See Chapter 24-20-00 section Internal generator.

Locking of the crankshaft into place. See Maintenance Manual Line for the engine type 915 i A Series .

NOTE

The assemblies and lines are only to be removed if necessary and only as far as is necessary!

REMOVAL OF THE SPRAG CLUTCH HOUSING

Step	Procedure
1	Pull out the intermediate gear shaft.
2	Remove the starter intermediate gear.

ATTENTION

The M32x1.5 hex. collar nut (secured with LOCTITE 648) must be heated correspondingly. The nut has a left handed thread!

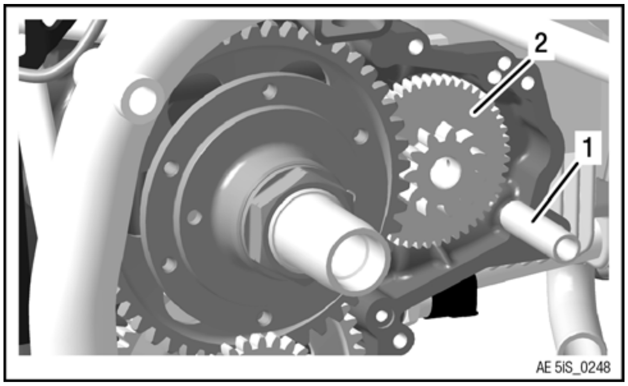

Figure 7.3

1 Intermediate gear shaft   *2 Intermediate gear*

Step	Procedure
3	Heat the hex. collar nut about 100 °C to 120 °C (212 °F to 248 °F) using a hot air gun.
4	Loosen the hex. collar M32x1.5 nut from the crankshaft with the socket wrench 38x20 part no. 876070.

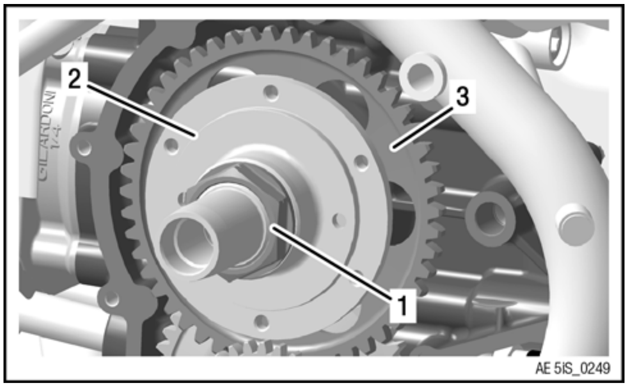

Figure 7.4

1 Hex. collar nut M32x1.5 *2 Sprag clutch housing*

3 Free wheel gear

Step	Procedure
5	Lubricate the surface of the crankshaft with lithium-based grease and push the protection mushroom part no. 877419 into the crankshaft.

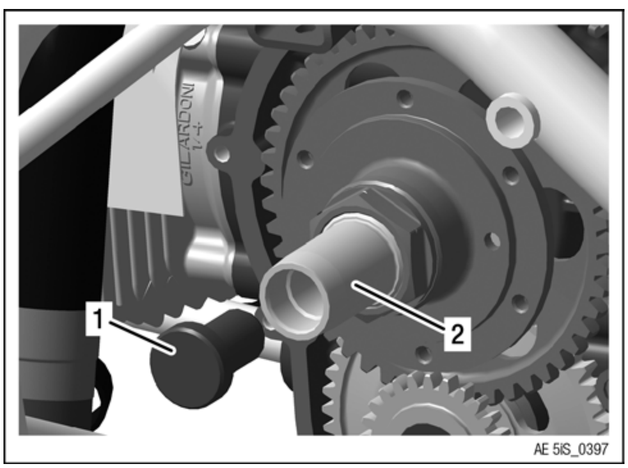

Figure 7.5

1 Protection mushroom *2 Crankshaft*

Step	Procedure
6	Pull off the sprag clutch housing using the puller part no. 877375.

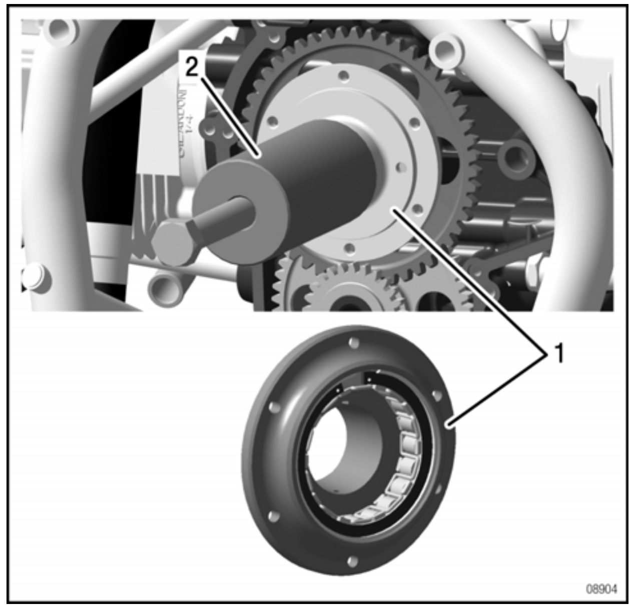

Figure 7.6

1 Sprag clutch housing *2 Puller part no. 877375*

Step	Procedure
7	Remove the woodruff key from the crankshaft.

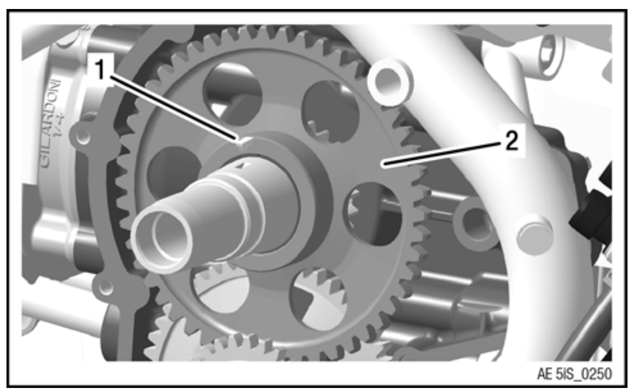

Figure 7.7

1 Woodruff key *2 Free wheel gear*

DISASSEMBLY

DISASSEMBLING THE SPRAG CLUTCH HOUSING

The sprag clutch housing should be disassembled on a clean surface. There must be enough space to lay out the removed parts to ensure that all the parts can be laid out and allocated according to their installation position.

Step	Procedure
1	Remove the circlip from the sprag clutch housing.
2	Compress the Seeger ring slightly using Seeger ring pliers and take the sprag clutch out of the sprag clutch housing while turning it.

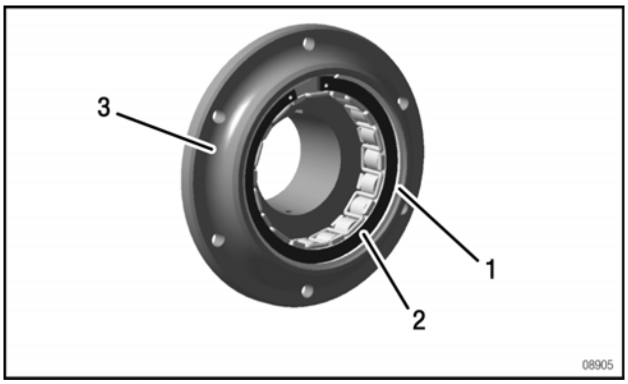

Figure 7.8

1 Circlip *2 Seeger ring*

3 Sprag clutch housing

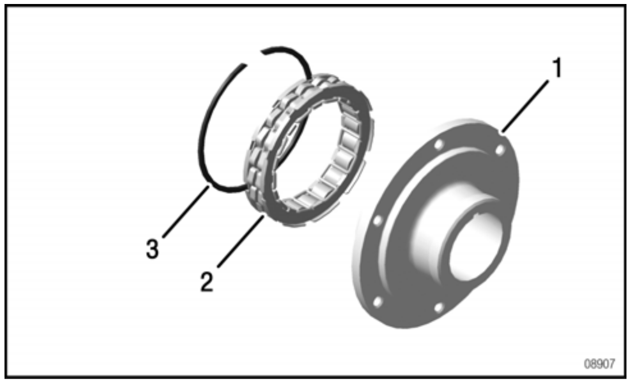

Figure 7.9

1 Sprag clutch housing *2 Sprag clutch*

3 Circlip

INSPECTION

SPRAG CLUTCH HOUSING SINGLE PARTS CHECK

Preparation

Clean all parts carefully.
See Maintenance Manual Line for the engine type 915 i A SeriesChapter 05-00-00 section Procedures.

SPRAG CLUTCH HOUSING CHECK

Step	Procedure
1	Check whether oil sludge has accumulated in the sprag clutch housing.
2	Check that the oil passage for the generator is clear. **NOTE** *The passage is 0.8 mm (0.030 in.) in diameter. Check using a 0.5 mm (0.020 in.) wire.*
3	Check crankshaft bore.
4	Check the taper surface.
5	Check the sprag clutch engagement faces in the sprag clutch housing.

ATTENTION

If the oil passage is clogged, the generator coils are no longer cooled sufficiently.

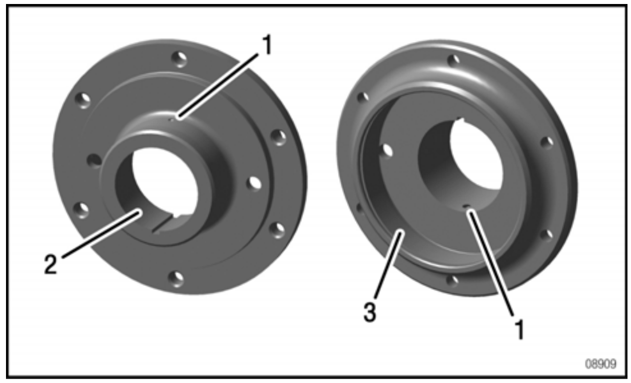

Figure 7.10

1	*Oil passage*	*2*	*Taper surface*
3	*Sprag clutch engagement face*		

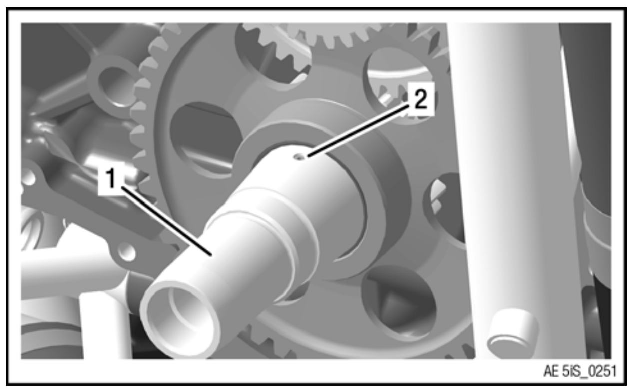

Figure 7.11

1	*Crankshaft*	*2*	*Crankshaft bore (oil passage)*

SPRAG CLUTCH CHECK

Step	Procedure
1	Check whether oil sludge has accumulated in the sprag clutch and in the spear body.
2	The spear body of the sprag clutch must be freely movable and may not be damaged.
3	The surrounding helical spring must not be loose or bent in a serpentine manner; replace the sprag clutch if necessary.

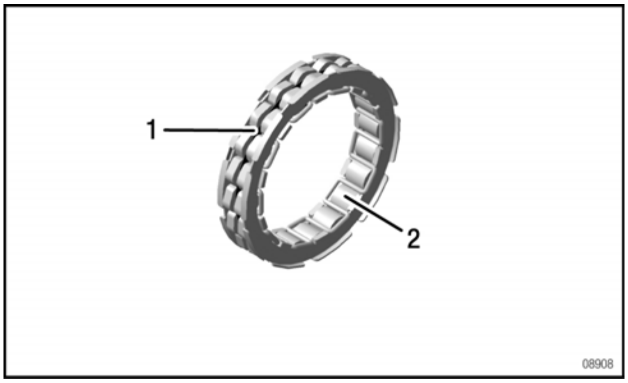

Figure 7.12

1 Helical spring *2 Spear body*

FREE WHEEL GEAR CHECK

Step	Procedure
1	Check the gear-tooth system of the free wheel gear.
2	Check the sprag clutch engagement face on the free wheel gear.
3	Check the taper surface.

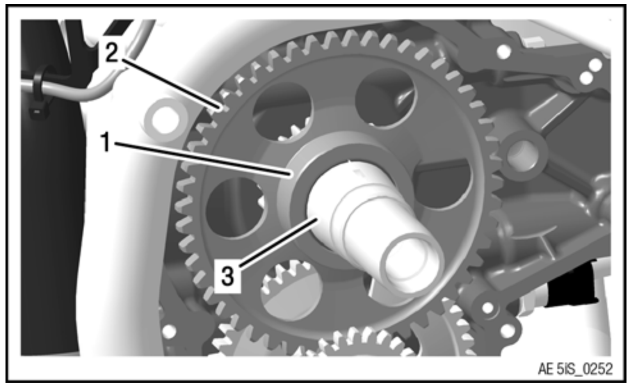

Figure 7.13

1 Sprag clutch engagement face *2 Gear-tooth system*

3 Taper surface

STARTER INTERMEDIATE GEAR CHECK

Step	Procedure
1	Check the gear-tooth system of the starter intermediate gear.
2	Check the intermediate gear shaft for damage.

ATTENTION

If the gear-tooth system is deformed, the starter intermediate gear must be replaced.

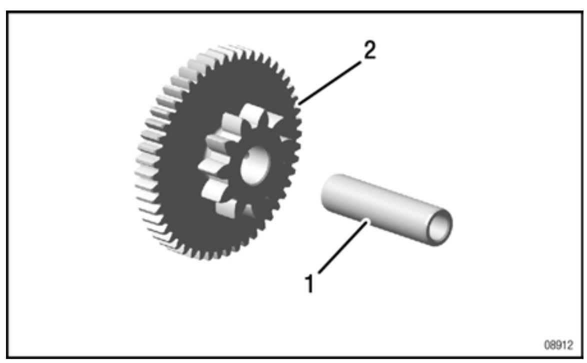

Figure 7.14

1 Intermediate gear shaft *2 Starter intermediate gear*

ASSEMBLY

ASSEMBLY OF THE SPRAG CLUTCH HOUSING

Step	Procedure
1	Clean the taper surface of the sprag clutch housing with a cloth.
2	Apply LOCTITE ANTI SEIZE to the spear body.

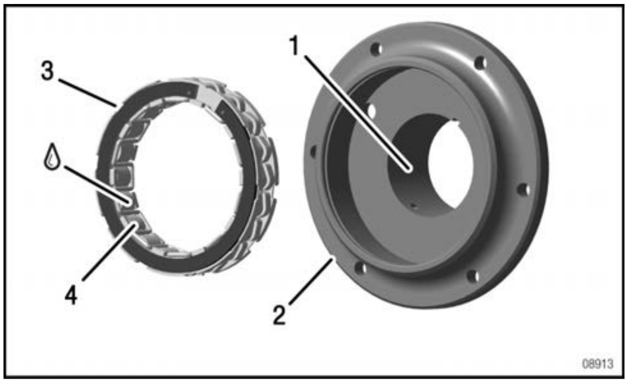

Figure 7.15

1	*Taper surface*	2	*Sprag clutch housing*
3	*Sprag clutch*	4	*Spear body*

Step	Procedure
3	Place the sprag clutch in the sprag clutch housing; the Seeger ring must be visible.
4	Install the circlip so that its chamfer faces the sprag clutch. **NOTE** *To assemble it, compress it slightly with Seeger ring pliers and ensure that the Seeger ring remains in position and latches completely with the teeth in the slots of the sprag clutch body.*

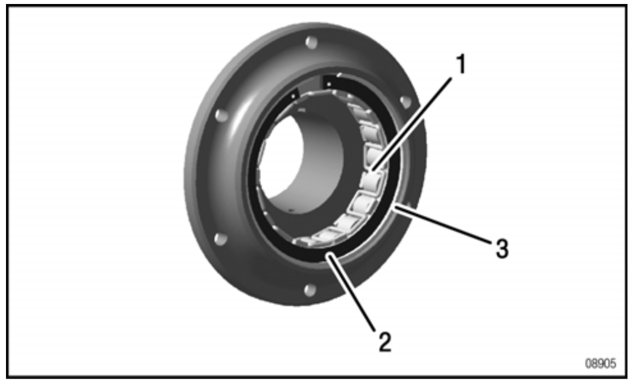

Figure 7.16

1	*Sprag clutch*	2	*Seeger ring*
3	*Circlip*		

INSTALLATION

Preparation

Lock the crankshaft into place. For installation see Maintenance Manual Line for the engine type 915 i A Series.

INSTALLATION OF THE SPRAG CLUTCH HOUSING

ATTENTION

Bearing bushing and the free wheel gear may stick to the crankshaft and the sprag clutch may be abraded.
Approx. 2 to 3 mm on the underside of the sprag clutch housing must not be in contact with LOCTITE 648.

Step	Procedure
1	Degrease the thread and taper surface of the crankshaft with LOCTITE 7063 and place the woodruff key in the crankshaft.

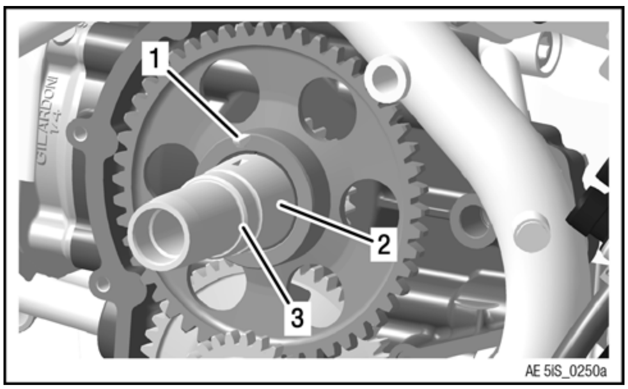

Figure 7.17

1 Woodruff key *2 Taper surface*

3 Thread

Step	Procedure
2	Degrease the taper surface in the sprag clutch housing with LOCTITE 7063 and lubricate thinly with LOCTITE 603.

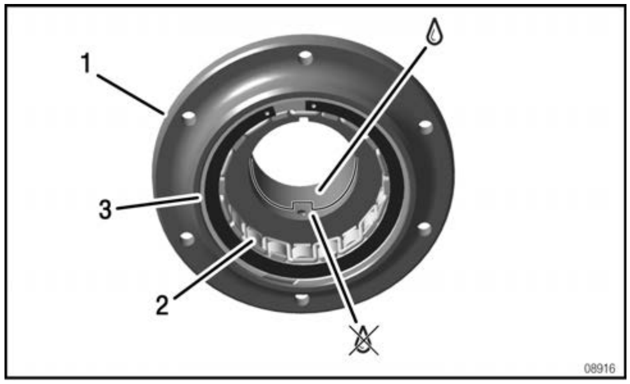

Figure 7.18

1 Sprag clutch housing *2 Spear body*

3 Circlip

Step	Procedure
3	Place the sprag clutch housing on the crankshaft. Turn the free wheel gear in the process to align the spear body.
4	Degrease hex. collar nut M32x1.5 with LOCTITE 7063, then secure it with LOCTITE 603 and tighten it. Tightening torque 240 Nm (177 ft. lb.).

NOTE

The free wheel gear must drive the crankshaft when turned counterclockwise and must be freely rotatable when turned clockwise, viewed towards the magneto side of the engine.

ATTENTION

Check that the passage and oil duct of the crankcase are not blocked.
If the oil passage is blocked, the generator coils are no longer cooled sufficiently.

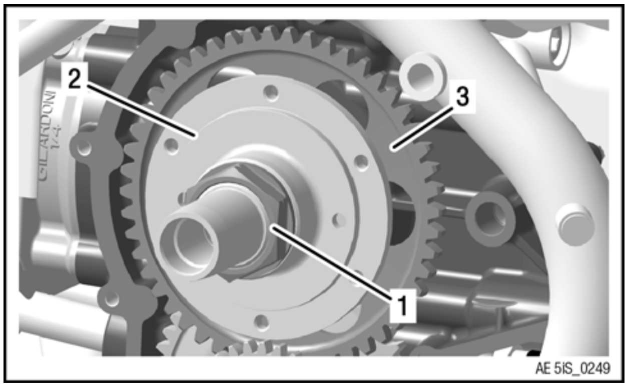

Figure 7.19

1	*Hex. collar nut M32x1.5*	2	*Sprag clutch housing*
3	*Free wheel gear*		

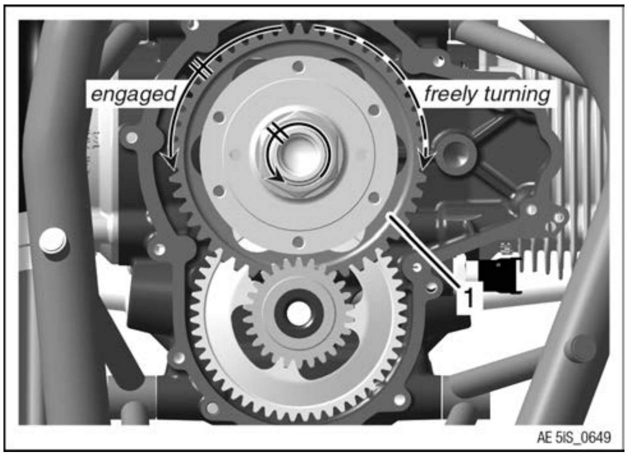

Figure 7.20

1	*Free wheel gear*

Step	Procedure
5	Lubricate the intermediate gear shaft and bore of the starter intermediate gear with LOCTITE ANTI SEIZE.
6	Install the starter intermediate gear.
7	Install the intermediate gear shaft.

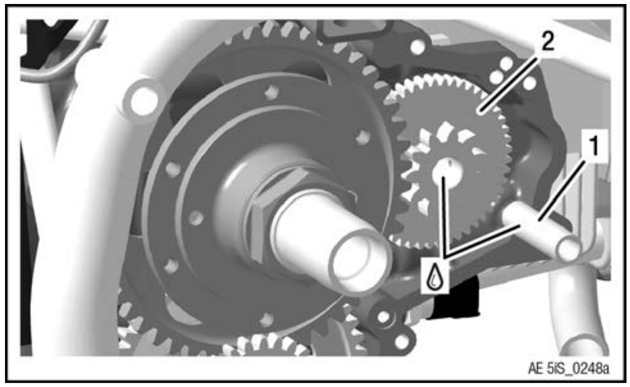

Figure 7.21

1	*Intermediate gear shaft*	2	*Starter intermediate gear*

MEASURING THE AXIAL CLEARANCE OF THE FREE WHEEL GEAR

ATTENTION

Electric starter may be damaged.
If there is no or too little axial clearance, the sprag clutch may not release.

WEAR LIMITS

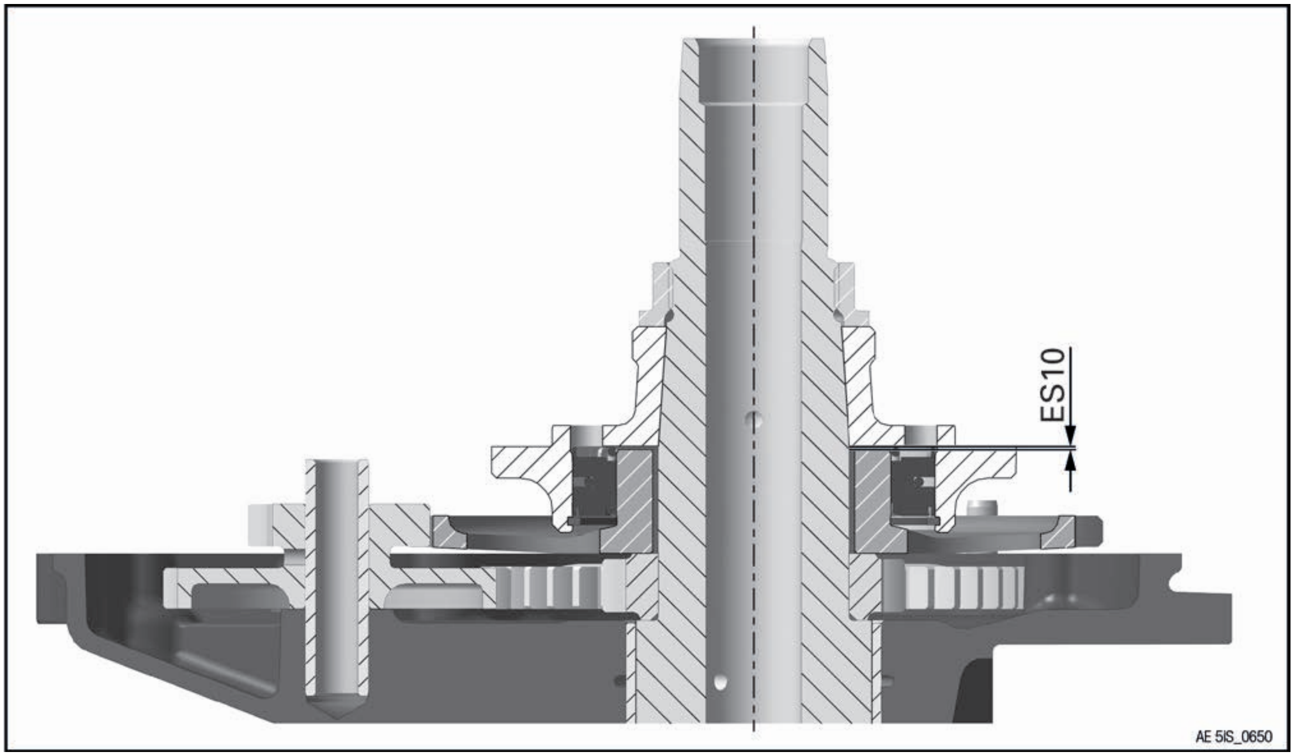

Figure 7.22: Free wheel gear

Description	Code	Reading new		Wear limit			Readings
		min.	max.	100 %	50 %		
Axial clearance	ES10	0.5 mm 0.02 in	1.1 mm 0.04 in	0.2 mm 0.01 in	0.4 mm 0.014 in	actual	
						renewed	

FINISHING WORK

- Install the ignition housing and fly wheel. See also Chapter 24-20-20 section Internal generator.
- Install the surrounding assemblies.

Fill with operating fluids or check filling levels.
See Maintenance Manual Line for the engine type 915 i A Series .

Carry out an engine test run.
See Maintenance Manual Line for the engine type915 i A Series .

INTENTIONALLY LEFT
BLANK

Chapter: 72–30–00
CYLINDER HEAD

TOPICS IN THIS CHAPTER

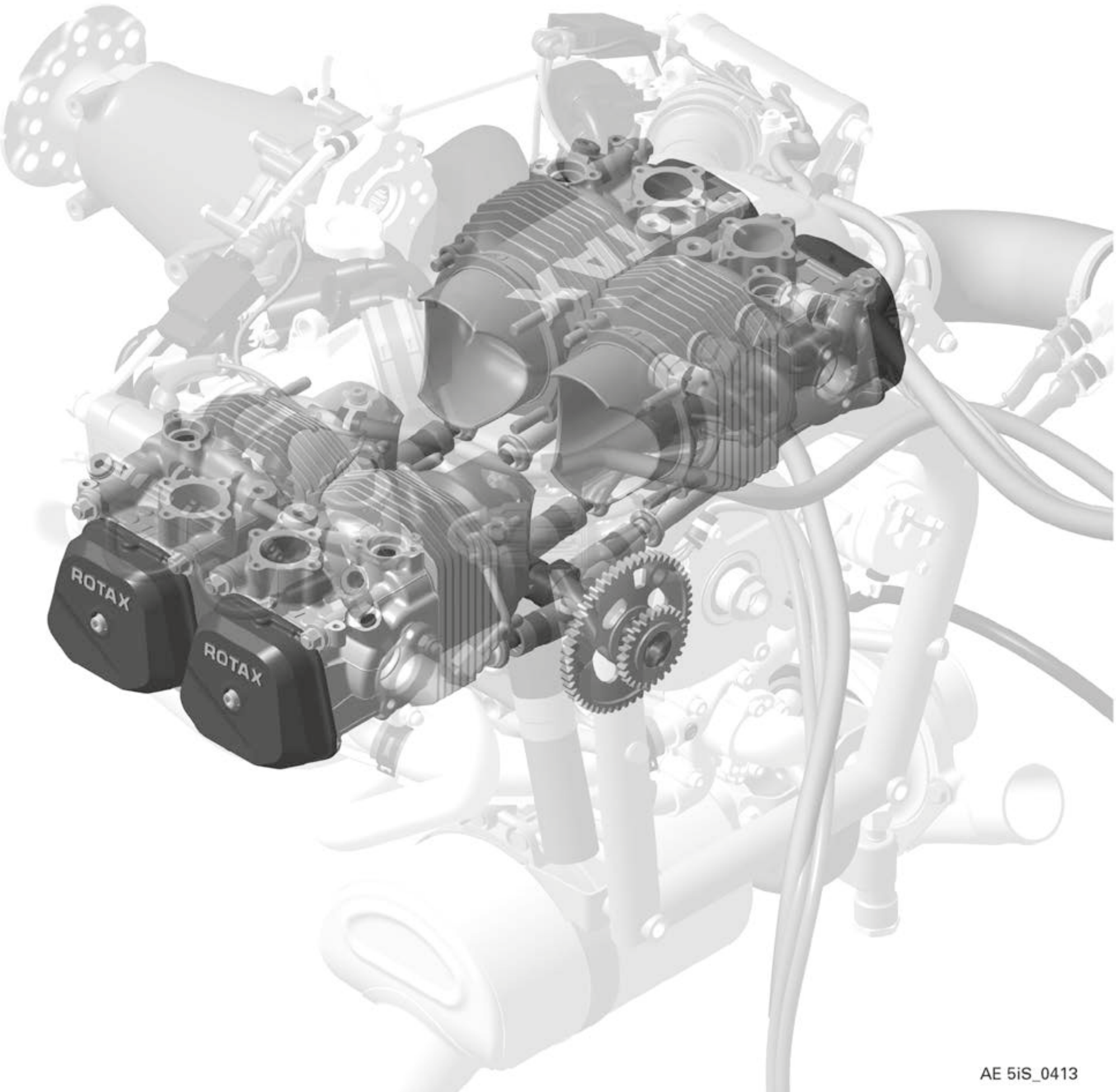

Figure 8.1: Location on the engine

SPECIAL TOOLS

Description	Part number	
Cylinder aligning tool	877263	Non certified part
Measuring fixture (valve spring inspection)	n.a.	Non certified part
Spring clamp pliers	877840	Non certified part
Valve spring mounting device	877380	Non certified part
Socket wrench 19x12.5	876130	Non certified part
Torx T30 ball-head insert	876180	Non certified part
Collet	n.a.	Non certified part

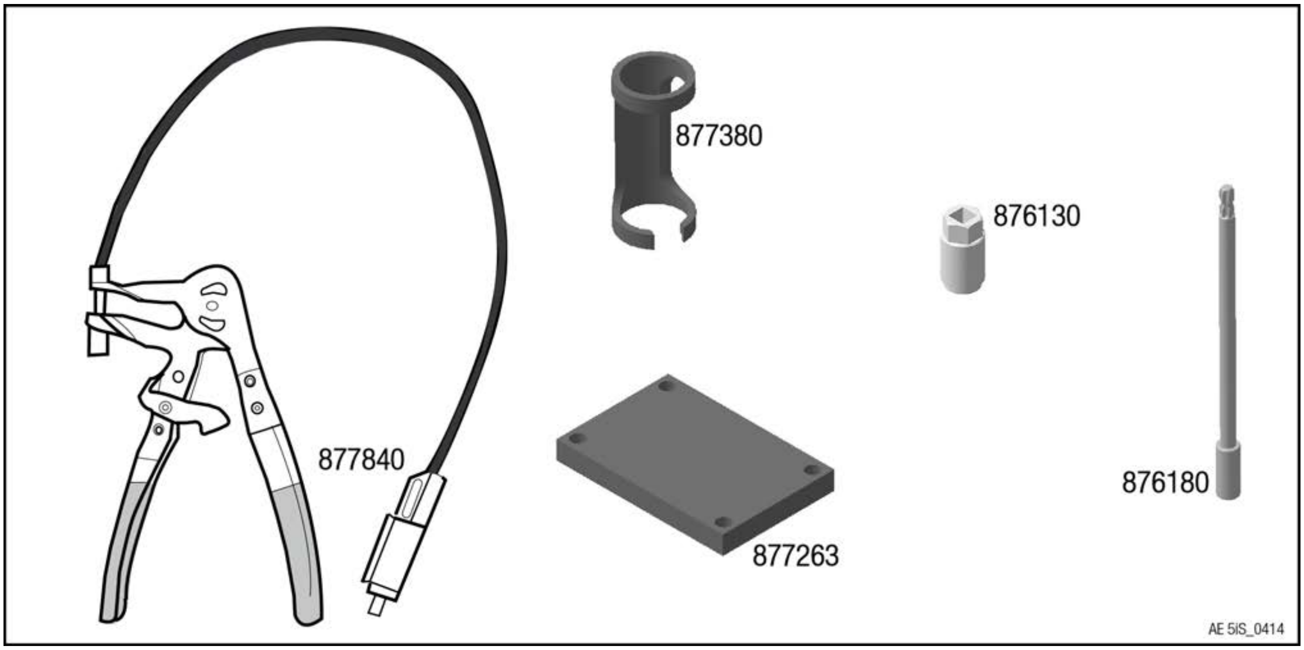

Figure 8.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 648	899788
LOCTITE 243	897651
Engine oil	n.a.

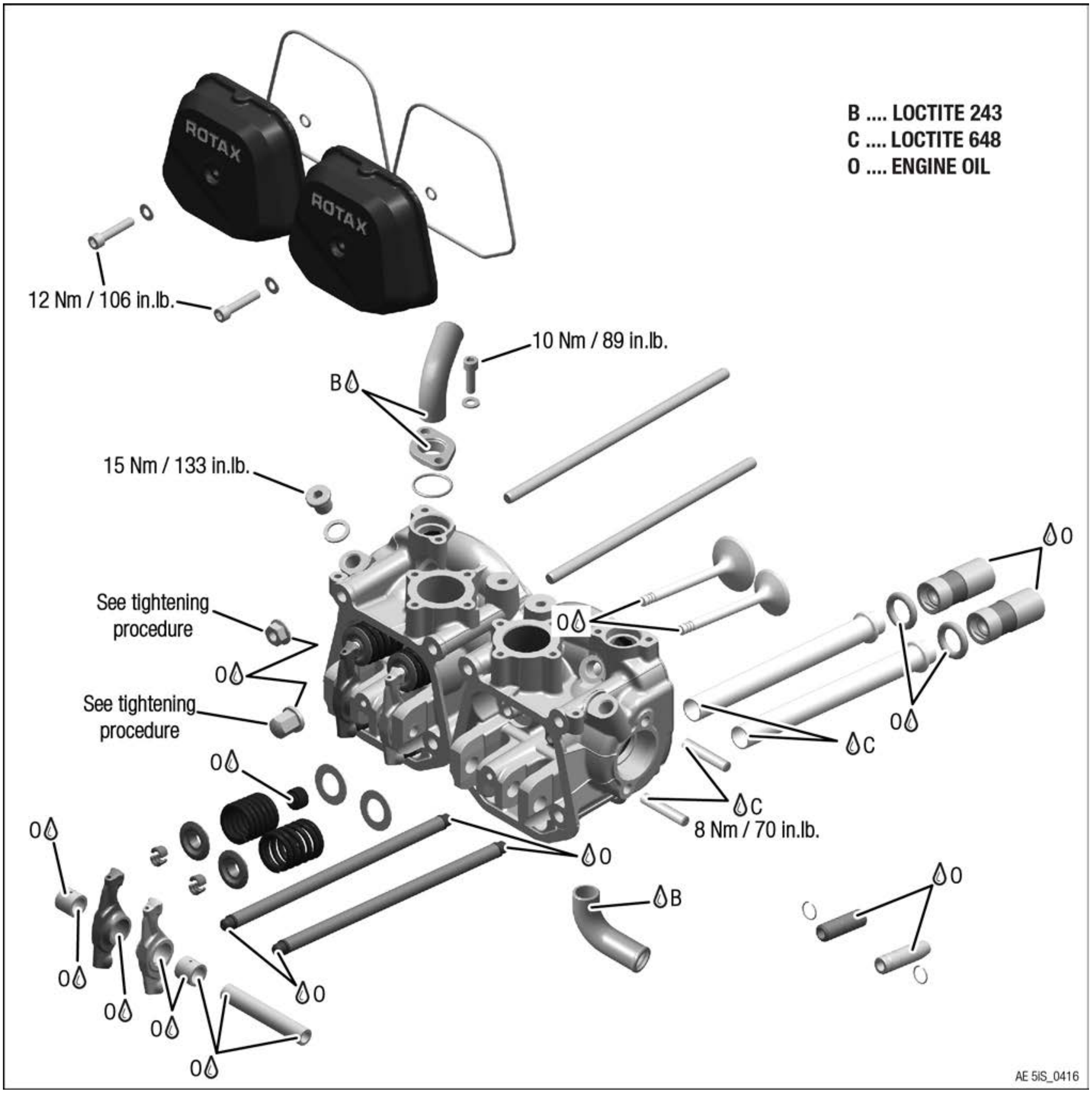

Figure 8.3: Cylinder head

SYSTEM DESCRIPTION

The 915 i A Series engine has 4 liquid-cooled cylinder heads.

SAFETY INSTRUCTION

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

CYLINDER HEAD

CYLINDER HEAD — REMOVAL

Preparation

Before the cylinder head is removed, the work described below must be carried out to identify any further faults in the cylinder head and rectify them as part of repair work.

ATTENTION

If these checks are omitted, it may be necessary to dismantle the cylinder head again to rectify any faults after it has been repaired.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

Engine cleaning.
See Maintenance Manual Line for the engine type 915 i A Series.

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL OF SURROUNDING ASSEMBLIES

ATTENTION

Prevent the ingress of foreign bodies into all disconnected lines and connections.
Use appropriate protective coverings.

NOTE

The assemblies and lines are only to be removed if necessary and only as far as is necessary!

Step	Procedure
1	If parts of more than one cylinder are removed, they must be numbered accordingly.
2	Remove the exhaust system. See Chapter 78-10-00 section Exhaust.
3	Remove the fuel hose assy. and outlet if necessary. To do this, see Chapter 73-10-00 section Fuel pump and distribution.

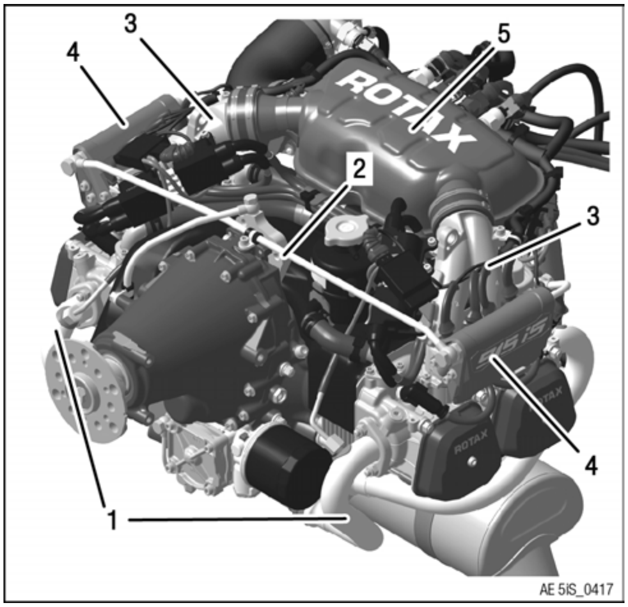

Figure 8.4

1 Exhaust system   *2 Fuel hose assy.*
3 Intake manifold   *4 Fuel rail*
5 Airbox

Step	Procedure
4	Disconnect the wiring harness from the temperature sensor and remove the temperature sensor. To do this, see Chapter 76-70-00 section Sensors and actuators.
5	Loosen 4 hex./torx collar screws M6x20 from the intake manifold.

NOTE

Remove the 2 insulating flanges between the intake manifold and the cylinder head.

Step	Procedure
6	Disconnect the spark plug connector and remove the spark plugs. See Chapter 74-20-00 section Distribution.

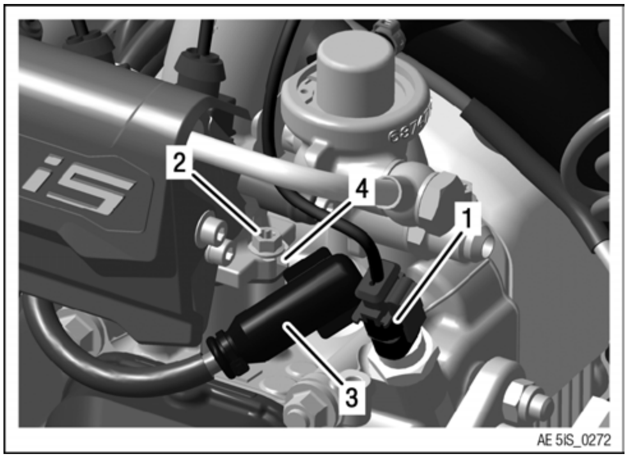

Figure 8.5

1	*Temperature sensor*	2	*Hex./torx collar screw M6x20*
3	*Spark plug connector*	4	*Insulating flange*

Step	Procedure
7	Release the attachment of the airbox to the ignition housing.
8	Take off the spring type hose clip 25 using spring clamp pliers part no. 877840.
9	Mark the coolant hoses and pull them off of the coolant elbows (inlet). See Chapter 75-00-00 section Cooling system.

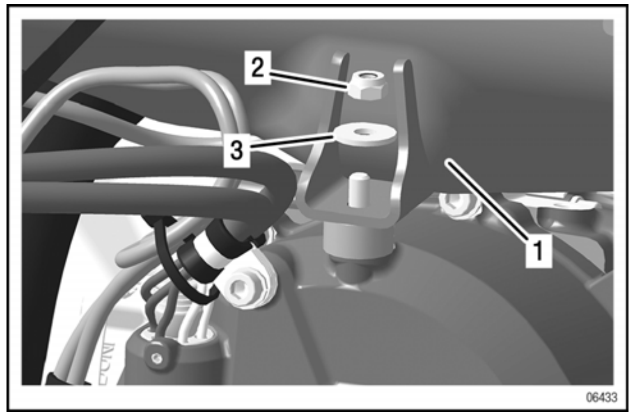

Figure 8.6

1	*Airbox*	2	*Hex. nut M6*
3	*Washer 6.4*		

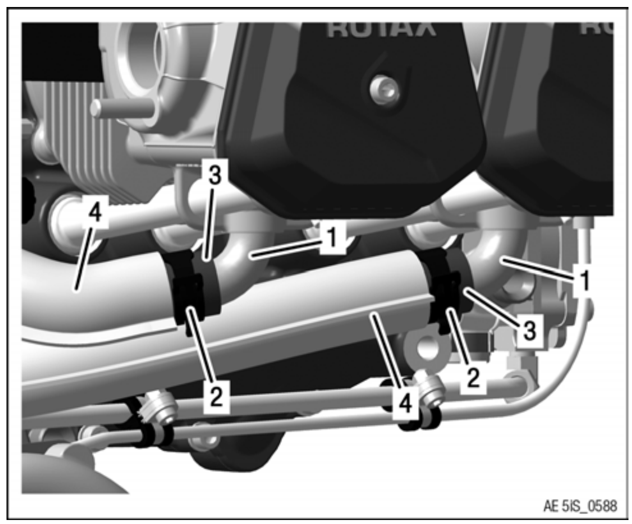

Figure 8.7

1	*Coolant elbow*	2	*Spring type hose clip 25*
3	*Coolant hose*	4	*Protection tube*

Step	Procedure
10	Loosen 2 Hex/Torx flange screws M6x20 along and remove the elbow flange.

NOTE

There is an O-ring under the elbow flange.
Remove the connector brackets on cylinder 3/4.

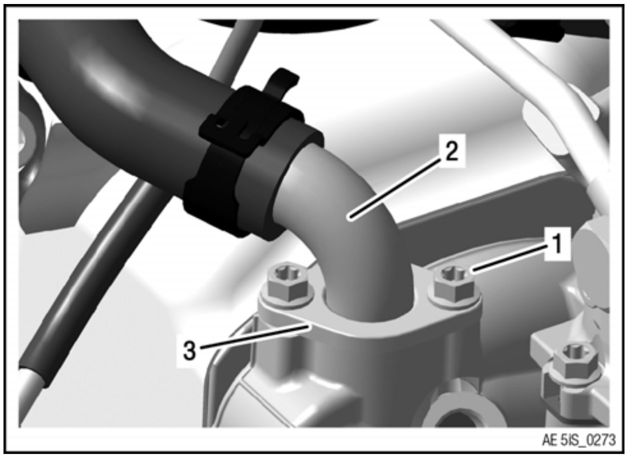

Figure 8.8

1	*Hex/Torx flange screw M6x20*	2	*Coolant elbow*
3	*Elbow flange*		

Step	Procedure
11	Remove the knock sensor from cylinder 1. To do this, see Chapter 76-70-00 section Sensors and actuators.

CYLINDER HEAD — REMOVAL

Step	Procedure
1	Loosen the M6x30 screw and washer.
2	Remove the valve cover with the large and small O-rings.

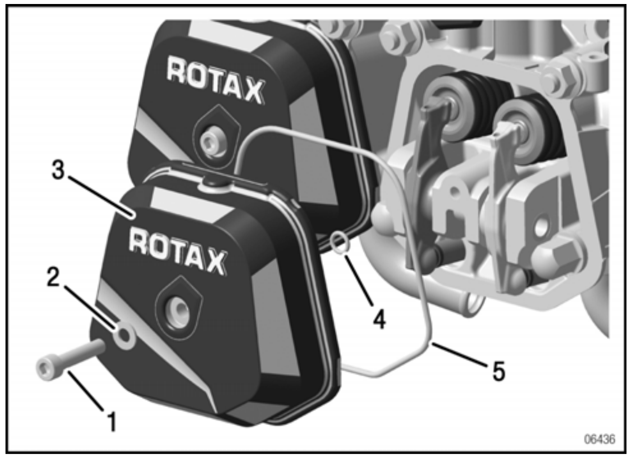

Figure 8.9: Typical

1	*M6x30 screw*	2	*6.0 washer*
3	*Valve cover*	4	*O-rings*

ATTENTION

Do not lose the O-rings!

Step	Procedure
3	Loosen 2 hex. nuts.
4	Loosen 2 M8 collar cap nuts inside the valve cover (diagonally).

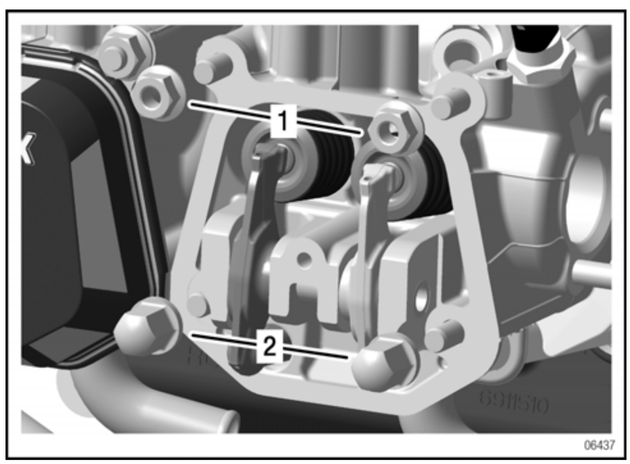

Figure 8.10

1	*Hex nuts*	2	*Collar cap nuts*

Step	Procedure
5	Lift the intake manifold with the fuel rail slightly and carefully pull the entire cylinder head off the cylinder with both hands.
6	Hold both push-rods in position in the oil return tubes. Hold the oil bore closed with a finger and remove the cylinder head.
7	Remove 16x5 O-rings from the oil return tubes and the crankcase.

ATTENTION

Damage to the sealing surfaces and the oil return tubes may occur.
Put down the cylinder head in such a manner that the sealing surfaces and the oil return tubes are not damaged.

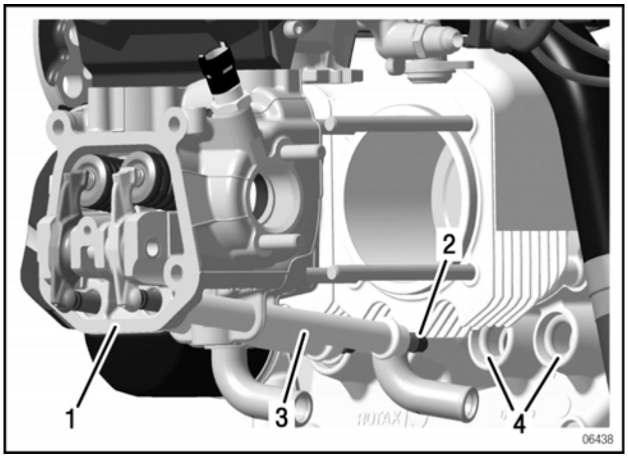

Figure 8.11

1	*Cylinder head assy.*	2	*Push-rod assy.*
3	*Oil return tubes*	4	*16x5 O-ring*

Step	Procedure
8	Hold the oil-filled push-rods closed with a finger, remove them and put them down with the corresponding cylinder heads to prevent confusion.

NOTE

Mark the installation position of the push-rod with an appropriate marker (e.g. a touch-up pen) (e.g. "IV1" for intake valve cylinder 1).

NOTE

If the parts are installed again with the same position and allocation as before they were removed, the push-rods can be reused. The reason for this is the break-in which takes place on the parts prior to removal.

DISASSEMBLY

DISASSEMBLING THE CYLINDER HEAD

The cylinder head should be disassembled on a clean surface. There must be enough space to lay out the removed parts to ensure that all the parts can be laid out and allocated according to their installation position.

ATTENTION

Danger of consequent damage to engine! During assembly, the valves and all the associated components must be re-installed in their original position.
Mark the valves and the associated components correspondingly before removing them.

ROCKER ARM — REMOVAL

ATTENTION

The rocker arm shaft should never be forced out.

Step	Procedure
1	Pull out the rocker arm shaft and take out the two rocker arms.

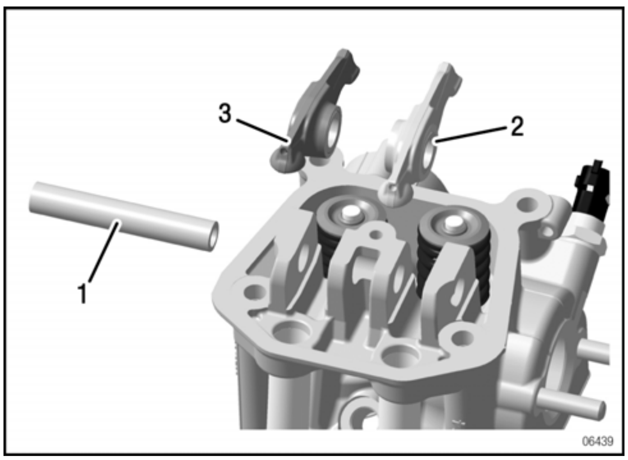

Figure 8.12

1	*Rocker arm shaft*	2	*Right rocker arm*
3	*Left rocker arm*		

VALVE — REMOVAL

ATTENTION

Avoid damage to the stem seal or guide.
Before taking out the valves, remove any burrs on the valve stem. Mark the valves accordingly.

Step	Procedure
1	Compress the valve springs using the valve spring mounting device part no. 877380 and valve spring collet.
2	Removal of the valve cotters.
3	Release the valve spring tension.
4	Remove the valve spring retainer and valve springs with the washer and pull out the valve.
5	Repeat this process for the second valve and clean the cylinder head.

NOTE

There is a valve stem seal only on the intake valve.

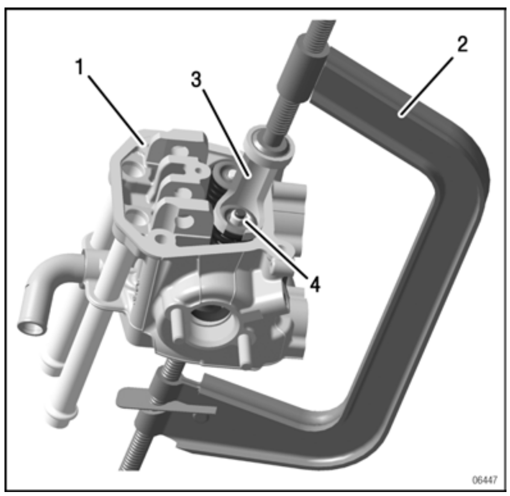

Figure 8.13

1	*Cylinder head assy.*	2	*Valve spring collet*
3	*Valve spring mounting device part no. 877380*	4	*Valve cotter*

COOLANT ELBOW INLET — REMOVAL

Step	Procedure
1	Heat the coolant elbow with a hot air gun to max. 120 °C (248 °F).
2	Remove the coolant elbow.
3	Remove adhesive residues in the bore and check the thread.

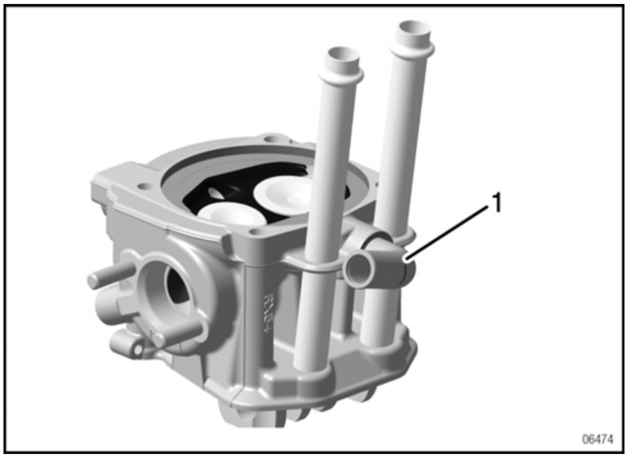

Figure 8.14

1 *Coolant elbow*

REMOVAL OF THE OIL RETURN TUBE

Preparation

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series .

ATTENTION

If there are leaks, the corresponding oil return lines must be replaced.

Step	Procedure
1	Pull out the oil return tube.
2	Remove adhesive residues in the bore.

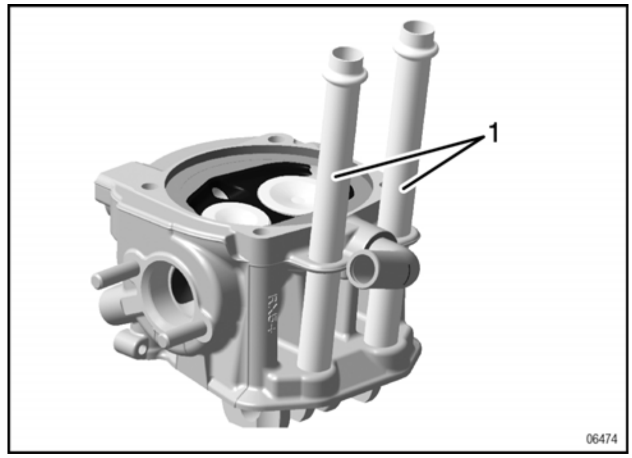

Figure 8.15

1 *Oil return tube*

COOLANT ELBOW OUTLET — REMOVAL

Step	Procedure
1	Take off the spring type hose clip 25 using spring clamp pliers part no. 877840.
2	Mark the coolant hoses and pull them out of the coolant elbows (outlet). See Chapter 75-00-00 section Cooling system.
3	Loosen 2 Allen screws M6x20 with washer 6.4.
4	Remove the elbow flange and O-ring.

NOTE

Remove the connector brackets on cylinder 3/4.

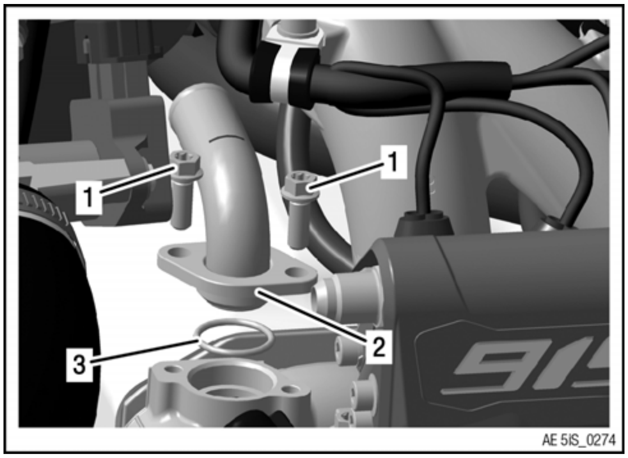

Figure 8.16

1 Screw M6x20 *2 Elbow flange*

3 O-ring 19x2

Step	Procedure
5	Heat the coolant elbow and elbow flange with a hot air gun to max. 120 °C (248 °F).
6	Remove the coolant elbow.
7	Remove adhesive residues in the bore and check the thread.

INSPECTION

CYLINDER HEAD SINGLE PARTS CHECK

Preparation

Clean all parts carefully.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-00-00 section Procedure.

CYLINDER HEAD STUDS CHECK

Step	Procedure
1	M8x20/23 studs are used to attach the exhaust manifold.
2	Check that they are securely fitted and undamaged.
3	If replacement is necessary, the stud is installed in such a manner that the longer thread (23 mm (0.91 in.)) is screwed into the cylinder head.
4	Secure studs with LOCTITE 648. Tightening torque 8 Nm (70 in. lb.).

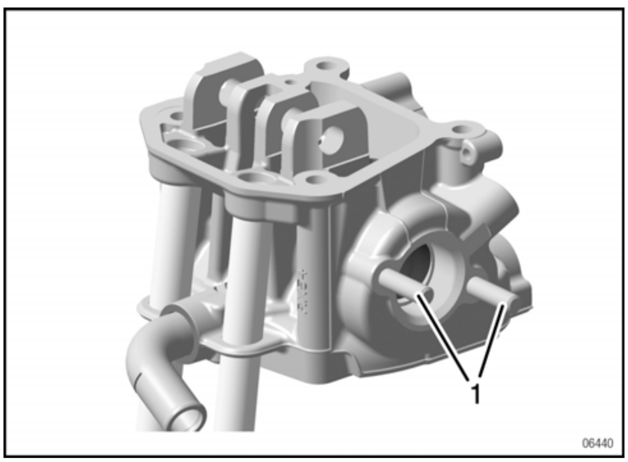

Figure 8.17

1 *Stud*

CYLINDER HEAD ASSY. — INSPECTION

Step	Procedure
1	Inspect the cone of the exhaust manifold. Indentations and scratches no greater than 0.2 mm (0.0079 in.) are permissible. Bumps no greater than 0.1 mm (0.0039 in.) are permissible.

NOTE

If the sealing cone of the exhaust manifold leaks, post-machining is permissible. If post-machining is necessary, the cylinder head must be sent to an authorised ROTAX® overhaul facility.

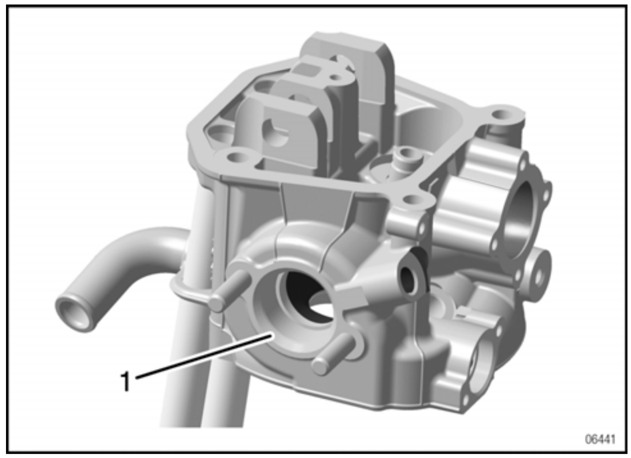

Figure 8.18

1 *Cone (exhaust manifold)*

ATTENTION

Cracks in the cylinder head are not permissible! If in doubt, inspect the affected parts for cracks.

Step	Procedure
2	Check the spark plug bore. Check the thread for damage.
3	Check the sealing surface of the cylinder block.

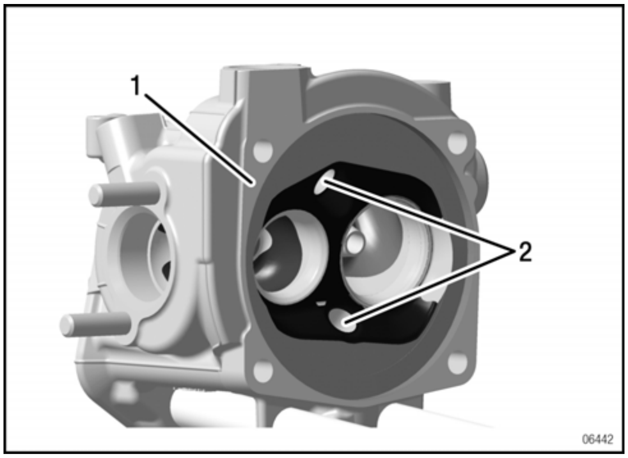

Figure 8.19

1 Sealing surface *2 Spark plug bore*

HARDNESS TEST METHOD

ATTENTION
If the engine has been overheated, a hardness test of the cylinder head is necessary.

See Maintenance Manual Line for the engine type 915 i A Series .

The hardness test takes place at measurement point CH08.

CH08: HB2,5/62,5 DIN EN ISO 6506-2

ATTENTION
The results of the hardness test must be noted in Chapter 72-30-00, subsection: Wear limits.

See Chapter 72-30-00 section Wear limits.

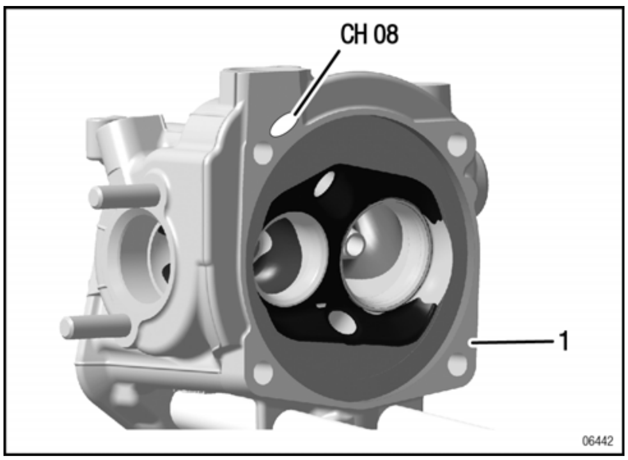

Figure 8.20

1 *Cylinder head*

NOTE

If the rocker arm shaft bearing (CH05) is worn, it can be re-machined to a certain extent. The cylinder head must be sent to an authorised ROTAX® overhaul facility.

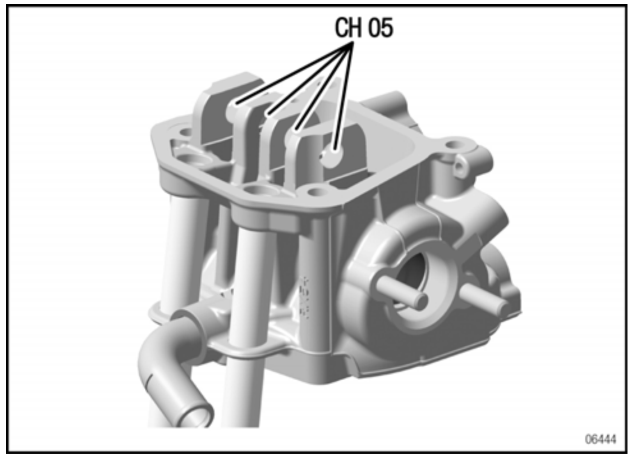

Figure 8.21

VALVE GUIDE CHECK

ATTENTION
If the wear limit has been reached, the valve guide must be replaced.

Step	Procedure
1	Check the valve guide visually for damage and wear.
2	Inspect the inner diameter of the valve guide.

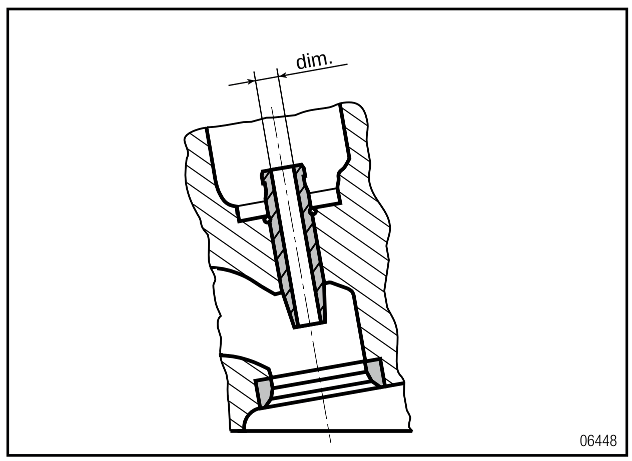

Figure 8.22

VALVE CHECK

ATTENTION

Replace the valve if the valve stem is out of specification, is damaged or shows traces of wear.

Step	Procedure
1	Check the valve visually for damage and wear.
2	Determine the valve stem diameter and check the valve disc for wear.
3	Check the valve end face for pitting.
4	Check the valve stem for any deposits.

NOTE

The valve stem diameter VTO is measured in the edge region of the running surface of the valve stem.

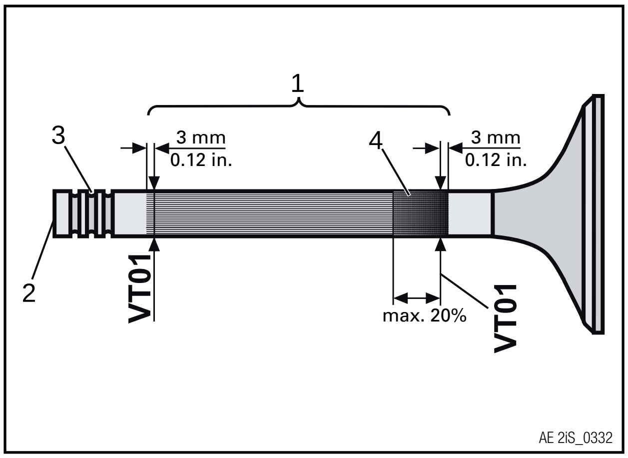

Figure 8.23

1 Valve stem *2 Valve end face*
3 Retaining grooves *4 Max. oil residues*

ATTENTION

Risk of valve fracture at the weld point.
Oil residues up to **max. 20 %** of the running surface are permissible.At greater values, the valve may have already been overheated and must be replaced.

Step	Procedure
5	The 3 retaining grooves on the valve stem must be visually inspected for damage and wear.

NOTE

A new valve cotter must be inserted for the wear check. This must have no perceptible axial clearance.

VALVE SEATS CHECK

Step	Procedure
1	Check the valve seat faces visually for damage and wear.
2	Lubricate the valve seat faces evenly with touch up paste and install the valves in the corresponding valve guides.
3	Turn the valves with moderate pressure so that a clear print of the sealing surface is produced on the valve seat ring.
4	Check that the seal fits properly, if necessary touch up small variances with valve lapping paste.

ATTENTION

The ring-shaped print on the valve seat faces of the valve seat rings must be continuous and have no breaks. The width of the print corresponds to the valve seat width CH02.

ATTENTION

If there are burn marks or distortion, the cylinder head must be sent to an ROTAX® authorized overhaul facility for overhauling or repair.

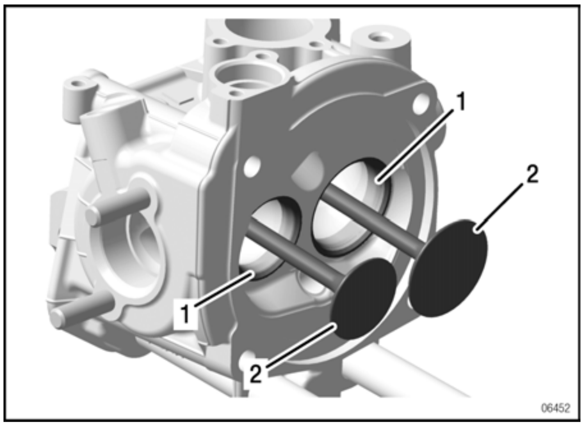

Figure 8.24: Typical

1 Valve seat ring *2 Valve*

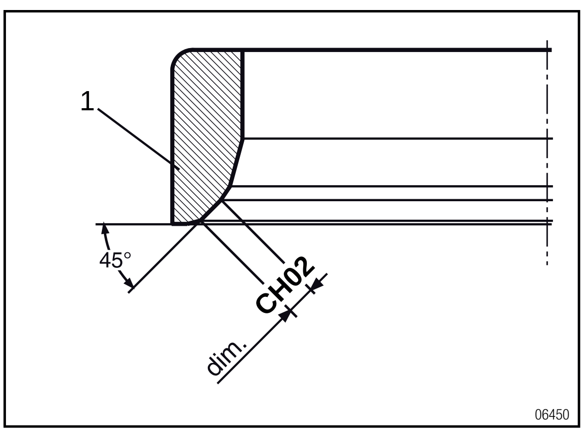

Figure 8.25

1 Valve seat ring

VALVE SPRING CHECK

Step	Procedure
1	Check the valve springs visually for damage such as fracture, deformation.

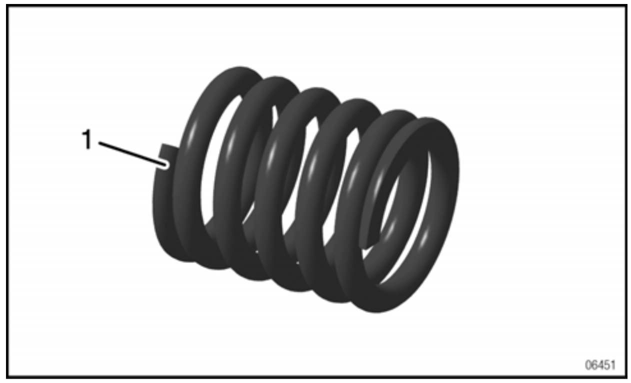

Figure 8.26

1 Valve spring

WASHER CHECK

Step	Procedure
1	Check the washers visually for damage and wear.

The wear must be measured starting from the reference face (on the inner part of the valve spring support) radially outwards in the measurement region, using a dial gauge. **Dimension t = max. 0.04 mm (0.0016 in)**.
Wear of more than 0.04 mm is not permissible. If this value is exceeded, the valve, the valve spring support, the valve spring retainer, the valve cotter and the hydraulic valve tappet or other damaged components in the affected valve drive must always be replaced.

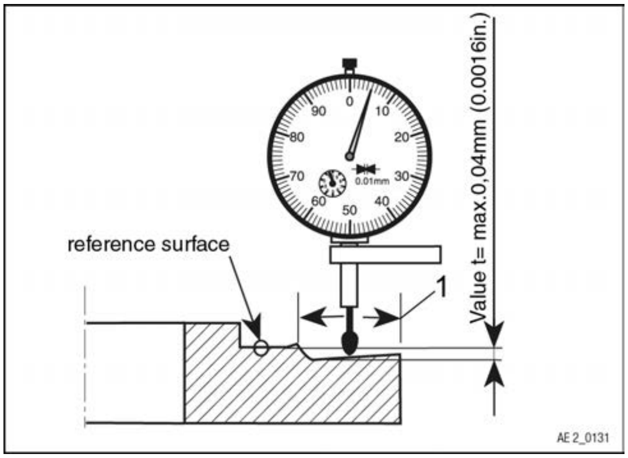

Figure 8.27: Typical

1 *Measurement region*

NOTE

The valve spring support can be used as an indicator of a malfunction of the valve drive relating to poorly or insufficiently purged hydraulic valve tappets. In normal conditions, no measurable wear can be seen even after a relatively long operating time.

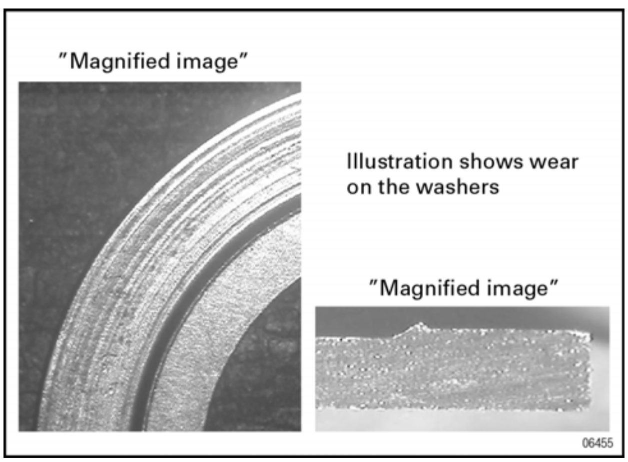

Figure 8.28

ROCKER ARM CHECK AND ROCKER ARM SHAFT CHECK

System description

The rocker arm bearing is lubricated by the hollow drilled push-rod of the ball joint socket. The rocker arm bearing is supplied with oil via the oil ducts in the rocker arm. The oil exits and thus lubricates the rest of the valve mechanism via the bore. The rocker arms for the inlet and outlet are different.

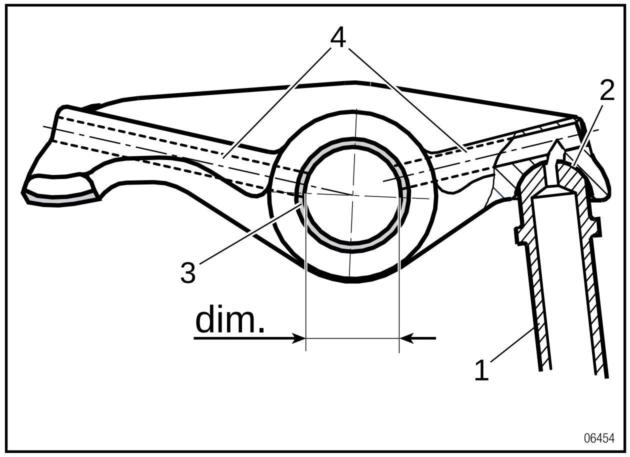

Figure 8.29

1	*Push-rod*	2	*Ball joint*
3	*Rocker arm bushing*	4	*Oil ducts*

Step	Procedure
1	Check the surface of the rocker arm shaft and the inner diameter of the rocker arm bushing for traces of wear.
2	Check the valve support surface and ball joint of the rocker arm.

ATTENTION

If excessive wear is visible in the rocker arm bearing, this indicates a lack of oil. The support surface for the valve stem can be re-machined a little bit.

NOTE

Oversized rocker arm shafts and rocker arm bushings are available to provide the option of repairing the rocker arm bearing in the cylinder head.

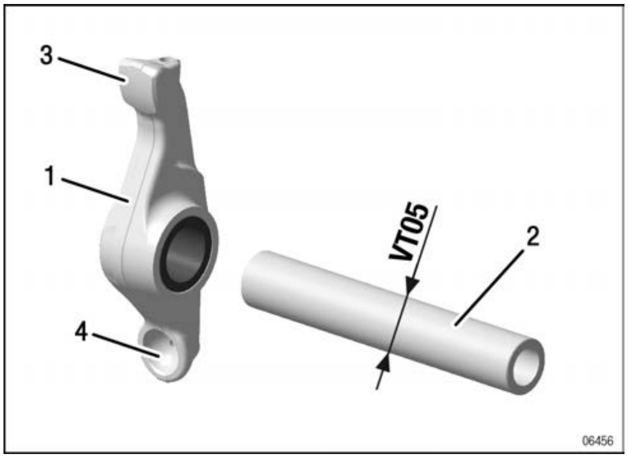

Figure 8.30

1	*Rocker arm*	*2*	*Rocker arm shaft*
3	*Valve guide*	*4*	*Ball joint*

ROCKER ARM BUSHING

With the rocker arm bushings (plastic bushing), ensure that the plastic bushing is slide-fit. This can rotate relative to the rocker arm bore after installation too. The rocker arm bushing is therefore provided with an outer circular groove to allow oil supply. The rocker arm bushing can be installed independently of position.

NOTE

Oversized rocker arm shafts and rocker arm bushings are available to provide the option of repairing the rocker arm bearing in the cylinder head. In this case ensure that the correct rocker arm bushing is installed. The oversized rocker arm bushing part no. 933397 has two mutually opposite bores for identification and differentiation.

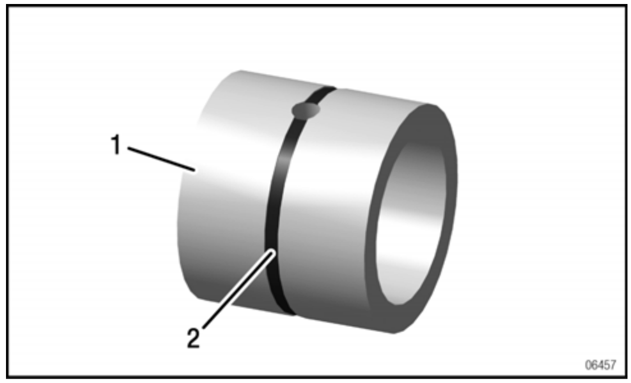

Figure 8.31

1	*Rocker arm bushing*	*2*	*Groove*

PUSH RODS

Step	Procedure
1	Check the push rods visually for damage and wear.
2	Inspect the diameter of the push rods.
3	Ball joint: Check if polished on outer diameter.

See Chapter 72-30-00 section Wear limits.

WEAR LIMITS

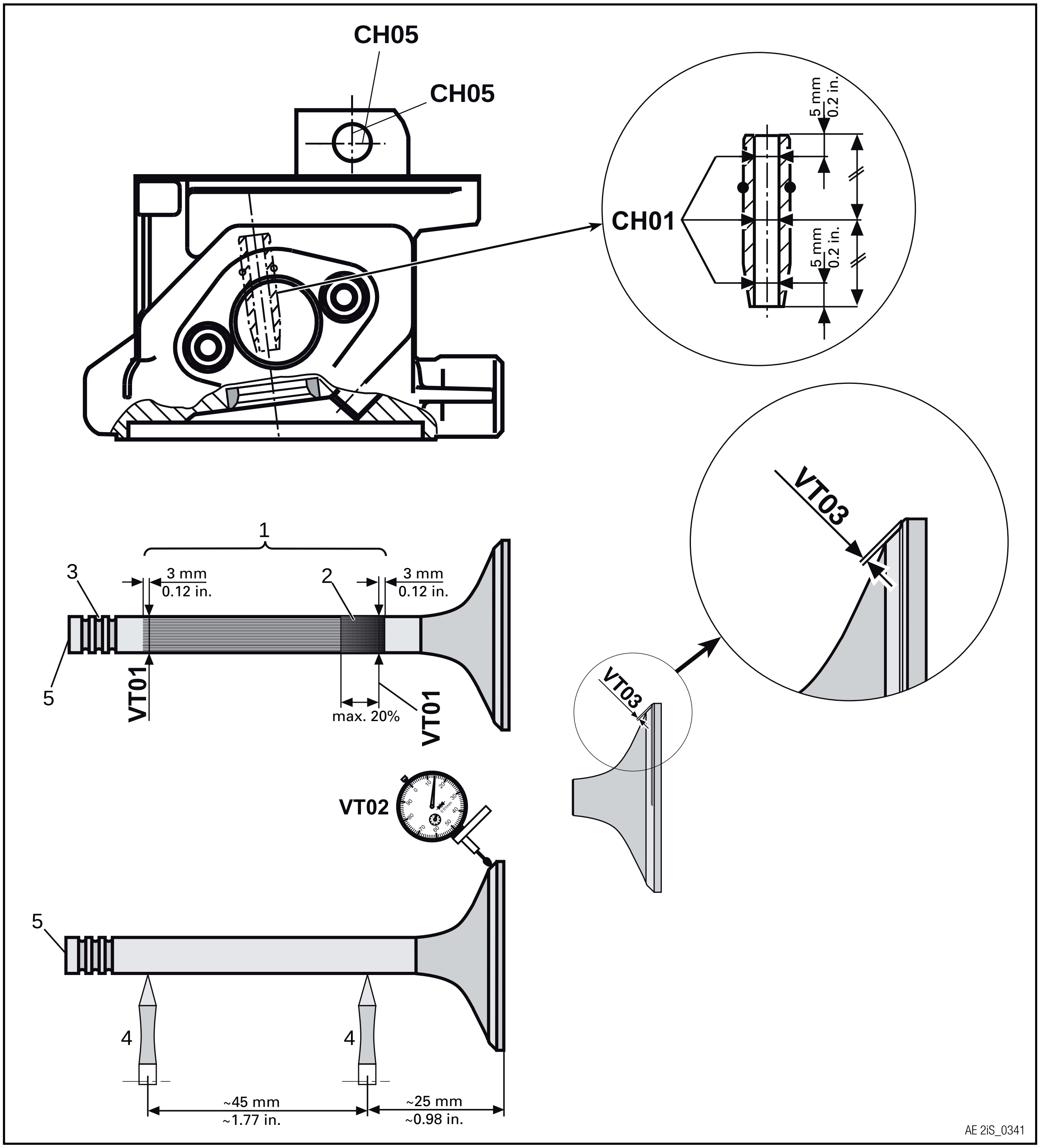

Figure 8.32

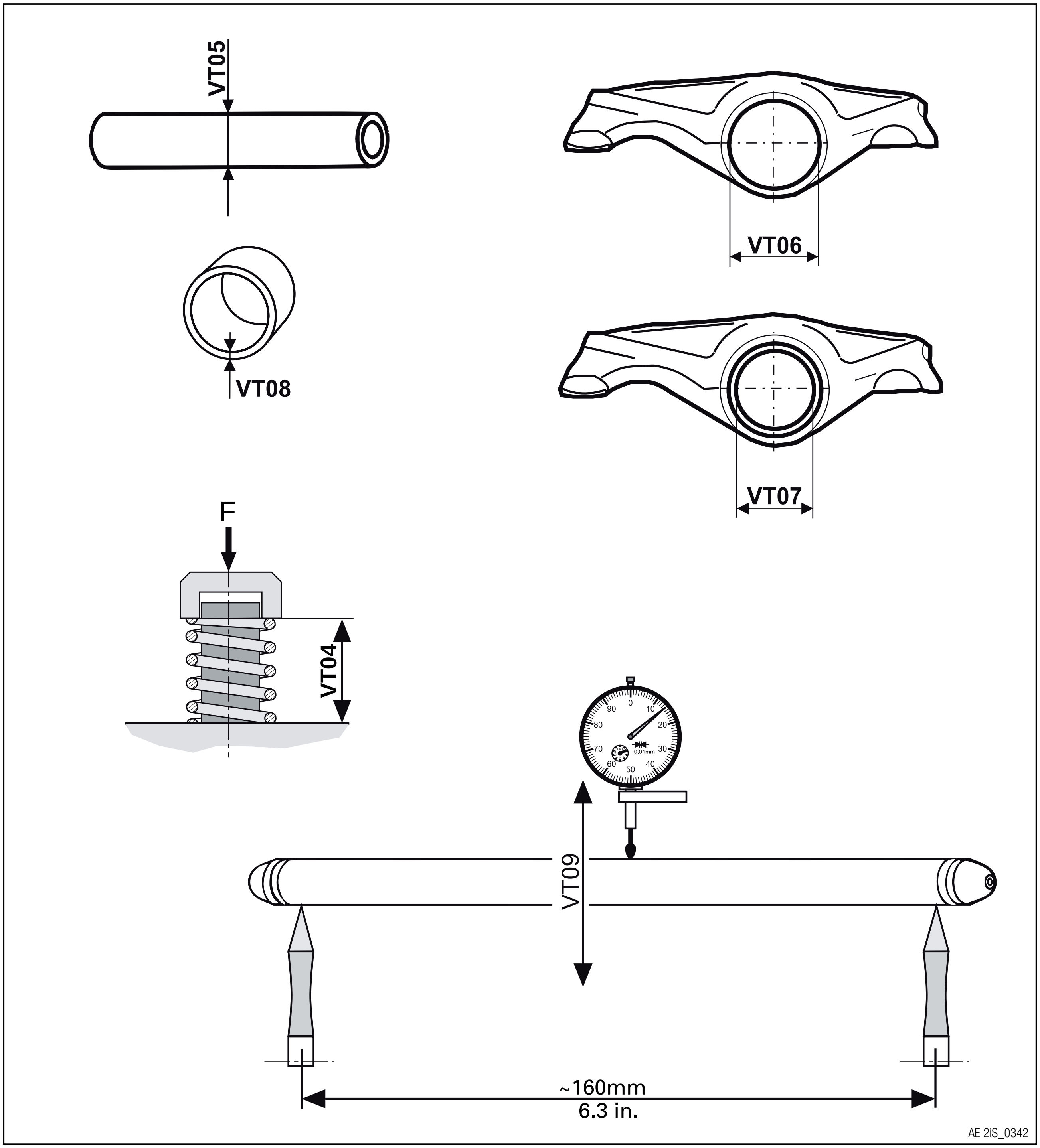

Figure 8.33

Description		Code	Current measurement value		Tolerance limit	Tolerance limit		Measurements			
			min	max	100 %	50 %					
Cylinder head								Cy. 1	Cy. 2	Cy. 3	Cy. 4
Valve guide bore inner diam.	Intake Valve	CH01	7.01 mm 0.2758 in.	7.018 mm 0.2763 in.	7.150 mm 0.2815 in.	7.084 mm 0.2789 in.	current replaced				
	Exhaust Valve	CH01	7.006 mm 0.2758 in.	7.018 mm 0.2763 in.	7.150 mm 0.2815 in.	7.084 mm 0.2789 in.	current replaced				
Width of Valve seat	Intake Valve	CH02	1.4 mm 0.0551 in.	1.9 mm 0.0748 in.	2.4 mm 0.0945 in.	2.2 mm 0.0846 in.	current replaced				
	Exhaust Valve	CH02	1.5 mm 0.0591 in.	2.0 mm 0.0787 in.	2.5 mm 0.0984 in.	2.3 mm 0.0886 in.	current replaced				
Hardness test		CH08	85 HB				current replaced				
Valves											
Diameter of Valve stem	Intake Valve	VT01	6.965 mm 0.2742 in.	6.980 mm 0.2748 in.	6.940 mm 0.2732 in.	6.953 mm 0.2737 in.	current replaced				
	Exhaust Valve	VT01	6.965 mm 0.2742 in.	6.980 mm 0.2748 in.	6.940 mm 0.2732 in.	6.953 mm 0.2737 in.	current replaced				
Backlash Valve guide/ valve stem	Intake Valve	CH01/ VT01	0.026 mm 0.0010 in.	0.053 mm 0.0021 in.	0.150 mm 0.0059 in.	0.102 mm 0.0040 in.	current replaced				
	Exhaust Valve	CH01/ VT01	0.026 mm 0.0010 in.	0.053 mm 0.0021 in.	0.150 mm 0.0059 in.	0.102 mm 0.0040 in.	current replaced				
Out of round	Intake Valve	VT02	0.00 mm 0.0000 in.	0.03 mm 0.0012 in.	0.04 mm 0.0016 in.	0.035 mm 0.0014 in.	current replaced				
	Exhaust Valve	VT02	0.00 mm 0.0000 in.	0.03 mm 0.0012 in.	0.04 mm 0.0016 in.	0.035 mm 0.0014 in.	current replaced				

Description		Code	Current measurement value		Tolerance limit	Tolerance limit		Measurements			
			min	max	100 %	50 %					
Wear on Valve disc	Intake Valve	VT03	0.00 mm 0.0000 in.	0.00 mm 0.0000 in.	0.2 mm 0.0080 in.	0.1 mm 0.0040 in.	current replaced				
	Exhaust Valve	VT03	0.00 mm 0.0000 in.	0.00 mm 0.0000 in.	0.2 mm 0.0080 in.	0.1 mm 0.0040 in.	current replaced				
Length of valve spring at test, load each	Intake Valve	VT04	32.4 mm 1.276 in.	33.6 mm 1.323 in.	32.0 mm 1.260 in.	32.2 mm 1.2680 in.	current replaced				
	Exhaust Valve	VT04	32.4 mm 1.276 in.	33.6 mm 1.323 in.	32.0 mm 1.260 in.	32.2 mm 1.2680 in.	current replaced				
Rocker arm											
Bore for rocker arm shaft	Intake Valve	CH05	12.000 mm 0.4724 in.	12.018 mm 0.4731 in.	12.090 mm 0.4760 in.	12.054 mm 0.4746 in.	current replaced				
	Exhaust Valve	CH05	12.000 mm 0.4724 in.	12.018 mm 0.4731 in.	12.090 mm 0.4760 in.	12.054 mm 0.4746 in.					
Rocker arm											
Diameter of Rocker arm shaft	Intake Valve	VT05	11.983 mm 0.4718 in.	11.994 mm 0.4722 in.	11.950 mm 0.4705 in.	11.967 mm 0.4711 in.	current replaced				
	Exhaust Valve	VT05	11.983 mm 0.4718 in.	11.994 mm 0.4722 in.	11.950 mm 0.4705 in.	11.967 mm 0.4711 in.	current replaced				
Radial clearance Bore/ rocker arm shaft	Intake Valve	CH05 /VT05	0.006 mm 0.0002 in.	0.035 mm 0.0014 in.	0.150 mm 0.0059 in.	0.093 mm 0.0036 in.	current replaced				
	Exhaust Valve	CH05 /VT05	0.006 mm 0.0002 in.	0.035 mm 0.0014 in	0.150 mm 0.0059 in.	0.093 mm 0.0036 in.	current replaced				

Description		**Code**	**Current measurement value**		**Tolerance limit**	**Tolerance limit**		**Measurements**			
			min	**max**	**100 %**	**50 %**					
Rocker arm bushing (plastic)	Intake Valve	VT06	16.000 mm 0.6299 in.	16.018 mm 0.6306 in.	16.038 mm 0.6314 in.	16.028 mm 0.6310 in.	current replaced				
	Exhaust Valve	VT06	16.000 mm 0.6299 in.	16.018 mm 0.6306 in.	16.038 mm 0.6314 in.	16.028 mm 0.6310 in.	current replaced				
Wall thickness of rocker arm shaft (plastic)	Intake Valve	VT08	1.95 mm 0.0768 in.	1.98 mm 0.0780 in.	1.90 mm 0.0748 in.	1.93 mm 0.0758 in.	current replaced				
	Exhaust Valve	VT08	1.95 mm 0.0768 in.	1.98 mm 0.0780 in.	1.90 mm 0.0748 in.	1.93 mm 0.0758 in.	current replaced				
Push-rod assy.											
Deflection of Push-rod	Intake Valve	VT09	0.000 mm 0.0000 in.	0.100 mm 0.0039 in.	0.200 mm 0.0079 in.	0.150 mm 0.0059 in.	current replaced				
	Exhaust Valve	VT09	0.000 mm 0.0000 in.	0.100 mm 0.0039 in.	0.200 mm 0.0079 in.	0.150 mm 0.0059 in.	current replaced				

ASSEMBLY

CYLINDER HEAD — ASSEMBLY

Preparation

- Clean all parts carefully.

ATTENTION
Check sealing surface for damage! Remove carbon residues!

OIL RETURN TUBE INSTALLATION

Step	Procedure
1	Secure the oil return tube with LOCTITE 648 and install it in the cylinder head.
2	Allow the cylinder head to harden for at least 10 hours at room temperature.

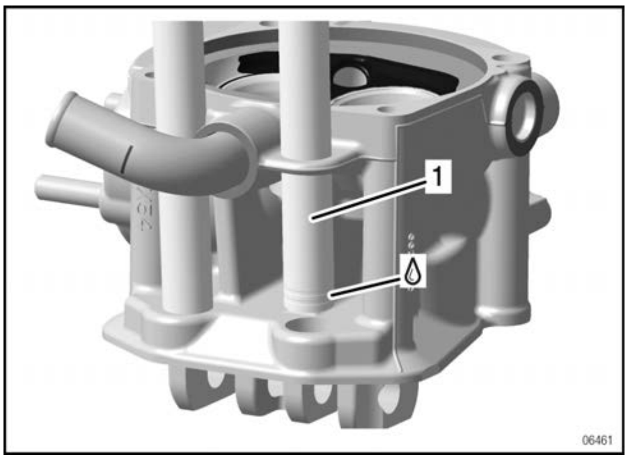

Figure 8.34

1 Oil return tube

INSTALLATION OF THE COOLANT ELBOW INLET

Step	Procedure
1	Secure the coolant elbow with LOCTITE 243 and install the elbow in the cold cylinder head.

NOTE

Also apply LOCTITE 243 the thread in the cylinder head.

Step	Procedure
2	Allow the cylinder head to harden for at least 10 hours at room temperature.

NOTE

If the sealing surface of the cylinder has carbon residues, it must be removed carefully.
Remove excess LOCTITE!

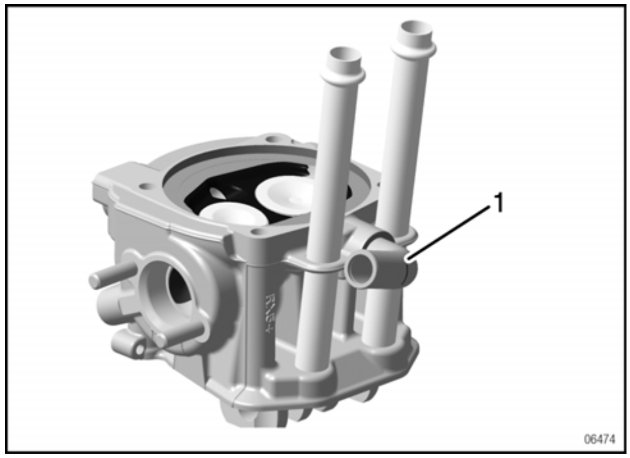

Figure 8.35

1 Coolant elbow inlet

COOLANT ELBOW OUTLET — ASSEMBLY

Step	Procedure
1	Secure the coolant elbow with LOCTITE 243 and install the elbow in the cold elbow flange.

NOTE

Also coat the thread in the elbow flange with LOCTITE 243.

Step	Procedure
2	Allow the elbow flange to harden for at least 10 hours at room temperature.

NOTE

Remove excess LOCTITE.

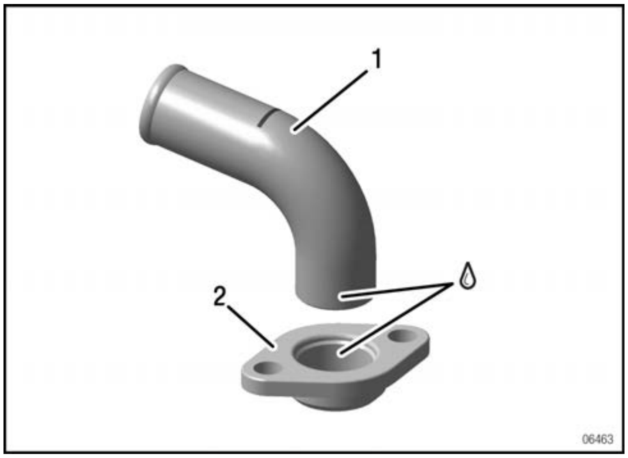

Figure 8.36

1 Coolant elbow *2 Elbow flange*

COOLANT ELBOW — INSTALLATION

Step	Procedure
1	Install a new O-ring 19x2 in the cylinder head.
2	Fasten the coolant elbow with 2 Allen screws M6x20 and lock washers 6.4. Tightening torque 10 Nm (89 in. lb.).

NOTE

Install the cable brackets on cylinder 2/4.

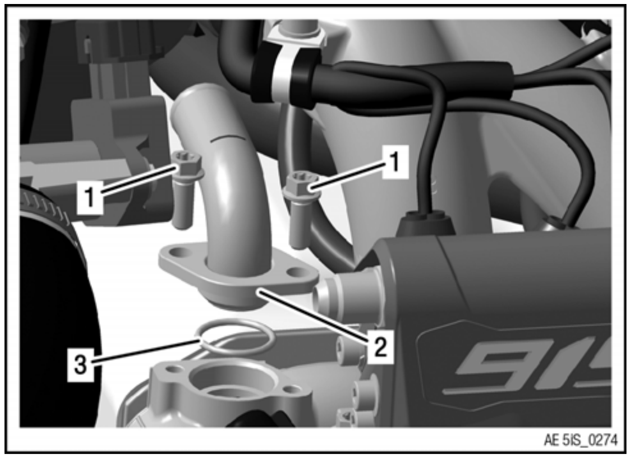

Figure 8.37

1 Screws M6x20 *2 Elbow flange*
3 O-ring 19x2

VALVE INSTALLATION

ATTENTION

Risk of engine damage if damaged parts are installed!
All parts must be measured and assessed before installation. All moving parts must be lubricated with engine oil before installation!

ATTENTION

Oil residues up to max. 20% of the running surface are permissible.

Step	Procedure
1	Push 16/27.9/1 onto the valve guide and install a new valve stem seal on the intake side.
2	Lubricate the valve stem and push the intake valve from outside into the valve guide.

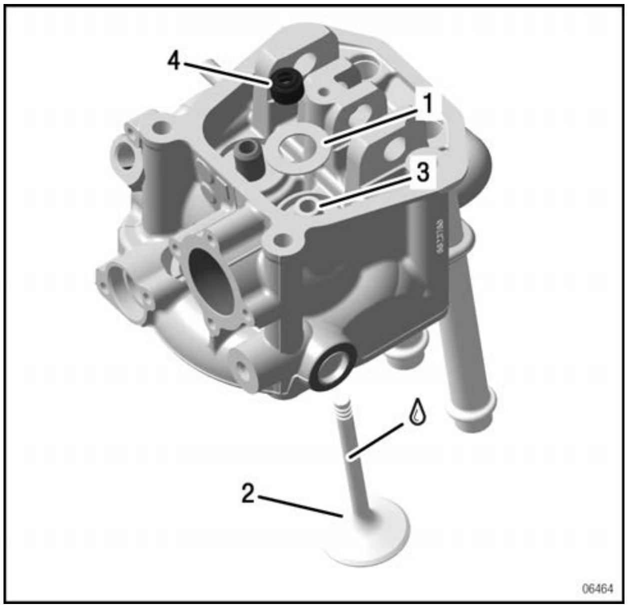

Figure 8.38

1	*Washer 16/27.9/1*	2	*Intake valve*
3	*Valve spring retainer*	4	*Valve stem seal*

Step	Procedure
3	Install the valve springs and the valve spring retainer

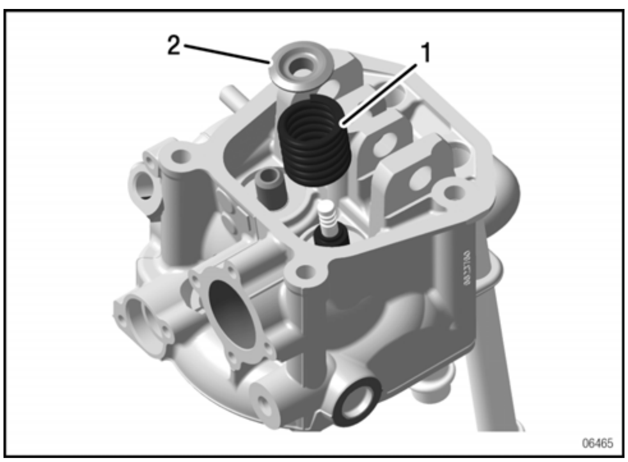

Figure 8.39

1	*Valve spring*	2	*Valve spring retainer*

Step	Procedure
4	Compress valve springs with the mounting device part no. 877380 and collet.
5	Insert the valve cotters and de-tension the valve springs.
6	Carry out the same procedure for the exhaust valve.

NOTE

Ensure they are positioned correctly and that there is a uniform gap between the valve cotters.

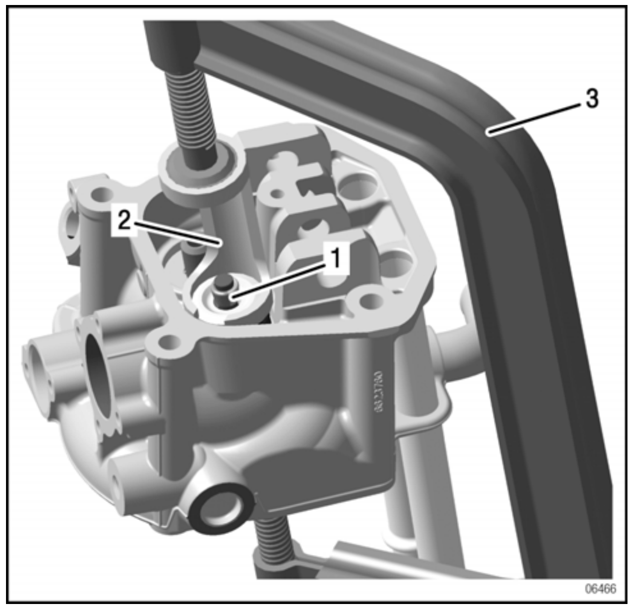

Figure 8.40: Typical

1	*Valve cotter*	2	*Mounting device*
3	*Collet*		

ROCKER ARM — INSTALLATION

ATTENTION

Do not use force! The rocker arm bearing is slide fit.

Step	Procedure
1	Lubricate the rocker arm shaft (on both sides), rocker arm bore and valve spring support with Engine oil.
2	Bring the intake rocker arm and the exhaust rocker arm with the rocker arm bushing into position depending on the state of construction.
3	Insert the rocker arm shaft.

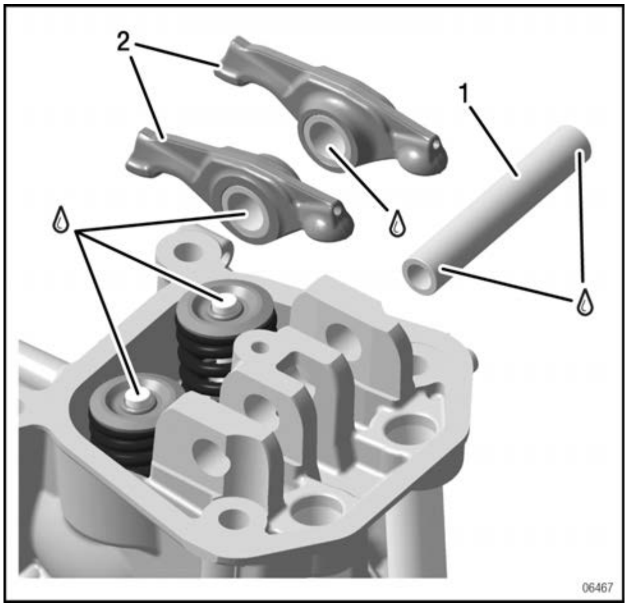

Figure 8.41

1 Rocker arm shaft *2 Rocker arm*

INSTALLATION

CYLINDER HEAD INSTALLATION

Preparation

- Clean all parts carefully.
- Lightly grease or lubricate O-rings and gaskets.

ATTENTION

To ensure constant tightening torque, lightly lubricate the flat surfaces of the collar cap nuts.

ATTENTION

Place the cylinder at TDC. The valves are then in overlap. This prevents a situation in which a valve is open and the cylinder head lifts off again from the cylinder head gasket face. Otherwise the oil return line O-rings can be damaged.

Step	Procedure
1	Install the corresponding push-rods in the oil return tubes.
2	Lubricate the push-rod heads with Engine oil.
3	Install the lubricated O-ring 16x5 on the oil return tube.

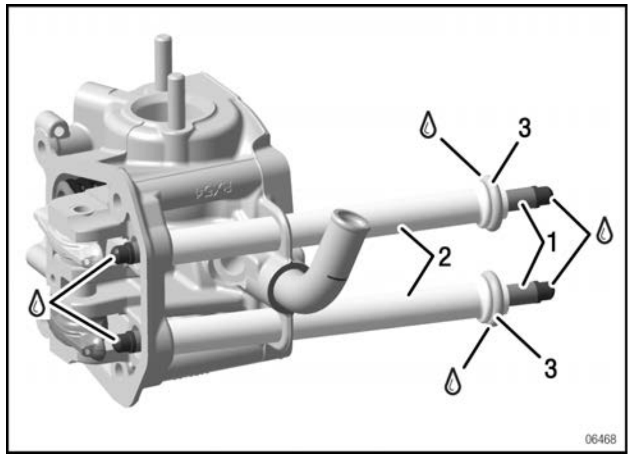

Figure 8.42

1 Push-rods
2 Oil return tubes
3 O-ring 16x5

NOTE

The intake manifold with the fuel rail must be raised slightly for part repairs.

Step	Procedure
4	Place on the cylinder head until the O-rings of the two oil return tubes rest in the crankcase.
5	Raise the cylinder until the centring collar of the cylinder engages into the cylinder head recess.

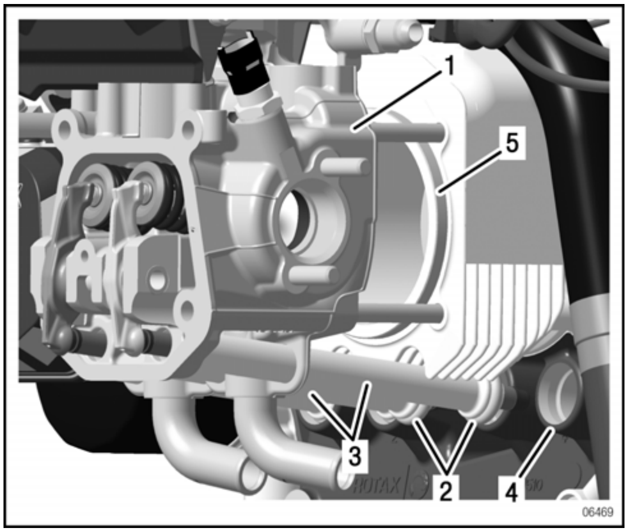

Figure 8.43

1	*Cylinder head assy.*	2	*O-ring*
3	*Oil return tube*	4	*Crankcase*
5	*Centring collar of cylinder*		

ATTENTION

O-rings must be seated into the crankcase at the same time as cylinder head is tightened onto cylinder.

Step	Procedure
6	Clean and degrease all threads of studs.

NOTE

M8 collar cap and M8 collar nuts also must be clean and free from residues

Step	Procedure
7	Squeeze the cylinder head and the cylinder together by hand and push towards crankcase.
8	Lubricate the contact area for the M8 collar cap nuts with grease.

NOTE

No grease for M8 collar nuts contact areas!

Step	Procedure
9	Hand-tighten 2 M8 collar cap nuts and 2 M8 collar nuts diagonally (maximum 5 Nm/44 in.lb), until cylinder head rests on cylinder.

NOTE

If necessary, repeat the process for the other cylinder heads.

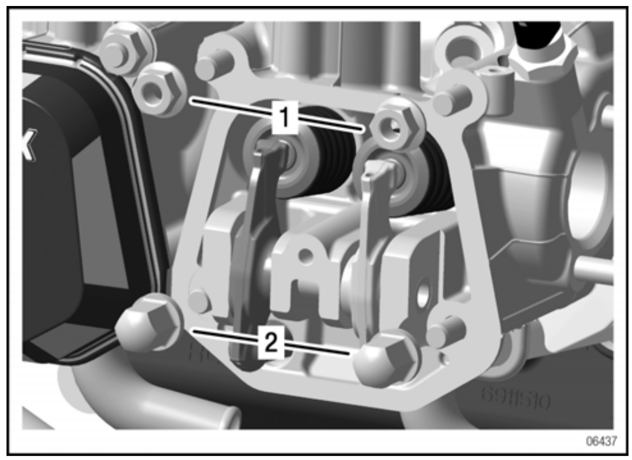

Figure 8.44

1	*Hex. nut M8*	2	*Collar cap nut*

CYLINDER HEAD (SINGLE) REPAIRED PER ENGINE SIDE

Step	Procedure
1	Position the insulating flange between the intake manifold and the cylinder head.
2	Install the intake manifold on the cylinder head which has not been removed with 2 hex./torx collar screws M6x20. Tightening torque 10 Nm (89 in. lb.).

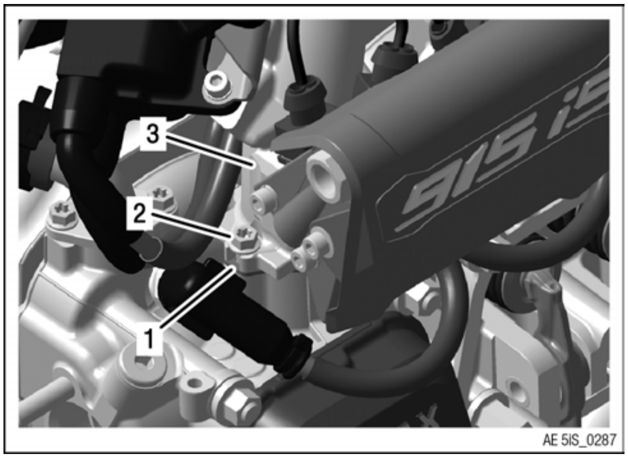

Figure 8.45

1	*Insulating flange*	2	*Hex./torx collar screw M6x20*
3	*Intake manifold*		

Step	Procedure
3	Align the second cylinder head on the intake manifold and fasten it with 2 hex./torx collar screws M6x20. Tightening torque 10 Nm (89 in. lb.).

Tightening torque procedure:

NOTE

This aligns the cylinder heads to ensure a flat support for the intake manifold.

Tightening torque procedure:

NOTE

The installation and tightening of a single cylinder head or any individual cylinder head nut is not allowed. The entire procedure to torque both cylinder heads together in one torque sequence must be performed.

Fasten the cylinder head according to the torque pattern. To do this, see Chapter 72-30-00 section “If both cylinder heads per engine side have been repaired”.

Finishing work

- Install the elbow flange.
- Install the coolant hose as far as the mark on the coolant elbow. See Chapter 75-00-00 section Cooling system.
- Install the spring type hose clip 25 using spring clamp pliers part no. 877840.

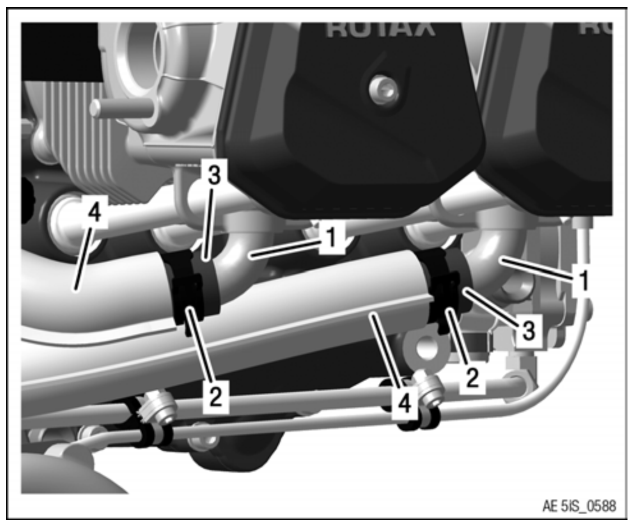

Figure 8.46

1	*Coolant elbow*	2	*Spring type hose clip 25*
3	*Coolant hose*	4	*Protection tube*

- Install the airbox on the ignition housing using an hex. nut M6 and washer 6.4. To do this, see Chapter 73-10-00 section Airbox installation.

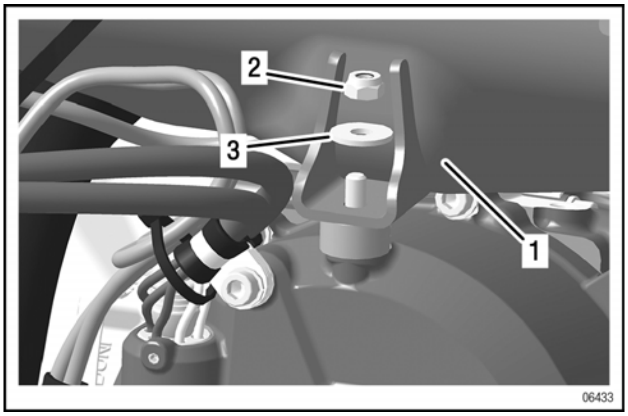

Figure 8.47

1	*Airbox*	2	*Hex. nut M6*
3	*Washer 6.4*		

- Install the spark plugs and connect the spark plug connectors. See Chapter 74-20-00 section Distribution.
- Install the wiring harness. To do this, see Chapter 76- 70-00 section Sensors and actuators.

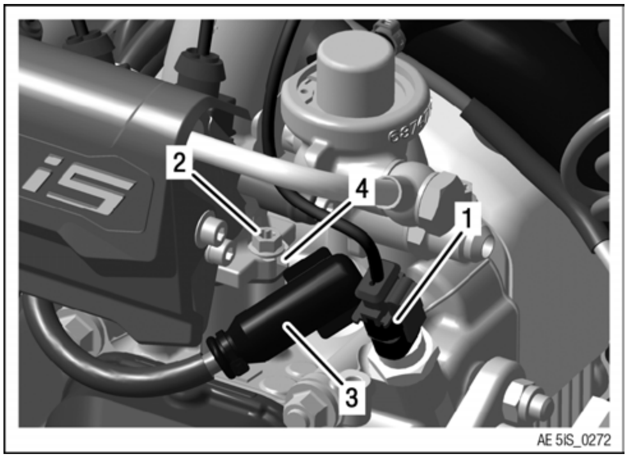

Figure 8.48

1	*Temperature sensor*	2	*Hex./torx collar screw M6x20*
3	*Spark plug connector*	4	*Insulating flange*

- Install the fuel line assy. To do this, see Chapter 73-10-00 section Fuel pump and distribution.
- Install the exhaust system. See Chapter 78-00-00 section Exhaust.

Fill with coolant.
See Maintenance Manual Line for the engine type 915 i A Series.

CYLINDER HEADS (BOTH) REPAIRED PER ENGINE SIDE

Tightening torque procedure:

NOTE

Assemble with clean parts only! Remove any residual carbon or oil from the mating surfaces of cylinder heads and cylinders.

Step	Procedure
1	Raise the cylinder and cylinder head until the centring collar of the cylinder engages in the cylinder head. **NOTE** *A slight “click” can be heard as they align together.*
2	Clean and degrease all threads of studs. **NOTE** *Collar cap M8 and collar nuts M8 also must be clean and free from residues.*
3	Lubricate the contact area for the collar cap nuts M8 with grease. **NOTE** *No grease for collar nuts M8 contact areas!*
4	Hand-tighten 2 collar cap nuts M8 and 2 collar nuts M8 evenly (maximum 5 Nm/44 in. lb), until cylinder head rests on cylinder.
5	Attach the cylinder aligning tool part no. 877263 to the intake flange of the cylinder heads with 4 Allen screws M6x25 and tighten to 10 Nm (89 in. lb). **NOTE** *This aligns the cylinder heads to ensure a flat support for the intake manifold.*

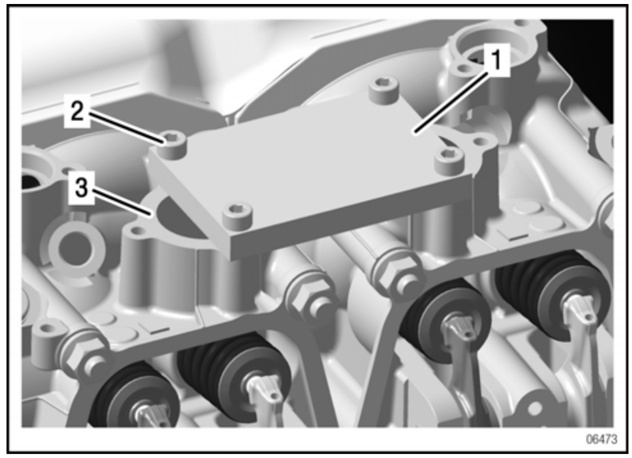

Figure 8.49: Typical

1	*Cylinder aligning tool 877263*	*2*	*Allen screw M6x25*
3	*Intake flange*		

Step	Procedure
6	See following Fig. Tighten the nuts in torque sequence following these steps: Step 1: all collar cap nuts M8 and collar nuts M8 with 10 Nm (89 in. lb.). Step 2: all collar cap nuts M8 and collar nuts M8 with 30 Nm (-5 Nm) / 265 in. lb. (-44 in. lb). **NOTE** *Perform step 3 sequentially for each cylinder head nut one at a time following the torque sequence in following figure* Step 3: Loosen each collar cap nut M8 or collar nut M8 360° then tighten to 10 Nm (89 in. lb.) + 150°.

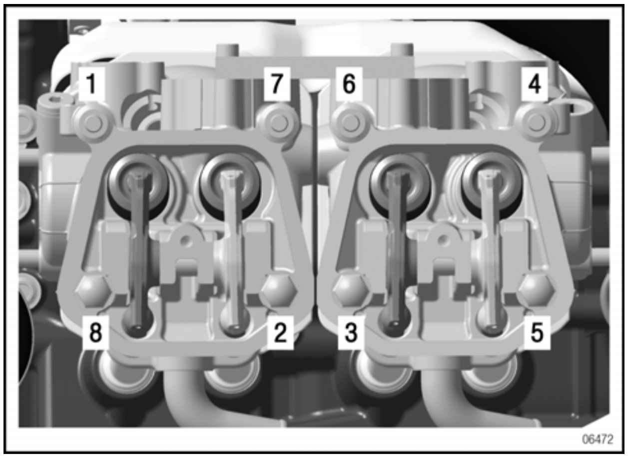

Figure 8.50: Torque pattern—Typical

Step	Procedure
7	Loosen 4 Allen screws M6x25 and remove the cylinder aligning tool.

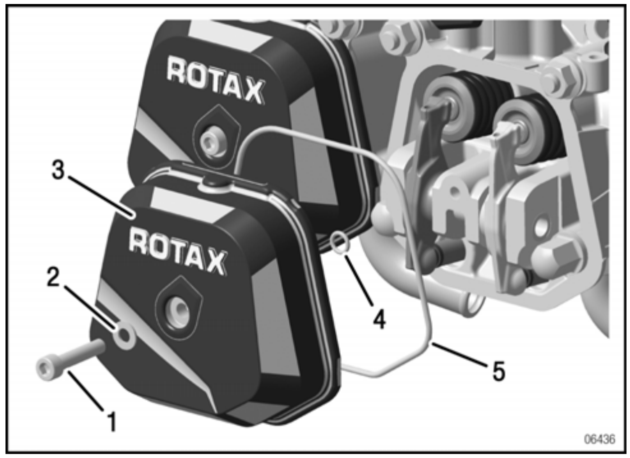

Figure 8.51

1 Allen screw M6x30
2 Washer 6/12/1
3 Cylinder head cover
4 O-ring 6.4x1.8
5 O-ring 105x2.5

VALVE COVER INSTALLATION

ATTENTION

There must be a minimum gap of 0.2 mm between the valve covers on the outer contour. The valve covers must not touch each other!

ATTENTION

Ensure the valve cover screw is the correct length! Look out for damaged threads. If the screw is loose or the valve cover leaks, the oil return to the oil tank works by "blow by gas" i. e. insufficiently.

Step	Procedure
1	Install both O-ring 105x2.5 and the O-ring 6.4x1.8 in the valve cover.
2	Place on the valve cover and fasten it with an Allen screw M6x30 and washer. Tightening torque 12 Nm (106 in. lb.).

FINISHING WORK

- Install the coolant hoses to the inlet and outlet elbow. See Chapter 75-00-00 section Cooling system.
- Install the intake manifold. See Chapter 73-00-00 section Fuel system.
- Form the connection to the airbox. To do this, see Chapter 73-10-00 section Fuel pump and distribution.
- Install the fuel rail assy. To do this, see Chapter 73-10-00 section Fuel pump and distribution.
- Install the spark plugs and connect the resistance spark plug connectors. See Chapter 74-20-00 section Distribution.
- Install the temperature sensor and connect the wiring harness. To do this, see Chapter 76-70-00 section Sensors and actuators.
- Install the fuel line inlet and outlet. To do this, see Chapter 73-10-00 section Fuel pump and distribution.
- Install the exhaust system. See Chapter 78-00-00 section Exhaust.
- Connect the wiring harness. See Chapter 76-00-00 section Wiring harness.

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Chapter: 72–30–10
DISPLACEMENT PARTS

TOPICS IN THIS CHAPTER

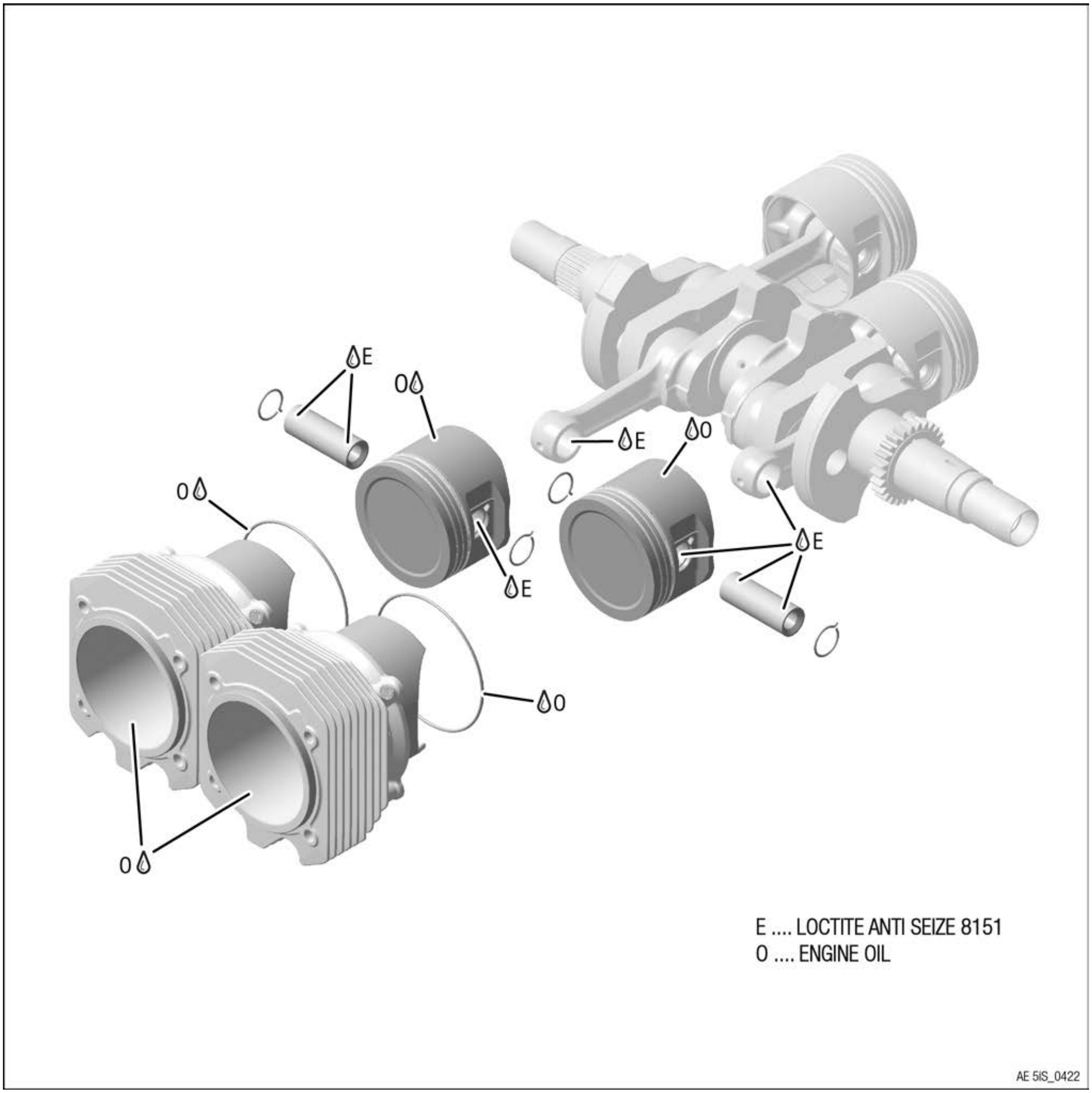
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Figure 9.1

SPECIAL TOOLS

Description	Part number	
Piston pin extractor assy.	877091	Non certified parts
Piston ring spanner, 84 mm	876967	Non certified parts
Monohook circlip remover	976380	Non certified parts
Installation tool assy.	877802	Non certified parts

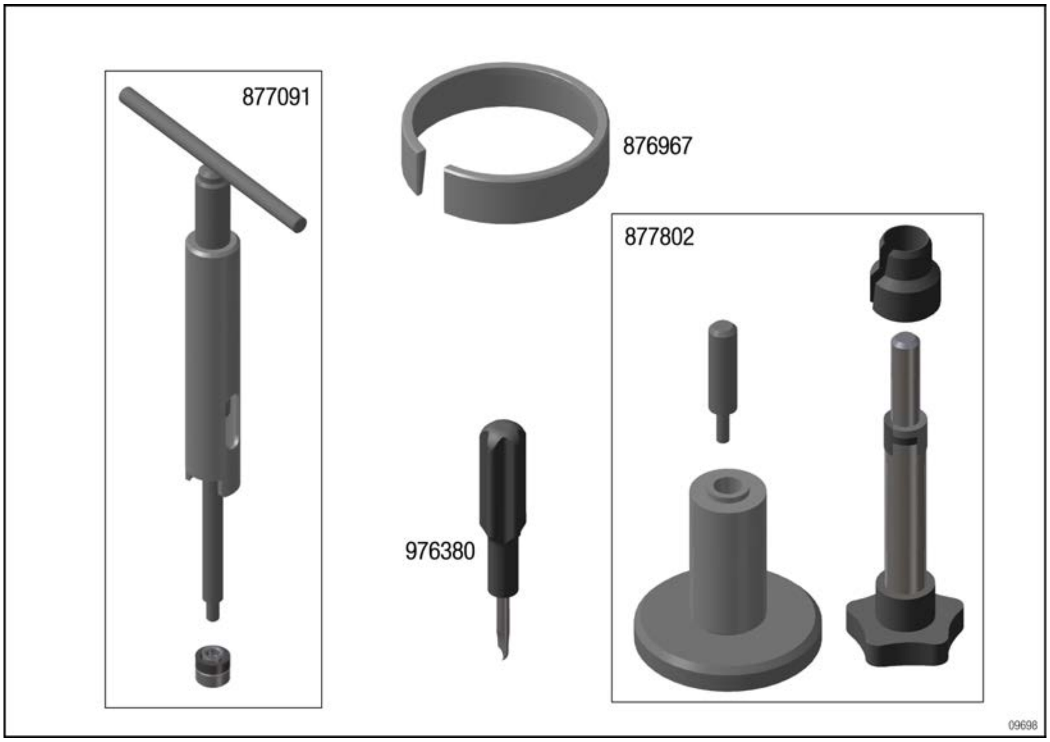


Figure 9.2

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE	297434
Engine oil	n.a.

SYSTEM DESCRIPTION

In the 915 i A Series engine, 4 cylinders with "GILNISIL"- coated running surfaces are used. The pistons are light alloy full skirt pistons. The piston pin is axially offset by 1 mm (0.03937 in.) with respect to the piston skirt, this is to minimize rocking of the piston.

SAFETY INSTRUCTION

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

Preparation

- Remove the cylinder head. See Chapter 72-30-00.

CYLINDER AND PISTON — REMOVAL

NOTE

Before the cylinders and pistons are removed, they must be marked in pairs to prevent confusion. The cylinders are all identical. The pistons are axially offset (directional)!

Step	Procedure
1	Put the piston in the TDC position and apply an arrow in the direction of the gearbox with permanent marker.

NOTE

When the piston is cleaned the original marking arrow becomes visible. It points in the direction of the gearbox for all four cylinders and aids correct assembly of the axially offset piston.

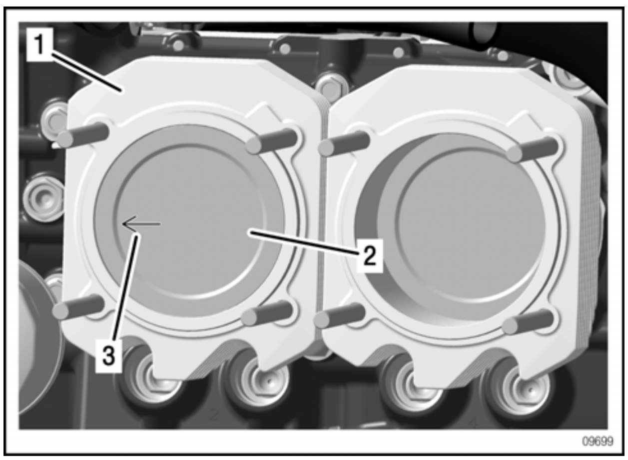


Figure 9.3

1 Cylinders *2 Pistons*

3 Marking arrow

ATTENTION

Pistons and piston rings can be damaged.
Support pistons by hand!

Step	Procedure
2	Support the piston by hand and carefully remove the cylinder along with the O-ring.

ATTENTION

Don't bend the oil spray nozzle with con rod. Otherwise cooling of piston crown is not assured.

⚠ WARNING

Wear eye protection.
The mono hook circlip is under tension!

ATTENTION

Plug the crankcase! The mono hook circlip must not fall in.

Step	Procedure
3	Remove the mono hook circlip with circlip remover part no. 976380.

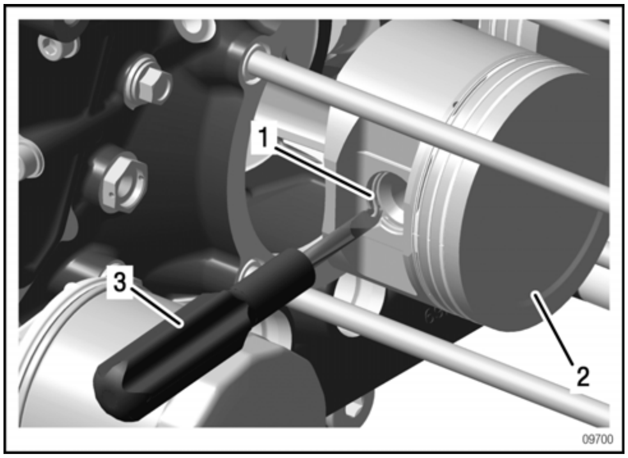


Figure 9.4

1 Mono hook circlip *2 Pistons*

3 Circlip remover

NOTE

Piston pin puller assy. part no. 877091 is used to pull out the piston pin.

Step	Procedure
4	Install the puller spindle in the piston pin and mount M6 extracting nut (part no. 877155).
5	Turn the puller spindle clockwise to pull the piston pin out of the conrod into the puller sleeve until the piston can be taken off.

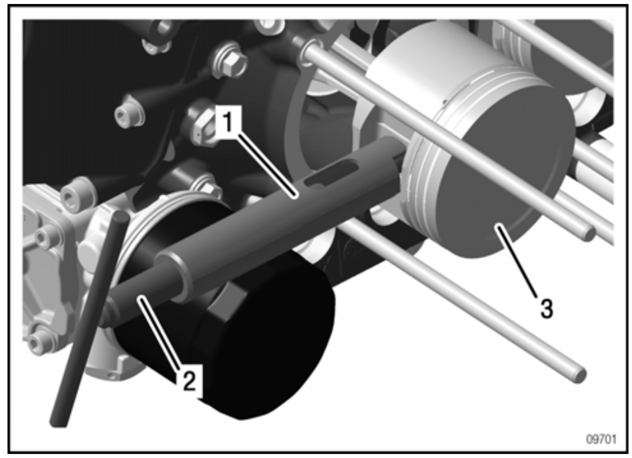


Figure 9.5

1 Piston pin puller *2 Puller spindle*

3 Pistons

Step	Procedure
6	Loosen the nut and remove the puller. Remove the piston and put it down with the corresponding cylinder.

REMOVAL OF THE HYDRAULIC VALVE TAPPET

NOTE

Store and identify the hydraulic valve tappet so that it can be installed in the same place when it is reused.

Step	Procedure
1	Remove the hydraulic valve tappet from the housing with the circlip remover part no. 976380.

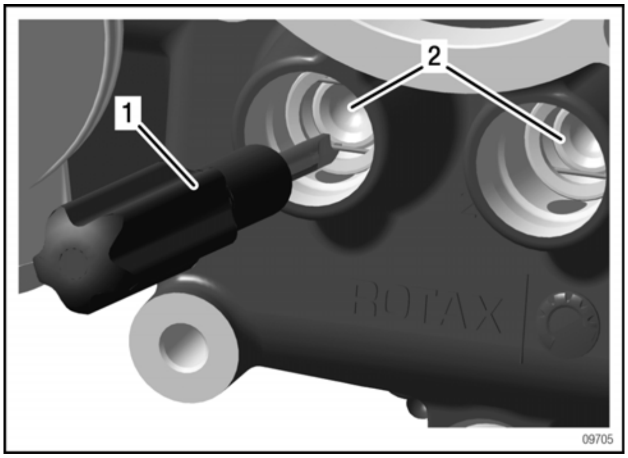


Figure 9.6

1	*Circlip remover*	2	*Hydraulic valve tappet*

INSPECTION

DISPLACEMENT PARTS — INSPECTION

Preparation

Clean all parts carefully.
See Maintenance Manual Line for the engine type 915 i A SeriesChapter 05-00-00 section Procedures.

PISTON — INSPECTION

Step	Procedure
1	Remove the piston rings with the piston ring pliers.

NOTE

Removed rings must be re-installed in the same position and location.

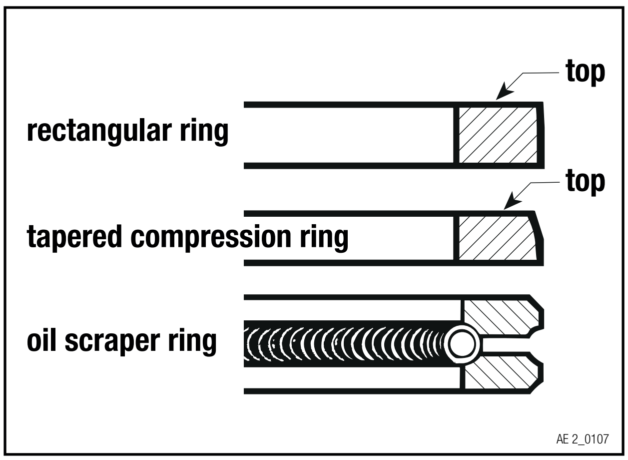


Figure 9.7

Step	Procedure
2	Remove carbon residues from piston rings and ring grooves and from the piston crown.

NOTE

The best way to clean the groove root is with an old, broken piston ring. Multiple deposits are likely if AVGAS 100LL is used.

Step	Procedure
3	Check the groove for the piston pin circlip. Carefully remove any burrs.

NOTE

If the groove is excessively worn (>0.3 mm (0.0118 in.), more than the retaining ring), the piston must be replaced.

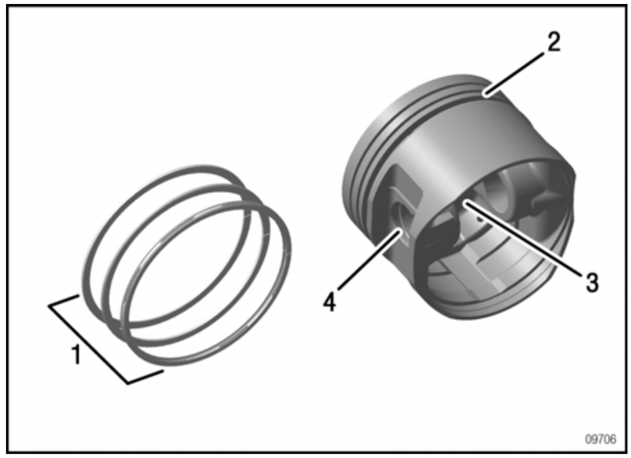


Figure 9.8

1	*Piston rings*	2	*Ring grooves*
3	*Piston crown*	4	*Piston pin circlip groove*

NOTE

Two sizes of pistons are available, red and green. The difference is 0.01 mm (0.00039 in.). The "red" piston is the smaller one. The nominal size of the piston is stamped on the piston crown. Oversized pistons are not available. The piston is only delivered with 3 rings installed.

Step	Procedure
4	Visually inspect and measure the piston. Measure the cylinder and determine the permissible installation clearance. See Chapter 72-30-10 section Wear limits.

NOTE

If the determined installation clearance is greater than the permissible installation clearance, the piston and/or cylinder must be replaced.

Step	Procedure
5	Determine the diameter of the piston pin bore. See Chapter 72-30-10 section Wear limits.

NOTE

The flank clearance can be measured on the installed rings using a feeler gauge. Multiple deposits in the spiral expander of the oil scraper ring suggests that AVGAS 100LL has been used.

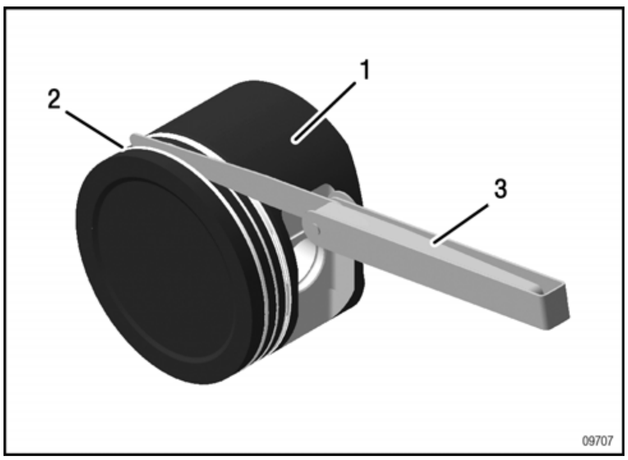


Figure 9.9

1 Piston *2 Ring grooves*

3 Feeler gauge

PISTON RINGS — INSPECTION

Step	Procedure
1	Check the cleaned piston rings for piston ring joint clearance.

NOTE

To determine the piston ring joint clearance, remove the piston rings with piston ring pliers, clean them and place them in the cylinder. Aligned with a piston in the cylinder and pushed approx. 10 mm (0.3937 in.) from the upper edge into the cylinder.

Step	Procedure
2	Measure the piston ring joint clearance using a feeler gauge. See Chapter 72-30-10 section Wear limits (PI07).

NOTE

Examine the ring surface closely to identify the supporting part and thus also the wear which has already taken place.

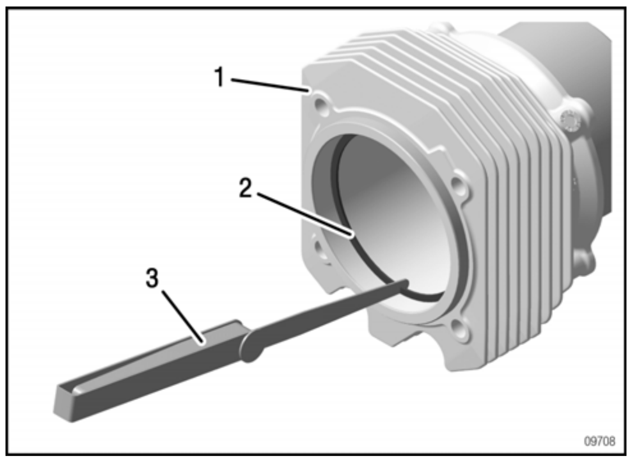


Figure 9.10

1 Cylinders *2 Piston ring*

3 Feeler gauge

PISTON PIN — INSPECTION

ATTENTION

The mono hook circlips for the axial piston pin must only be used once and must therefore be replaced.

Step	Procedure
1	Check the piston pin for traces of wear in the region of the conrod bearing and in the region of the piston bearing and measure it.

NOTE

If perceptible traces of wear are found, even if the pistons are within tolerable dimensions, the piston pin must be replaced.

Step	Procedure
2	Measure dimension PI03. See Chapter 72-30-10 section Wear limits.

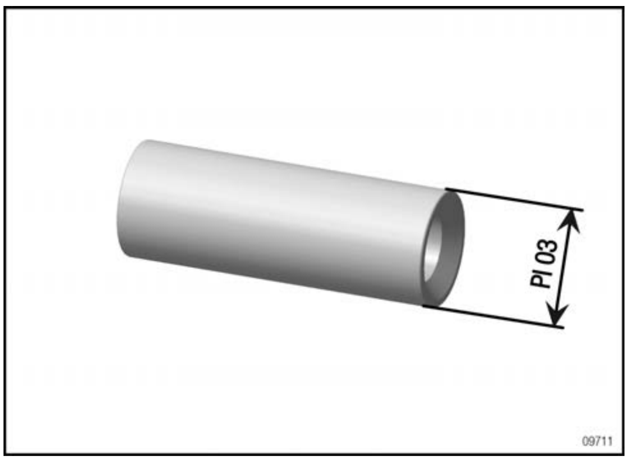


Figure 9.11

CYLINDER — INSPECTION

ATTENTION

If the engine has been overheated, a hardness test of the cylinder is necessary.

See Chapter 72-30-00 section Harness test method.

NOTE

If the sealing surface of the cylinder has slight carbon residues, this is a sign of leaking. The cylinder must be touched up with the cylinder head until uniform contact is achieved.

Step	Procedure
1	Clean the cooling fins of the cylinder and remove carbon residues in the upper region of the cylinder bore.
2	Clean and check the sealing surfaces on the upper side and rear side.

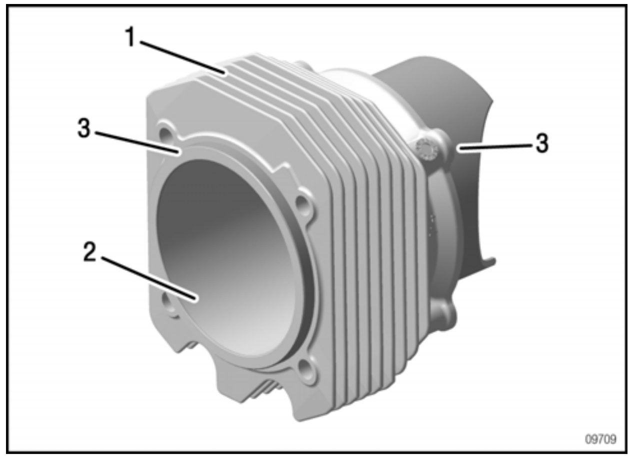


Figure 9.12

1 Cooling fins *2 Cylinder bore*

3 Sealing surface

Step	Procedure
3	Measure the cylinder and enter the measurement data (CY01/CY02/CY03). See Chapter 72-30-10 section Wear limits.
4	Determine the installation clearance. See Chapter 72-30-10 section Piston inspection.

NOTE

As long as the min. clearance is achieved, Cylinder B with red piston and/or Cylinder A with green piston can be paired.

HYDRAULIC VALVE TAPPET — INSPECTION

Step	Procedure
1	Check visually for damage and wear.

NOTE

The hydraulic valve tappet rotates during operation, so there is a uniform, rotational symmetrical support pattern on the cam contact face.

NOTE

If the tappet does not rotate, uneven wear occurs on the contact face. If there are uneven smooth areas, corroded areas/pitting, the tappet must be replaced.

ATTENTION

The hydraulic valve tappet must not be reground on the end!

ATTENTION

Disassembly of the hydraulic valve tappet is neither permissible nor necessary.

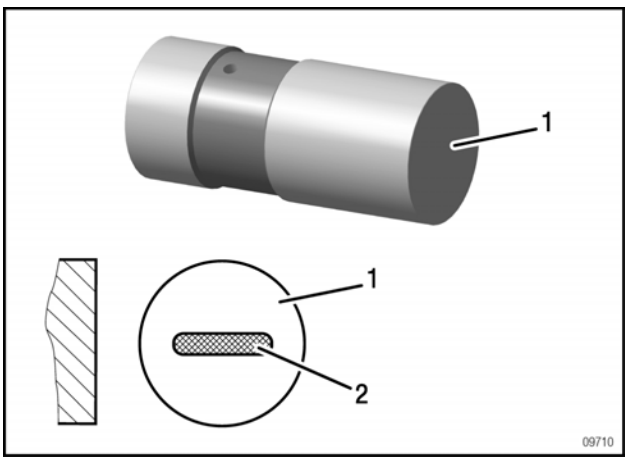


Figure 9.13

1 *Cam contact face* 2 *Uneven wear*

WEAR LIMITS

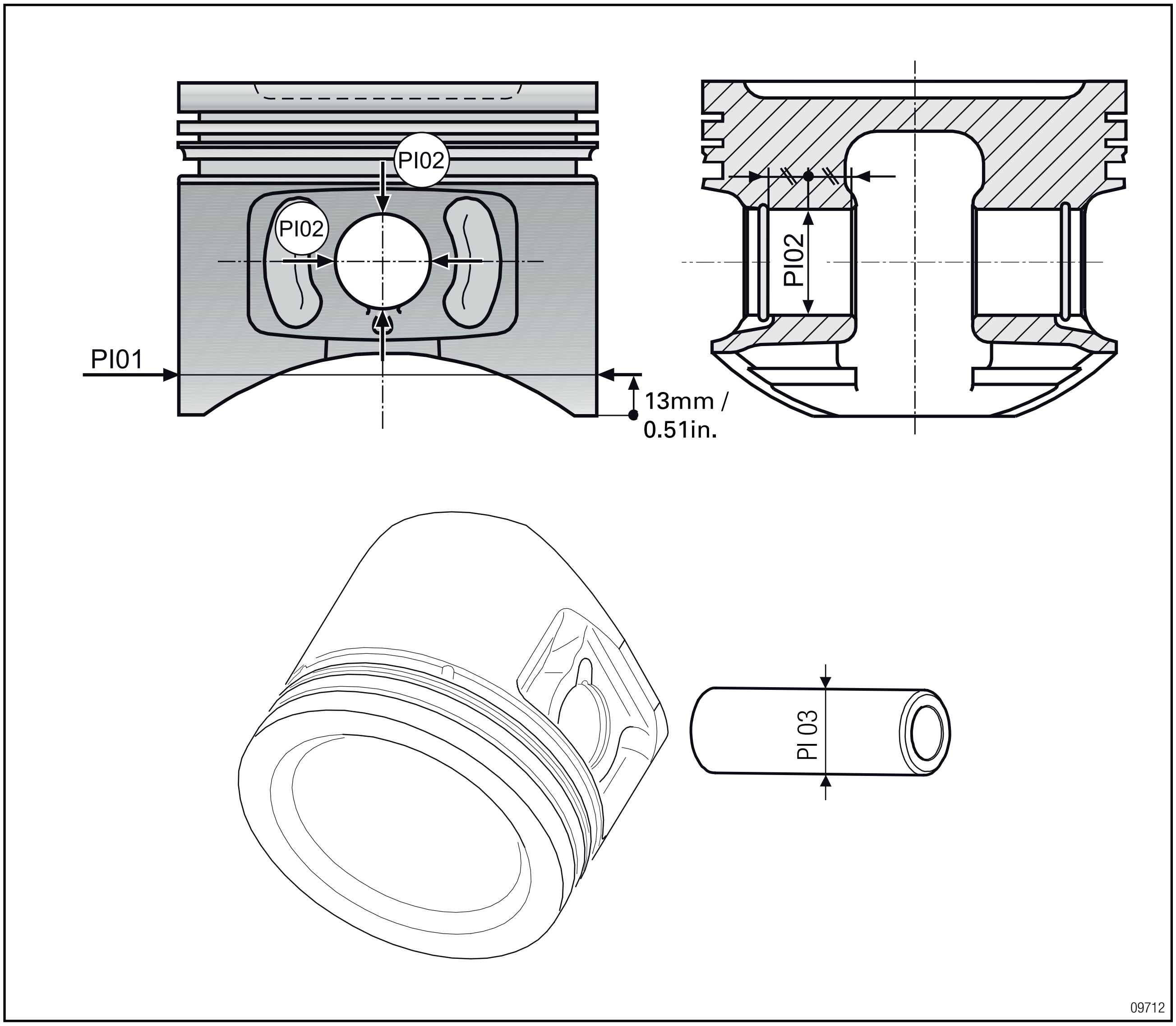


Figure 9.14

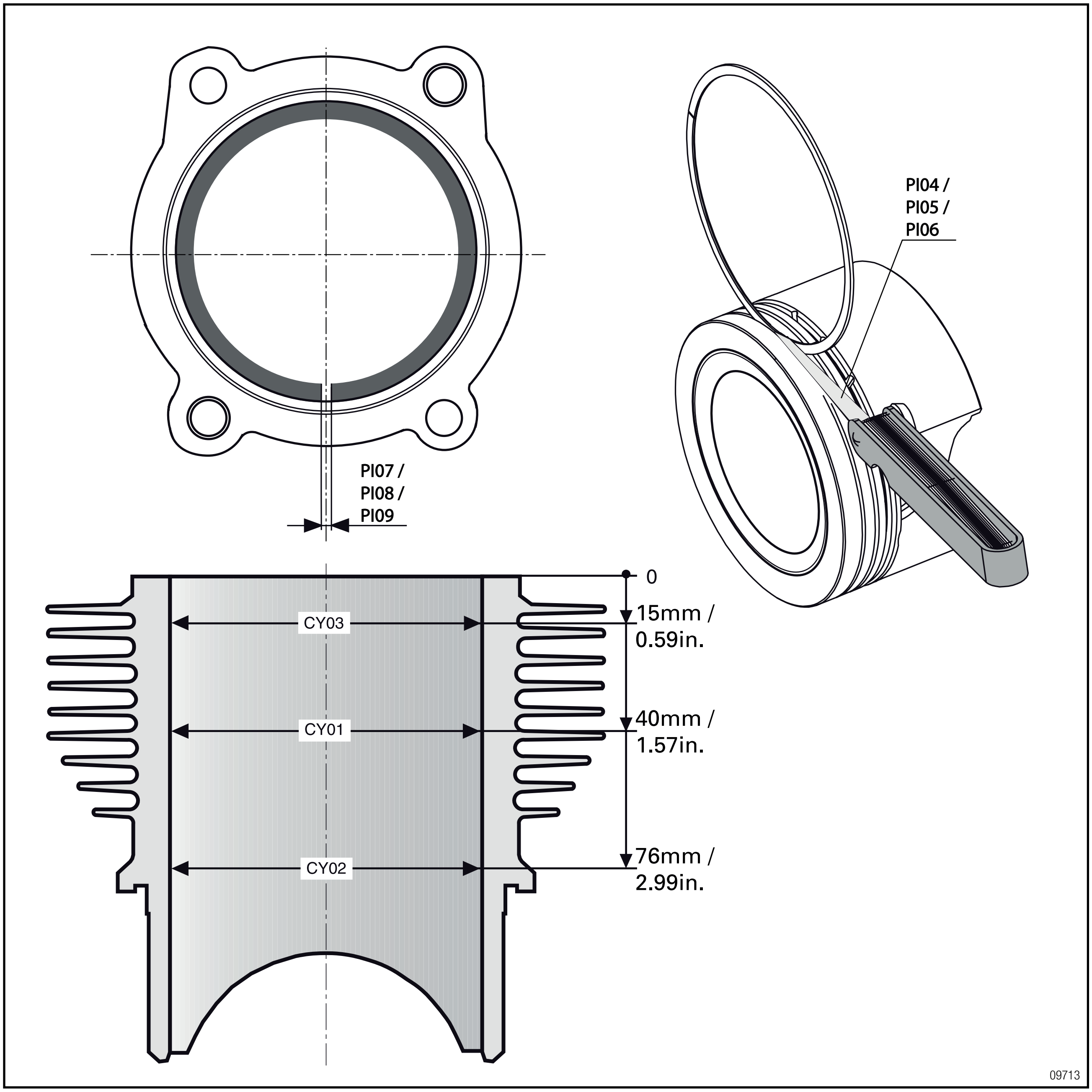

PI04 /
PI05 /
PI06
PI07 /
PI08 /
PI09
0
15mm /
0.59in.
CY03
40mm /
1.57in.
CY01
76mm /
2.99in.
CY02
09713

Figure 9.15

Description	Code	Reading new		Wear limit	Wear limit		Readings			
		min	max	100 %	50 %					
Piston							Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4
Piston, red 84 mm / 3.3 in.	PI01	83.988 mm 3.3066 in.	84.002 mm 3.3072 in.	83.980 mm 3.3027 in.	83.939 mm 3.3047 in.	actual				
						re-newed				
Piston, green 84 mm / 3.3 in.	PI01	83.998 mm 3.3070 in.	84.012 mm 3.3075 in.	83.890 mm 3.3027 in.	83.944 mm 3.3049 in.	actual				
						re-newed				
Installation clearance cyl. "A" with "red" piston	CY01 /PI01	0.002 mm 0.000079 in.	0.024 mm 0.0009 in.	0.130 mm 0.0051 in.	0.077 mm 0.0030 in.	actual				
						re-newed				
Installation clearance cyl. "B" with "green" piston	CY01 /PI01	0.002 mm 0.000079 in.	0.026 mm 0.0010 in.	0.130 mm 0.0051 in.	0.078 mm 0.0031 in.	actual				
						re-newed				
Piston pin bore	PI02	20.001 mm 0.7874 in.	20.005 mm 0.7876 in.	20.040 mm 0.7890 in.	20.023 mm 0.7883 in.	actual				
						re-newed				
Piston pin	PI03	19.992 mm 0.7871 in.	19.995 mm 0.7872 in.	19.970 mm 0.7862 in.	19.981 mm 0.7867 in.	actual				
						re-newed				
Piston pin clearance in piston pin bore	PI01 / PI02	0.006 mm 0.0002 in.	0.013 mm 0.0005 in.	0.050 mm 0.0020 in.	0.032 mm 0.0012 in.	actual				
						re-newed				
Piston pin clearance in conrod	CS06 / PI03	0.015 mm 0.0006 in.	0.035 mm 0.0014 in.	0.050 mm 0.0020 in.	0.043 mm 0.0017 in.	actual				
						re-newed				
Piston ring clearance, groove clearance rectangular ring 1	PI04	0.03 mm 0.001 in.	0.06 mm 0.002 in.	0.10 mm 0.004 in.	0.08 mm 0.003 in.	actual				
						re-newed				
Piston ring groove clearance	PI05	0.03 mm 0.001 in.	0.06 mm 0.002 in.	0.10 mm 0.004 in.	0.08 mm 0.003 in.	actual				

Description	Code	Reading new		Wear limit	Wear limit		Readings			
		min	max	100 %	50 %					
compression ring 2						re-newed				
Piston ring groove clearance oil scraper ring 3	PI06	0.02 mm 0.001 in.	0.06 mm 0.002 in.	0.10 mm 0.004 in.	0.08 mm 0.003 in.	actual				
						re-newed				
Piston ring end gap, rectangular piston ring 1	PI07	0.15 mm 0.0059 in.	0.35 mm 0.0138 in.	1.00 mm 0.0394 in.	0.68 mm 0.0266 in	actual				
						re-newed				
Piston ring end gap, conical compres-sion ring 2	PI08	0.15 mm 0.0059 in.	0.35 mm 0.0138 in.	1.00 mm 0.0394 in.	0.68 mm 0.0266 in.	actual				
						re-newed				
Piston ring end gap, oil scraper ring 3	PI09	0.15 mm 0.0059 in.	0.40 mm 0.0157 in.	1.00 mm 0.0394 in.	0.70 mm 0.0276 in.	actual				
						re-newed				

Description		Code	Reading new		Wear limit	Wear limit		Readings			
			min	max	100 %	50 %					
Cylinder								Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4
Cylinder bore A 84 mm / 3.3 in.	D1	CY01	84.000 mm 3.3071 in.	84.012 mm 3.3075 in.	84.080 mm 3.3075 in.	84.080 mm 3.3102 in.	actual				
							re-newed				
	D2	CY02	CY01 +0.015 mm CY01 +0.0006 in.		CY01 +0.015/-0.008 mm CY01 +0.0006/-0.0003 in.		actual				
							re-newed				
	D3	CY03	CY01 +/- 0.008 mm CY01 +/- 0.0003 in.		CY01 +0.020/-0.008 mm CY01 +0.0008/-0.0003 in.		actual				
							re-newed				
Cylinder bore B 84 mm / 3.3 in.	D1	CY01	84.012 mm 3.3075 in.	84.024 mm 3.308 in.	84.090 mm 3.3106 in.	84.057 mm 3.3093 in.	actual				
							re-newed				
	D2	CY02	CY01 +0.015 mm CY01 +.0006 in.		CY01 +0.015/-0.008 mm CY01 +0.0006/-0.0003 in.		actual				
							re-newed				
	D3	CY03	CY01 +/- 0.008 mm CY01 +/- 0.0003 in.		CY01 +0.020/-0.008 mm CY01 +0.0008/ 0.0003 in.		actual				
							re-newed				
Cylinder ovality			0.0000 mm 0.0000 in.	0.007 mm 0.00003 in.	0.050 mm 0.0020 in.	0.029 mm 0.0011 in.	actual				
							re-newed				
Cylinder cone			0.0000 mm 0.0000 in.	0.030 mm 0.0012 in.	0.060 mm 0.0024 in.	0.045 mm 0.0018 in.	actual				
							re-newed				
Rework of sealing surface cylinder / cylinder head			0.0000 mm 0.0000 in.	0.0000 mm 0.0000 in.	0.03 mm 0.0012 in.		actual				
							re-newed				

INSTALLATION

CYLINDER AND PISTON — INSTALLATION

Preparation

- Clean all parts carefully.
- Lightly grease or lubricate press-in parts and gaskets.

INSTALLATION OF THE HYDRAULIC VALVE TAPPET

ATTENTION
If a hydraulic valve tappet has to be replaced, it must be ensured that a hydraulic valve tappet with a polished cam running surface is used.

ATTENTION
If operating faults occur, such as operation with a non-purged hydraulic valve tappet, the components (plate) in the hydraulic valve tappet will be damaged.

NOTE

New hydraulic valve tappets are partially emptied depending on the bearing and are pumped full of oil during the starting process. The oil passes through the bore into the hydraulic valve tappet. The retaining ring holds the piston in position when the hydraulic valve tappet is removed.

See Fig. 11 and Fig. 13.

Step	Procedure
1	Lubricate the bearing bore for the hydraulic valve tappet in the crankcase and contact faces with Engine oil.
2	Install the circumstantially lubricated hydraulic valve tappet in the corresponding place in the crankcase.

NOTE

The hydraulic valve tappet must rotate in the crankcase without resistance.

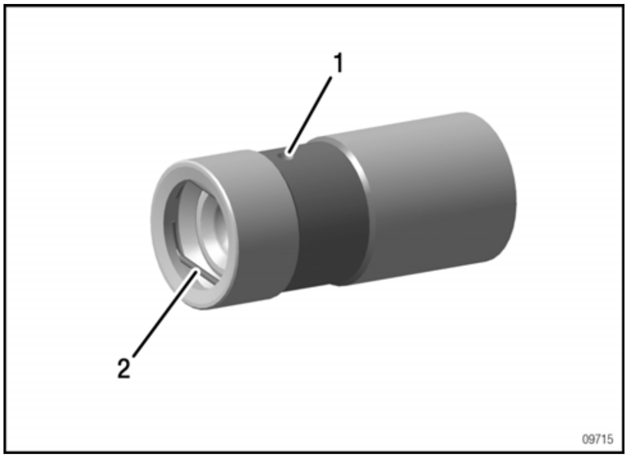


Figure 9.16

1 Bore *2 Retaining ring*

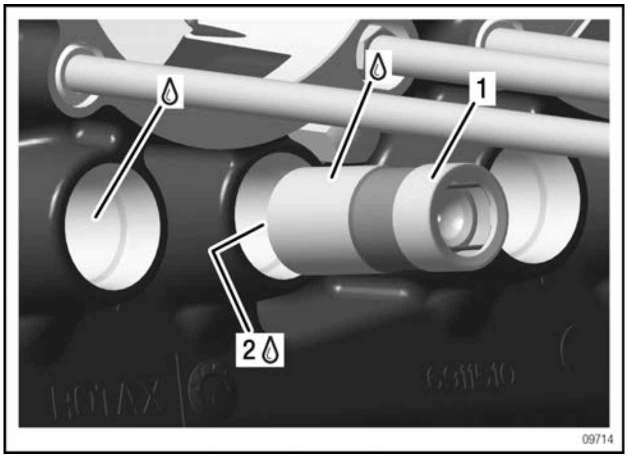


Figure 9.17

1 Hydraulic valve tappet *2 Contact faces*

PISTON — INSTALLATION

NOTE

The pistons are axially offset. When the piston is installed, the arrow on the piston crown points towards the propeller shaft. This means with axial offset downwards for cylinders 1 and 3 and with axial offset upwards for cylinders 2 and 4.

Step	Procedure
1	Install the piston in accordance with the following figures.

NOTE

The eccentricity of the piston pin bore is 1 mm (0.039 in).

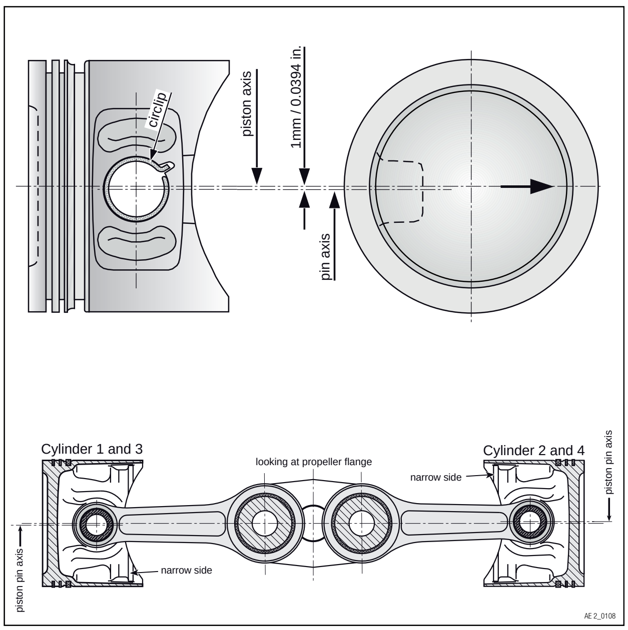


Figure 9.18

Step	Procedure
2	Lubricate the piston pin along with the conrod eye and the piston pin bore with LOCTITE ANTI SEIZE.

NOTE

Pull in the piston pin with the piston pin puller part no. 877091. The following steps must be followed.

Step	Procedure
3	Push the piston pin to one side in the piston, insert the puller spindle and mount the extracting nut.
4	Turn the spindle clockwise to pull in the piston pin entirely as far as the retaining ring.

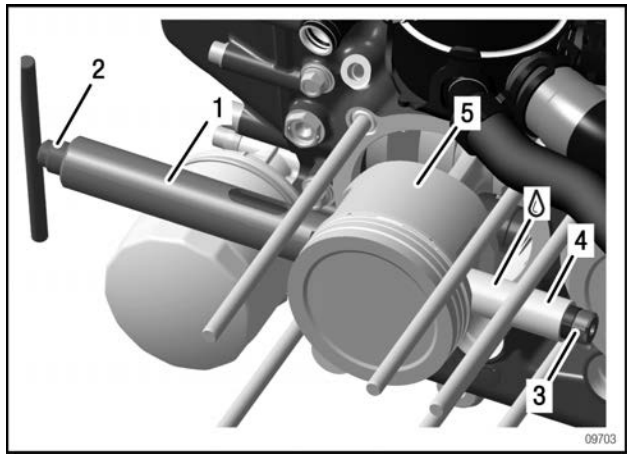


Figure 9.19

1 *Piston pin puller*
2 *Puller spindle*
3 *Extracting nut*
4 *Piston pin*
5 *Pistons*

ATTENTION

Circlips which are used or have already been installed have insufficient tangential tension, can twist and consequently abrade the groove in the piston.
Always use new mono hook circlips.

ATTENTION

The position of the mono hook circlip is defined by the recess in the piston. The open side of the mono hook circlip must be opposite the piston crown when installed.

Step	Procedure
5	Install the mono hook circlip with installation tool part no. 877802. To do this, press the mono hook circlip into the groove of the installation sleeve and push the guide tool into the installation sleeve.
6	Push the installation sleeve onto the installation tool.
7	Push the installation tool into the position gauge and press the ring forwards as far as it will go.

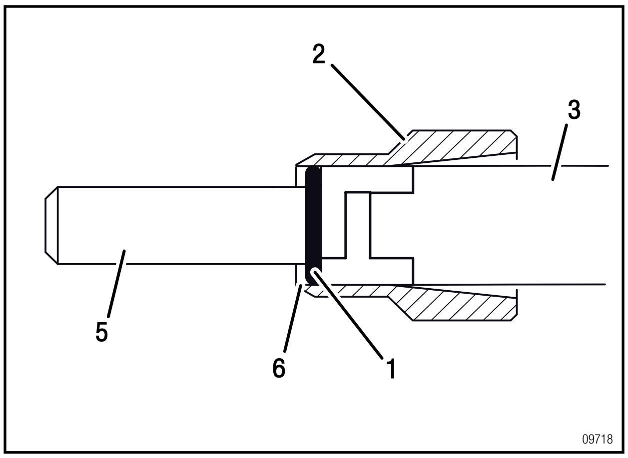


Figure 9.20

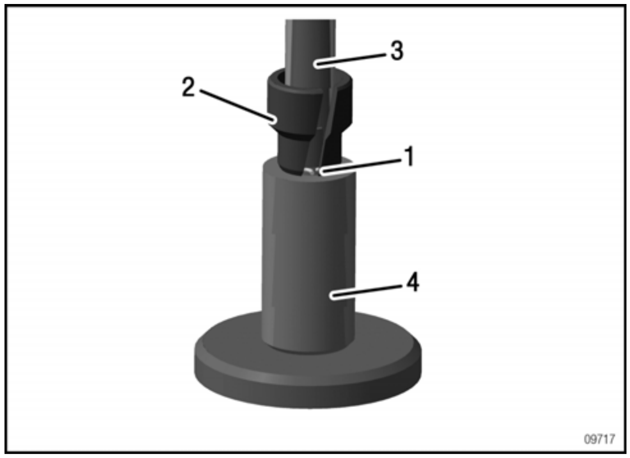


Figure 9.21

1 Mono hook circlip
2 Installation sleeve
3 Installation tool
4 Punch tool assy.
5 Guide tool
6 Groove

Step	Procedure
8	Place the whole installation tool on the piston. Support the piston with your hand and push the mono hook circlip into the retaining groove of the piston with a strong pressure on the installation tool.

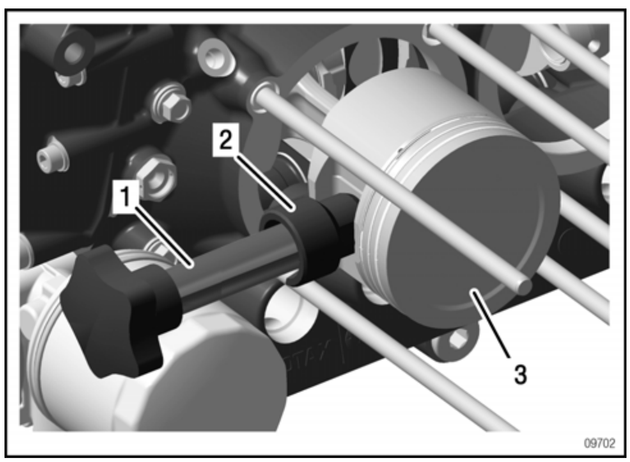


Figure 9.22

1 Installation tool
2 Installation sleeve
3 Piston

CYLINDER INSTALLATION

ATTENTION

The suitable piston ring spanner part no. 876967 must be used to avoid ring breakages. Ensure that the piston ring joints are in the specified angle range.

See Figure 17.

Step	Procedure
1	Install the piston ring in the centre of the lower piston skirt.
2	Install the compression and oil scraper rings on the upper piston skirt, inclined away between 25° and max. 30°.

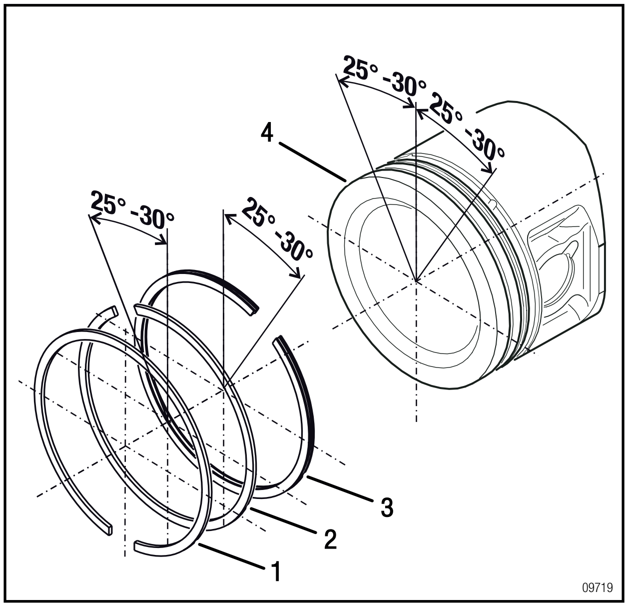


Figure 9.23

1	*Piston ring*	2	*Compression ring*
3	*Oil scraper ring*	4	*Pistons*

ATTENTION

The ring gap should never come to lie in the region of the piston pin eye.

ATTENTION

Double-check that piston pin circlips are installed properly.

Step	Procedure
3	Install the 87x2 O-ring on the cylinder skirt and lubricate the cylinder running surface.
4	Lubricate the piston, compress the piston rings with piston ring spanner part no. 876967 and carefully install the corresponding cylinders.

NOTE

Repeat this process for the other cylinders.

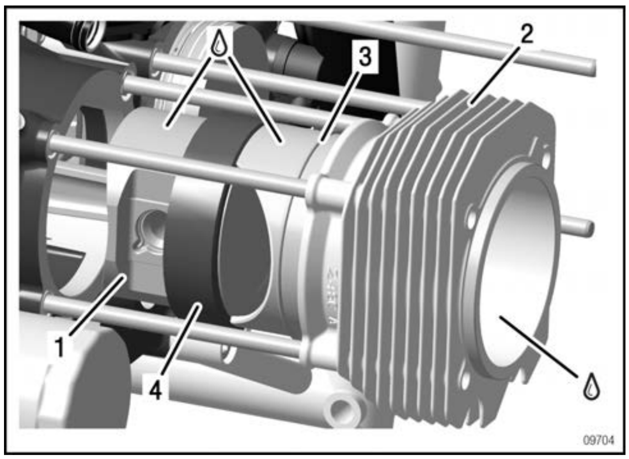


Figure 9.24

1	*Pistons*	2	*Cylinders*
3	*87x2 O-ring*	4	*Piston ring spanner part no. 876967*

FINISHING WORK

- Install the cylinder head. See Chapter 72-30-00.
- Purge the lubrication system.

Chapter: 73–00–00
FUEL SYSTEM

TOPICS IN THIS CHAPTER

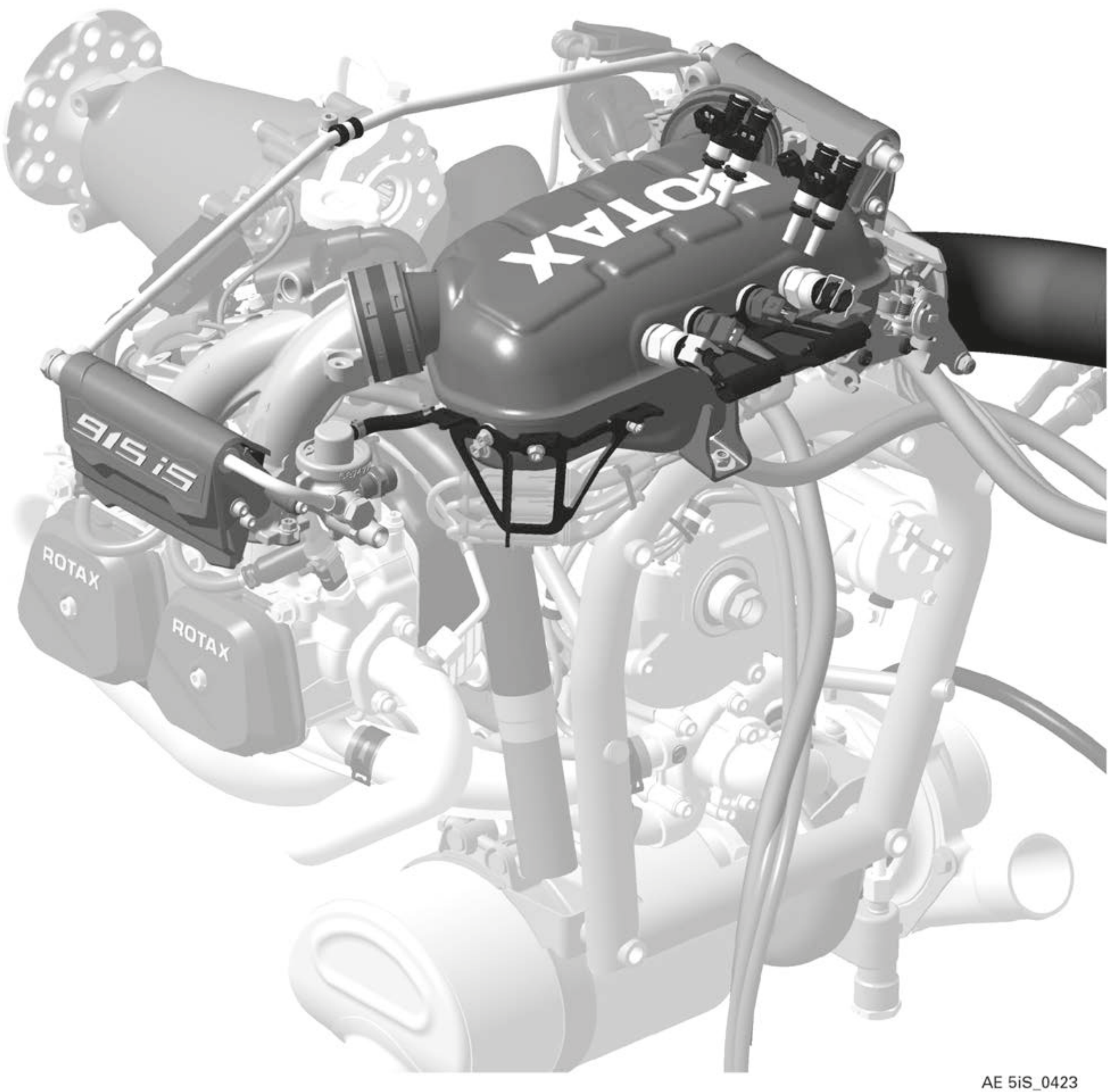


Figure 10.1: Fuel system

SYSTEM DESCRIPTION

The fuel passes from the tanks via the water trap to the series-connected electric fuel pumps, through fine filter from there to the fuel rails, the injection valves and the fuel pressure regulator.

The fuel pressure is measured with an absolute pressure sensor.

ECU

The ECU controls one of the two fuel pumps through one of the two LANEs. The pilot can switch on the second fuel pump with an additional switch if required, if no automatic detection is present.

FUEL FILTER

Coarse filter

The coarse filter is installed by the aircraft manufacturer and is not included in the ROTAX® delivery.

Fine Filter

The fine filter is installed by the aircraft manufacturer, see aircraft manufacturer manual.

SAFETY INSTRUCTION

⚠ WARNING

During work on the fuel system there is a risk of injury due to pressure and fuel!
Always wear safety goggles and gloves when working on the fuel system! Before starting repair work on the fuel system, ensure that it is no longer pressurised! Ensure that pressure cannot build up again by disconnecting the electric supply. At the workplace, ensure that drained fuel is handled according to the safety information.

⚠ WARNING

Flammable material must be placed at a sufficient distance from all sources of ignition, direct and strong sunlight, spotlights and heating devices, so that it cannot be ignited by such items.

ENVIRONMENTAL NOTE

Please observe the disposal regulations applicable in your area.

ENVIRONMENTAL NOTE

Observe the safety instructions of the manufacturer of hazardous substances (coolant, oil) or fuels and the applicable regional waste disposal regulations.

ENVIRONMENTAL NOTE

Work with the utmost care to ensure that no water pollutants can penetrate into the soil, water or the sewerage system.

CONNECTIONS FOR DISPLAY SYSTEMS

ATTENTION
Follow the instructions in the installation manual regarding connections for instrumentation.

PRESSURE SENSOR

The 2 pressure sensors are situated directly on the airbox and measure the intake air pressure.

TEMPERATURE SENSOR

The 2 temperature sensors are situated directly on the airbox and measure the intake air temperature.

Chapter: 73–10–00
FUEL SYSTEM AND DISTRIBUTION

TOPICS IN THIS CHAPTER

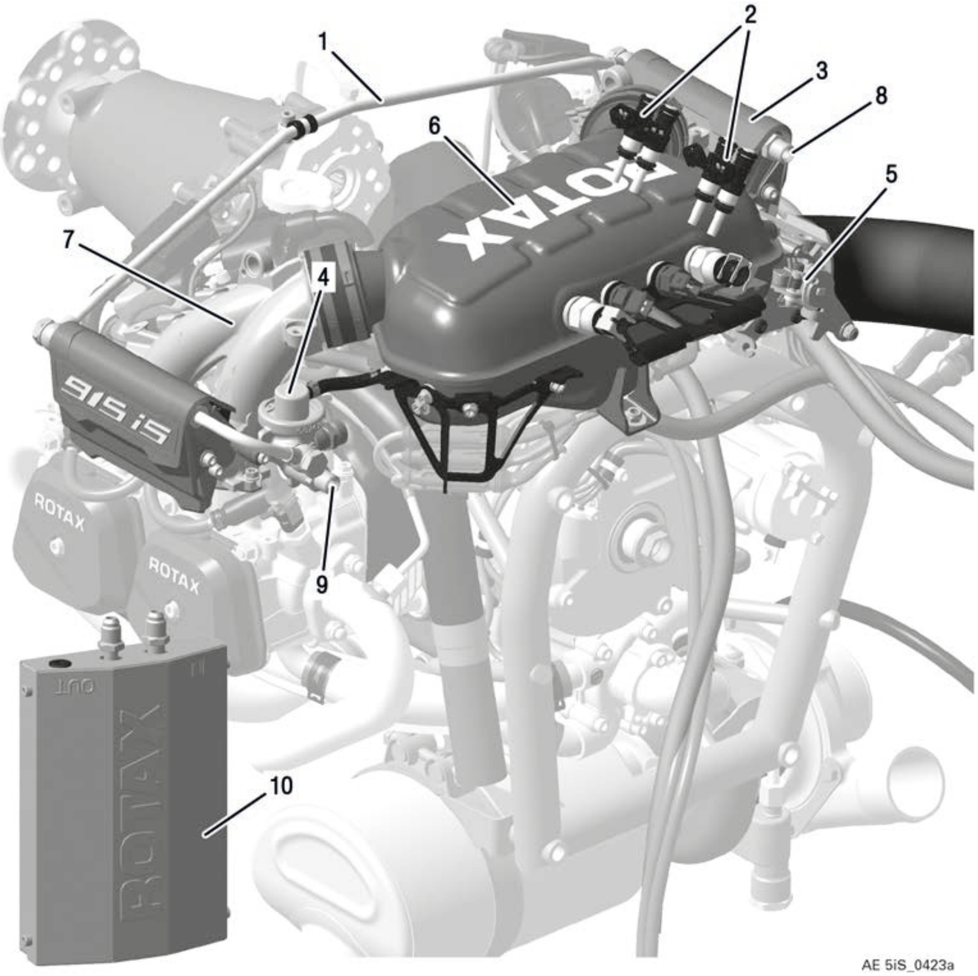


Figure 11.1: Fuel distribution

1	*Fuel line assy.*	2	*Injectors*	3	*Fuel rail 1/3*
4	*Fuel pressure regulator assy.*	5	*Throttle body*	6	*Airbox*
7	*Intake manifold*	8	*Fuel rail 1/3 feed line*	9	*Fuel rail 2/4 outlet line*
10	*Fuel pump assembly*				

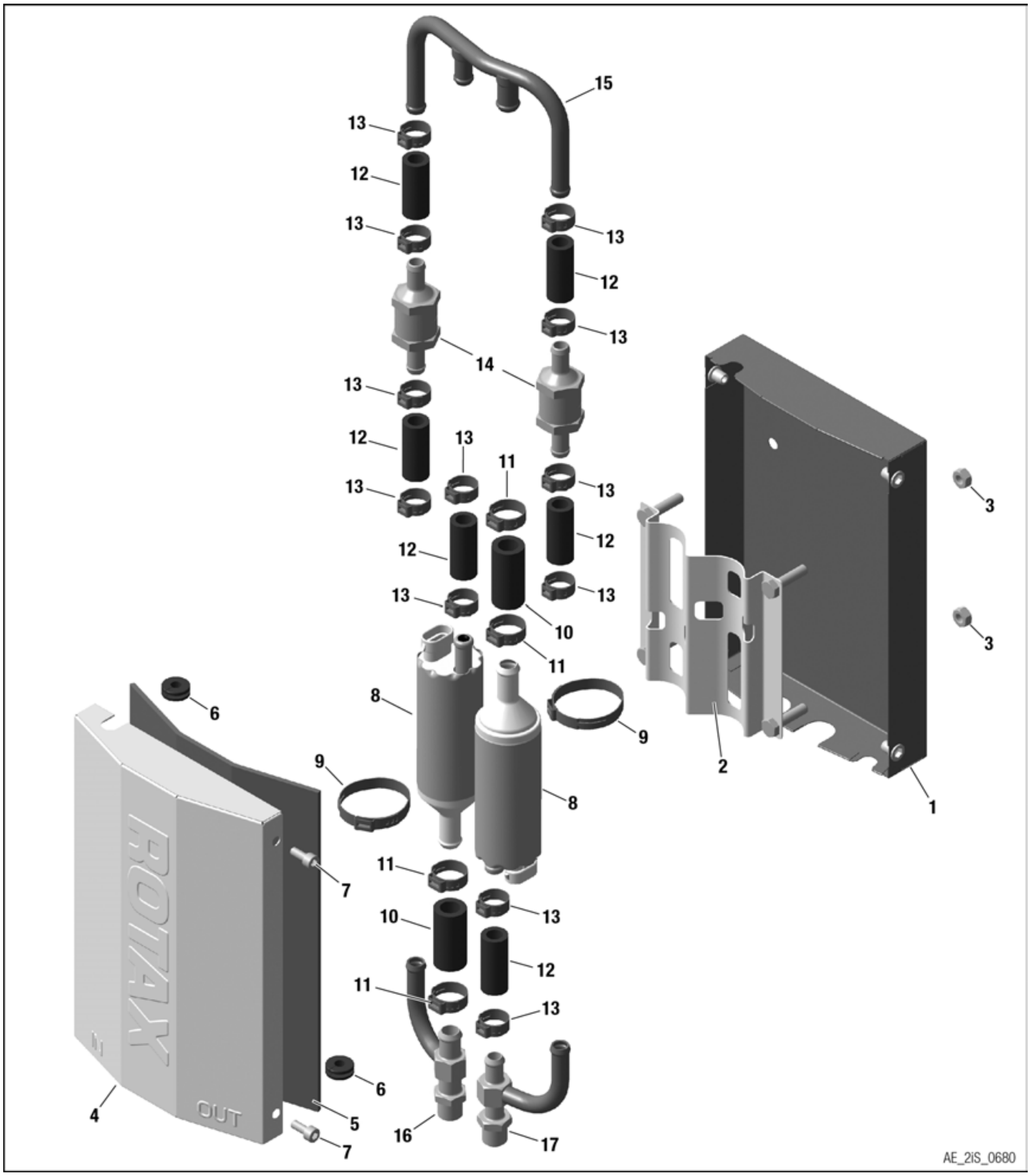


Figure 11.2: Fuel pump single parts

1	*Fuel pump housing*	2	*Fuel pump bracket assy.*
3	*Hex. nut M6*	4	*Fuel pump cover*
5	*Heat protection mat*	6	*Rubber grommet*
7	*Allen screw M5x12*	8	*Main and Aux. fuel pump*
9	*1-ear clamp*	10	*Hoses*

11	*1-ear clamp*	*12*	*Hoses*
13	*1-ear clamp*	*14*	*Check valves*
15	*Connection line*	*16*	*Suction line*
17	*Pressure line*		

SPECIAL TOOLS

Description	Part number
Snap ring pliers	n.a.
KNIPEX 1099 pliers (or similar OETIKER pliers)	889537
Socket driver T30	876180
Socket wrench 21	876075

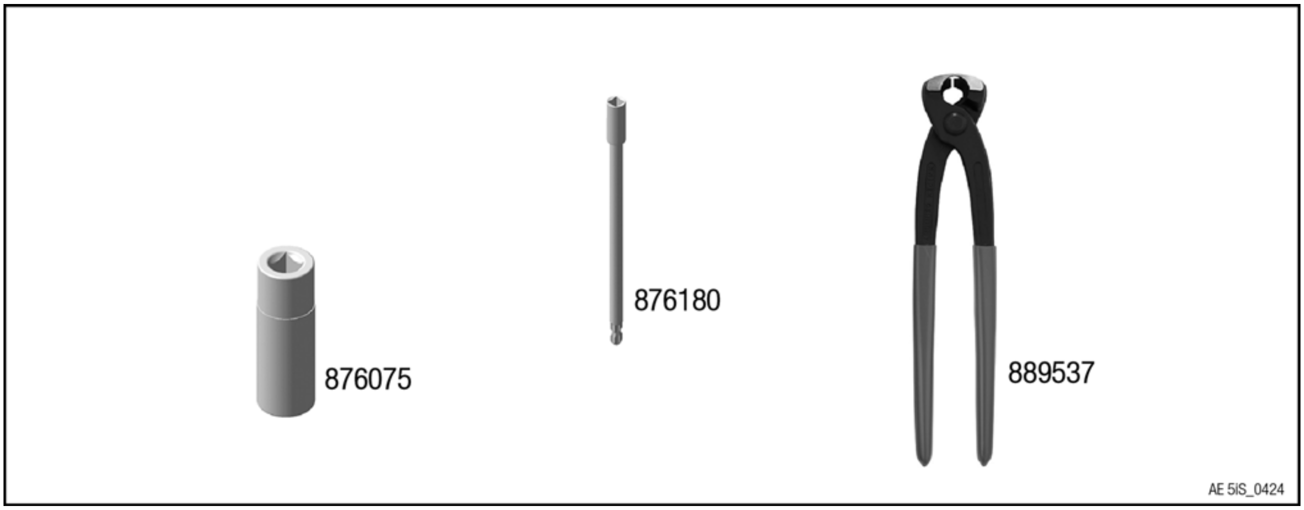


Figure 11.3: Special tools

SERVICE PRODUCTS

Description	Part number
LITHIUM BASED GREASE	898351
LOCTITE 243	897651
LOCTITE 648	899788

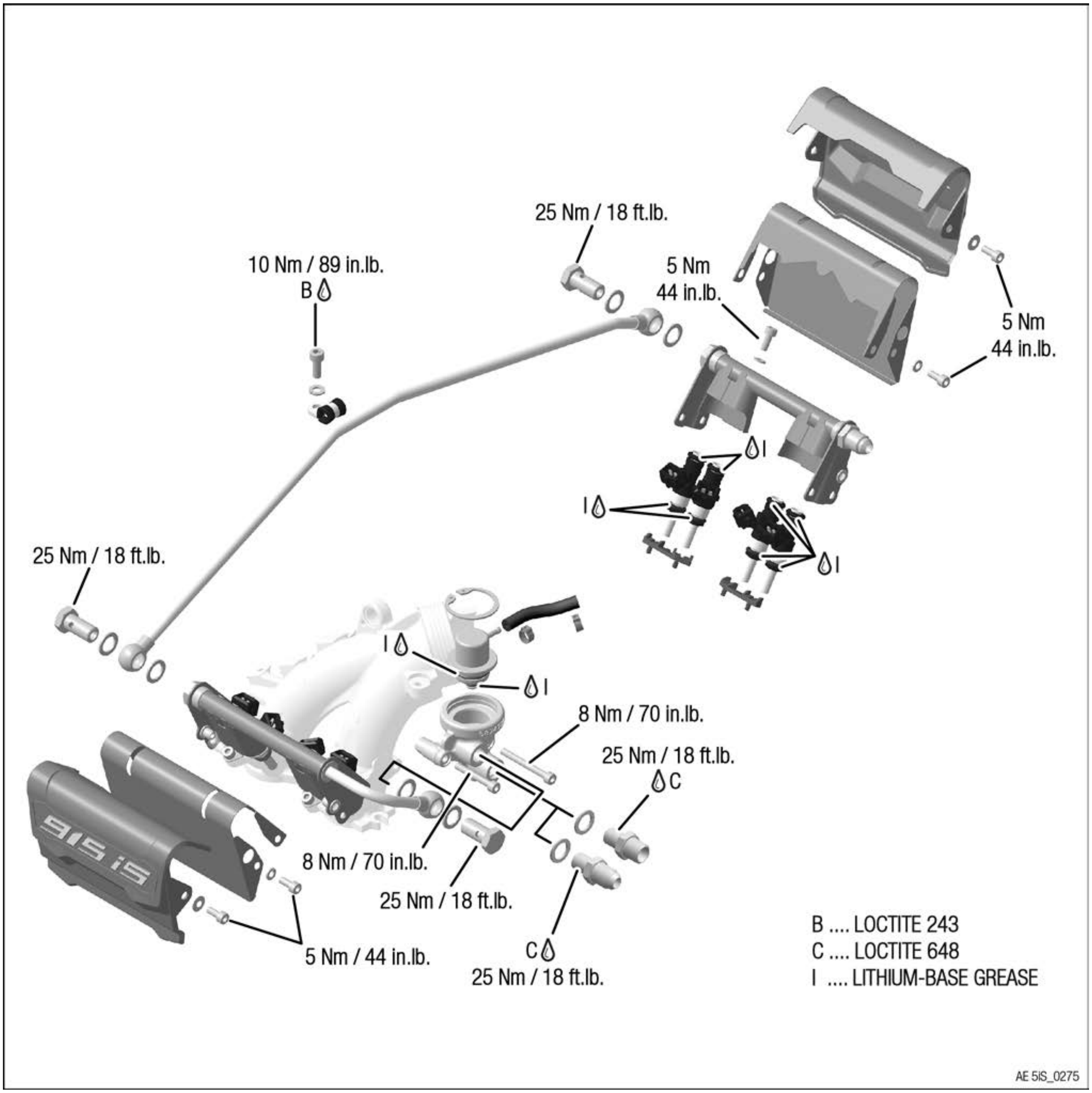


Figure 11.4: Fuel distribution

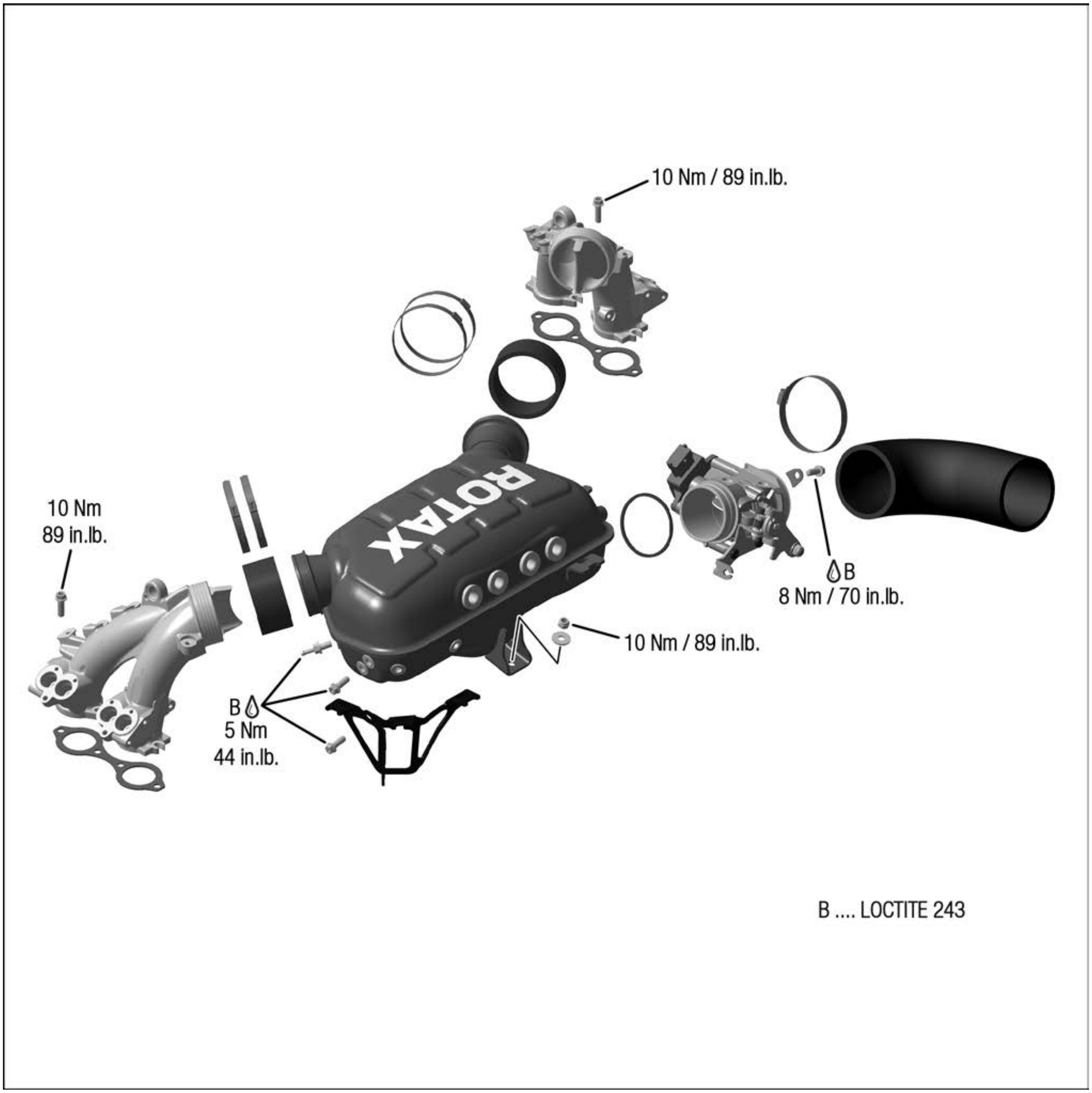

10 Nm / 89 in.lb.
10 Nm
89 in.lb.
B
8 Nm / 70 in.lb.
10 Nm / 89 in.lb.
B
5 Nm
44 in.lb.
B .... LOCTITE 243

Figure 11.5

SYSTEM DESCRIPTION

FUEL PUMP MODULE

The fuel pump module consists of:
Main and auxiliary (AUX) pump
2 check valves
connecting lines, connecting hoses
sheet metal housing

The main fuel pump is always switched on during operation of the aircraft engine. The AUX fuel pump is switched on in the event of a failure of the main pump or for certain flight situations (e.g. take-off and landing). If a pump is blocked by contamination, the fuel is sucked in via the check valves and carried to the engine.

FUEL DISTRIBUTION

The main elements of the fuel distribution assembly are:

- Air filter
- Throttle body
- Airbox
- Injection system with fuel pressure regulator assy.

Throttle body
The throttle valve is actuated by using the throttle lever. The position of the throttle valve is detected by the throttle potentiometer and the signal is sent to the ECU. The ECU uses the sensors to determine the amount of fuel and the fuel is injected directly into the intake manifold through the injection valves.

ATTENTION
The throttle valve is spring loaded to WOT, if no throttle cable is attached. Never start the engine without connecting a throttle cable.

Fuel pressure regulator
The fuel pressure regulator keeps the fuel system pressure upstream of the injection valves constant relative to the intake manifold pressure (differential fuel pressure). The injection quantity is therefore only dependent on the activation time of the injection valves and can be reproduced using the activation time in all operating conditions. Therefore, the same amount of fuel is injected per unit time at all pressure ratios. It is essentially a bypass valve, which opens a return duct to the tank for the fuel by means of a spring-loaded diaphragm when the set pressure is exceeded. The regulator has a hose connecting to the airbox (reference hose) so that the absolute fuel pressure can be changed proportionally to the airbox pressure.

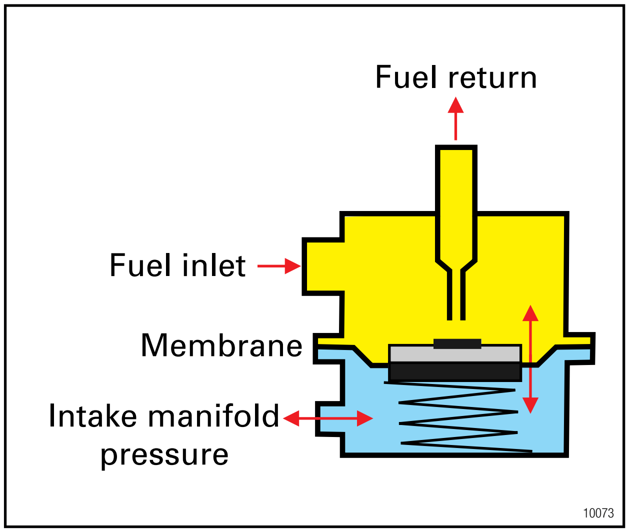


Figure 11.6

1 *Function principle*

NOTE

The fuel pressure is 3.00 bar (43.5 psi) +/-0.2 bar (+/- 2.9 psi).

Injection valve
The injection valves are laid out in a redundant manner and are activated by the control unit so that they inject alternately.
1-4-2-3 and in the next cycle 5-8-6-7.

Fuel lines.
Follow the instructions of the aircraft manufacturer.

Bubble trap.
Follow the instructions of the aircraft manufacturer.

Water trap.
Follow the instructions of the aircraft manufacturer.

Fuel cock.
Follow the instructions of the aircraft manufacturer.

SAFETY INSTRUCTION

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

⚠ WARNING

During work on the fuel distribution system/ fuel pump there is a risk of injury due to pressure and fuel!
Before starting repair work on the fuel system, ensure that it is no longer pressurised!

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

DISASSEMBLY

Preparation

Before the fuel distribution system/fuel pump is removed, the work described below must be carried out to identify any further faults in the fuel distribution system and rectify them as part of the repair work.

ATTENTION
If these checks are omitted, it may be necessary to dismantle the fuel distribution system again to rectify any faults after it has been repaired.

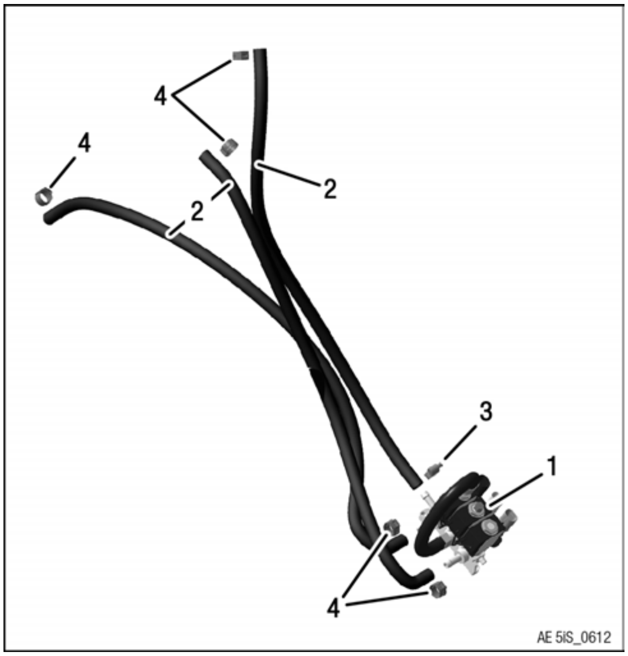
General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series.

- Functional check of the fuel distribution system assy.
- Check that the system has no leaks.
- Check the injection valves. Check the "spray pattern" using the map.
- Measure the resistance of the injection valves. To do this, see Chapter 76-70-00 section Sensors and actuators.
- Check the fuel pressure regulator with a pressure gauge in the static operating state.
- Check that the fuel filter in the feed line is clear.

PRESSURE CONTROL VALVE HOSES - REMOVAL

Step	Procedure
1	Loosen hose clamps and remove the PCV hoses.



1	*Pressure control valve*	2	*Hoses*
3	*Clamp 8*	4	*Clamp 10*

Figure 11.7: PCV hoses

FUEL LINE ASSY. — REMOVAL

Step	Procedure
1	Drain the fuel. See relevant Maintenance Manual Line Chapter 12-20-00 section Planned maintenance.
2	Remove the feed line to fuel rail 1/3, return line to fuel rail 2/4 and the fuel pressure regulator. Close all openings with appropriate caps.
3	Loosen the Allen screw M6x16 of the fuel line assy.

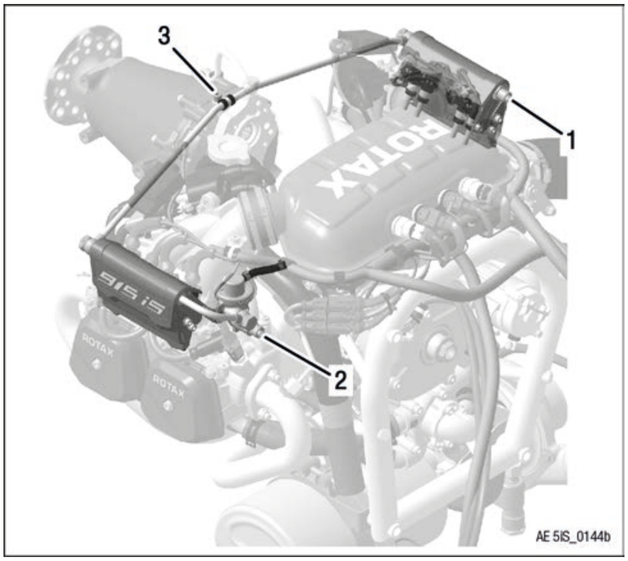


Figure 11.8

1 Fuel rail 1/3 feed line *2 Fuel rail 2/4 outlet line*

3 Allen screw M6x16

Step	Procedure
4	Loosen 2 banjo bolts M12x1.5 with gasket ring.
5	Remove the fuel line assy.

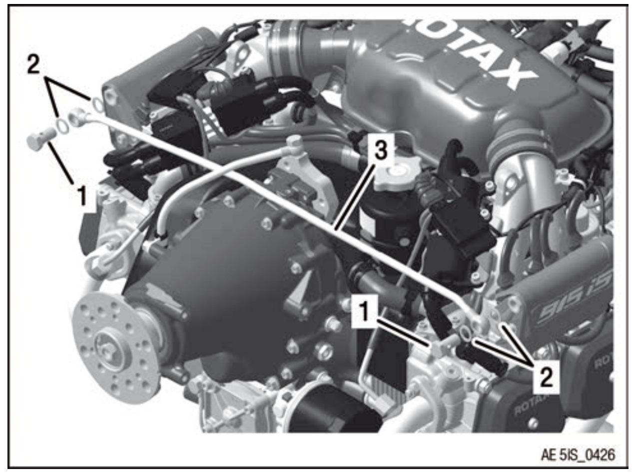


Figure 11.9

1 Banjo bolt M12x1.5 *2 Gasket ring*

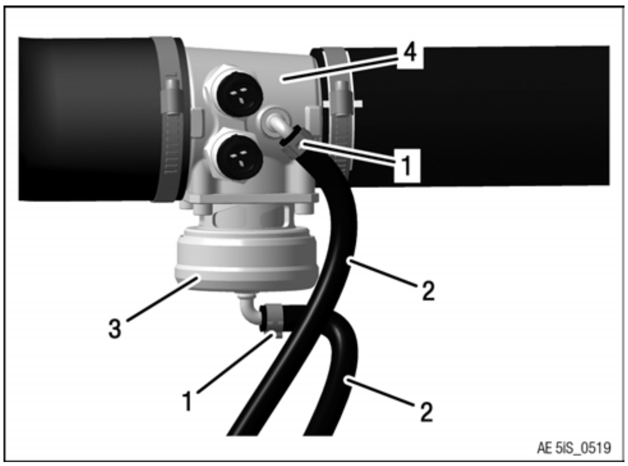
3 Fuel hose assy.

POP OFF VALVE — REMOVAL

⚠ WARNING
Danger of severe burns and scalds! Allow the engine and exhaust system to cool to ambient temperature before starting work.

Before removal, check for function and perform a leakage test, see Maintenance Manual Line for the engine type 915 i A Series.

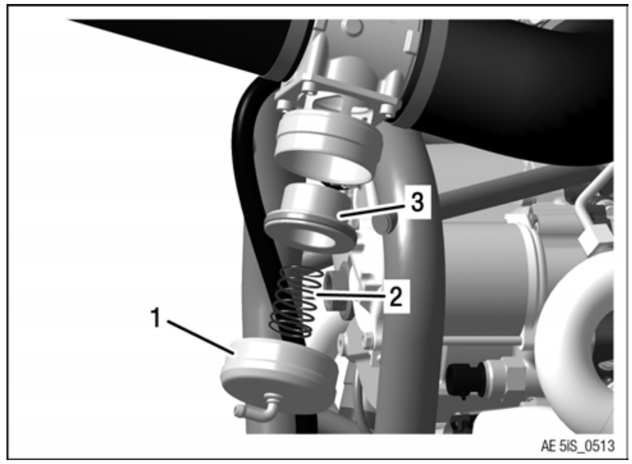
Step	Procedure
1	Loosen the hose clamp and remove the low pressure hose.



1 Hose clamp *2 Low pressure hose*
3 Valve cover *4 Pop off valve*

Figure 11.10

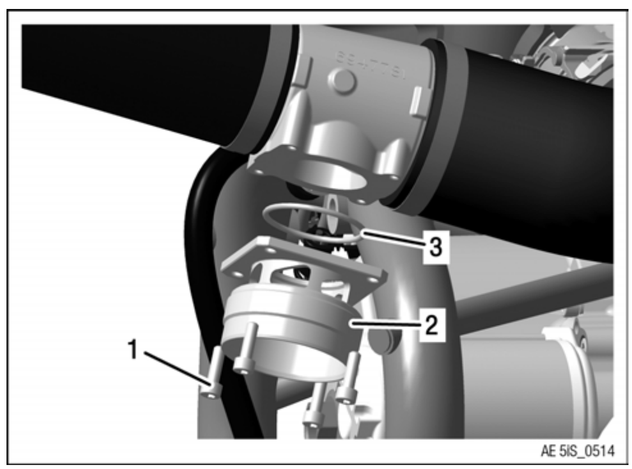
Step	Procedure
2	Remove valve cover, spring and piston.



1 Valve cover *2 Valve spring*
3 Valve piston

Figure 11.11

Step	Procedure
3	Loosen the 4 M5x16 Allen screws and remove the valve housing with O-ring.



1 M5x16 Allen screw *2 Valve housing*
3 O-ring

Reduction sleeve - removal (if necessary)

- Loosen the hose clamp and remove the low pressure hose.
- Loosen the clamps and remove the hose to intercooler and air intake hose.

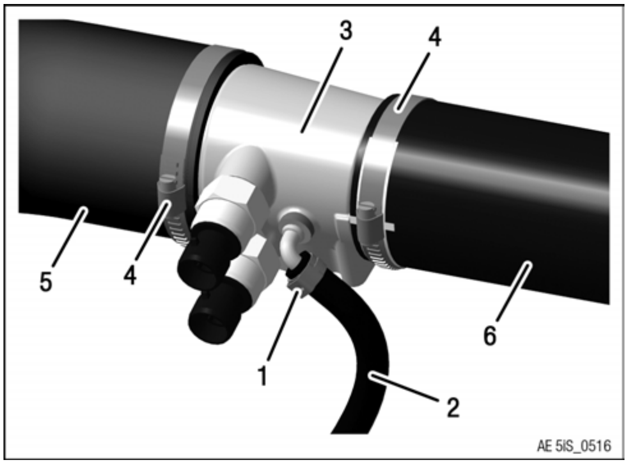


Figure 11.12

1	*Hose clamp (low pressure hose)*	2	*Low pressure hose*
3	*Reduction sleeve*	4	*Clamps (intercooler / air intake)*
5	*Air intake hose*	6	*Intercooler hose*

Figure 11.13

FUEL PUMP ASSY. — REMOVAL

Preparation

Drain the fuel.
See Maintenance Manual Line for the engine type 915 i A Series, Chapter 12-20-00 section Planned maintenance.

- Remove the feed line to fuel rail 1/3 and the return line to fuel rail 2/4 and fuel pressure regulator and close them with the appropriate caps.
- Drain the fuel from the fuel pump and close it with appropriate plug caps.

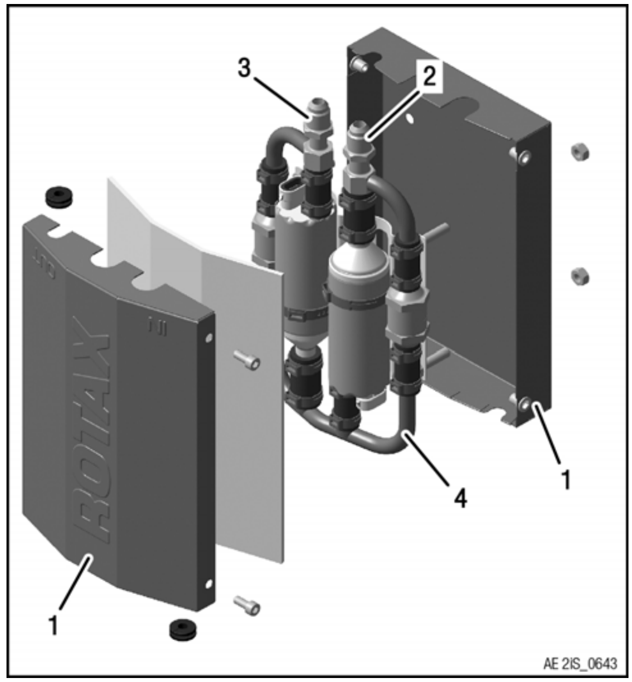


Figure 11.14: Overview

1	*Housing*	2	*Intake system*
3	*Pressure line*	4	*Fuel pump assy.*

NOTE

The position and type of positioning and attachment of the fuel pump depends on the aircraft type. See aircraft manufacturer documentation.

ENVIRONMENTAL NOTE

All the operating fluids and cleaning agents can damage the environment if not disposed of properly.
Dispose of operating fluids in an eco-friendly manner!

Step	Procedure
1	Loosen 4 Allen screws M5 from the cover.
2	Disconnect the fuel inlet and outlet.
3	Disconnect the fuel pumps (main, aux): • Lift the latches. • Unplug the connectors.

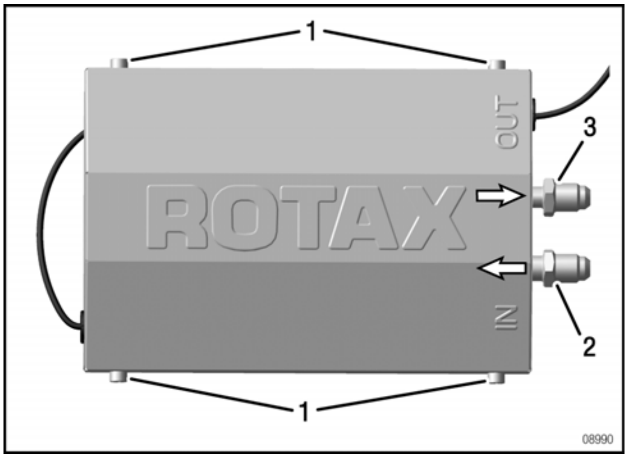


Figure 11.15

1 Allen screws M5x12 *2 Fuel inlet*
3 Fuel outlet

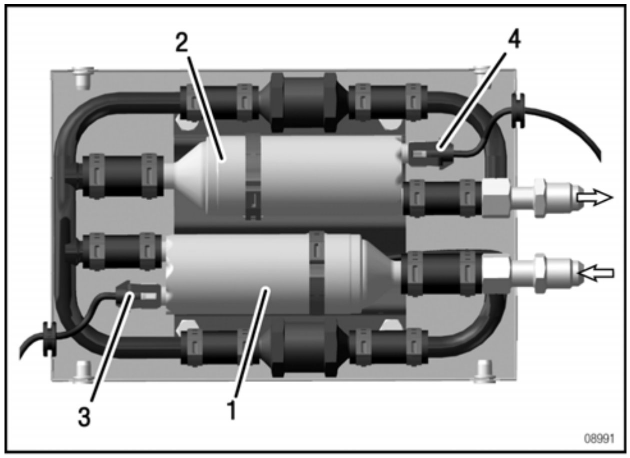


Figure 11.16

1 Main pump (main) *2 Additional pump (aux)*
3 Connector (Fuel pump 1) *4 Connector (Fuel pump 2)*

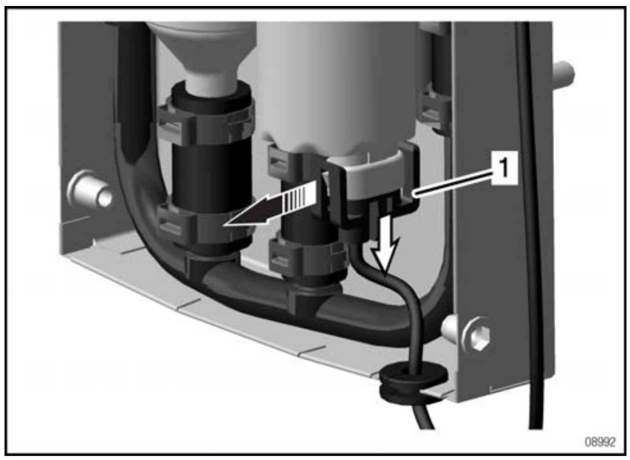


Figure 11.17

1 Connector

Step	Procedure
4	Remove the fuel pump module from the aircraft according to the aircraft manufacturer's manual.
5	Loosen the 4 hex. nut M6 and take the fuel pump unit out of the housing.

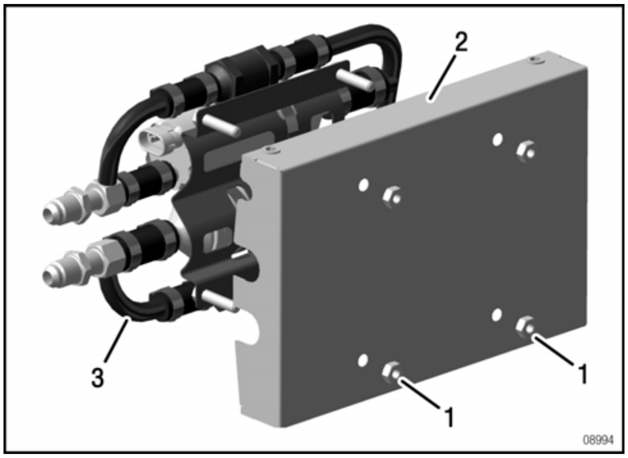


Figure 11.18

1 Hex. nut M6 *2 Housing*

3 Fuel pump unit

FUEL PUMP ASSY. SINGLE PARTS — DISASSEMBLY

NOTE

Fuel pump lines and hoses must be exchanged every 5 years. Therefore ROTAX offers a fuel pump service kit.

Disassembly of lines and hoses (every 5 years)

For understanding the position numbers see illustration "fuel pump single parts" at the beginning of this section.

Step	Procedure
1	Remove 1-ear clamps (pos. 9, 11 and 13) using a small flat screwdriver.
2	Remove pump bracket assy. (pos. 2).
3	Disassemble fuel hoses from pumps, lines and check valves.

FUEL PRESSURE REGULATOR ASSY. — REMOVAL

Preparation

- Carry out functional check, switch on both fuel pumps. Fuel pressure on pilot display should show: 3.00 bar (43.5 psi) +/- 0.2 bar (+/- 2.9 psi) (differential pressure to the intake manifold pressure or intake air pressure)

Step	Procedure
1	Drain the fuel. See relevant Maintenance Manual Line Chapter 12-20-00 section Planned maintenance.
2	Remove the return line to fuel rail 2/4 and fuel pressure regulator and close them with the appropriate caps.
3	Remove the cable ties and pull out the hose.
4	Disconnect the plug connection to the temperature sensor.

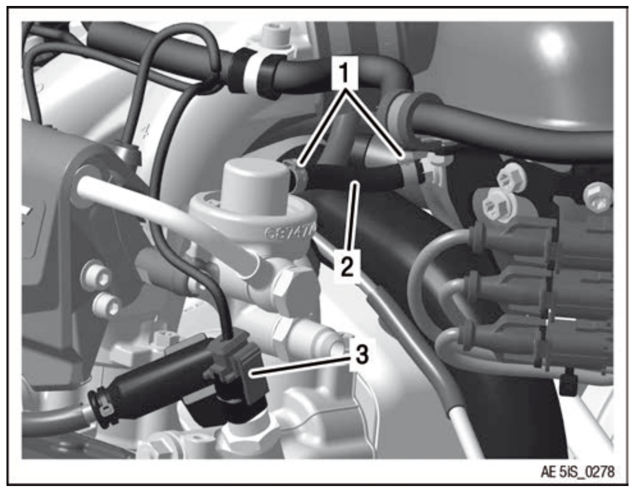


Figure 11.19

1 Cable ties *2 Hose*

3 Temperature sensor

Step	Procedure
5	Loosen the banjo bolt with gasket ring in the pressure regulator housing.

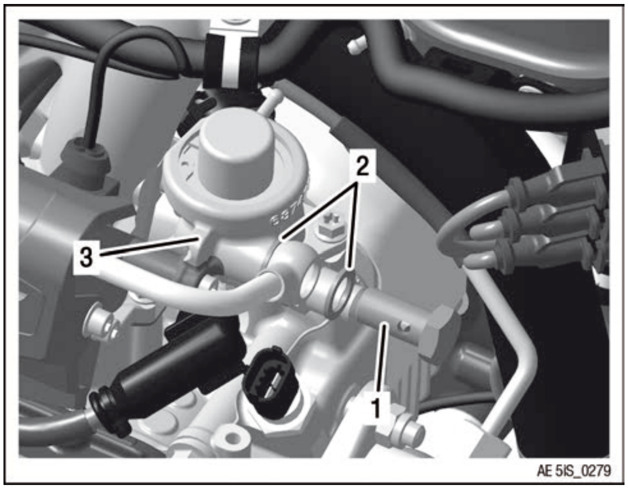


Figure 11.20

1	*Banjo bolt*	2	*Gasket ring*
3	*Pressure regulator housing*		

Step	Procedure
6	Loosen the M5 Allen screws. **NOTE** *1 M5x35 Allen screw. 1 M5x45 Allen screw.*
7	Remove the fuel pressure regulator and housing.

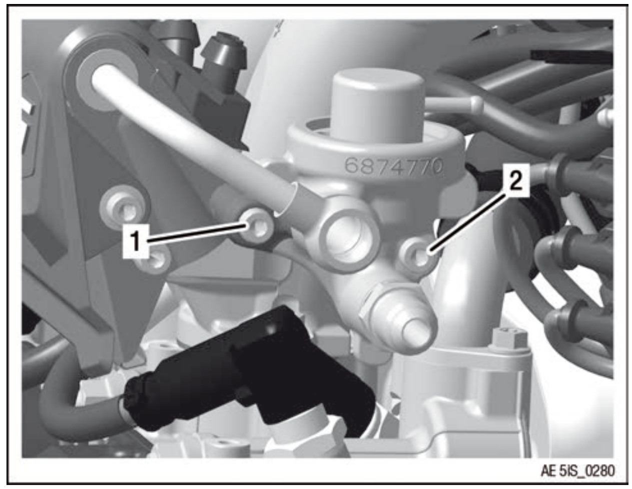


Figure 11.21

1	*Allen screw M5x35*	2	*Allen screw M5x45*

FUEL PRESSURE REGULATOR – DISASSEMBLY

Drain the fuel.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

Step	Procedure
1	Remove the cable ties and pull off the airbox reference hose.
2	Disconnect the plug connection to the temperature sensor.

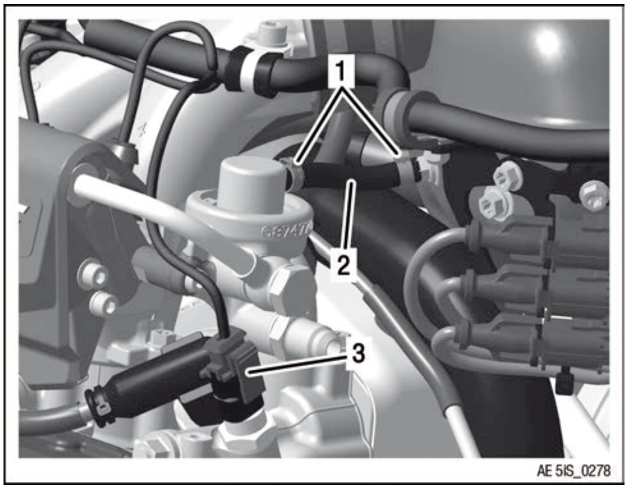


Figure 11.22

1 *Cable ties*	2 *Airbox reference hose*
3 *Temperature sensor*	

Step	Procedure
3	Remove the retaining ring using snap ring pliers.
4	Remove the fuel pressure regulator.

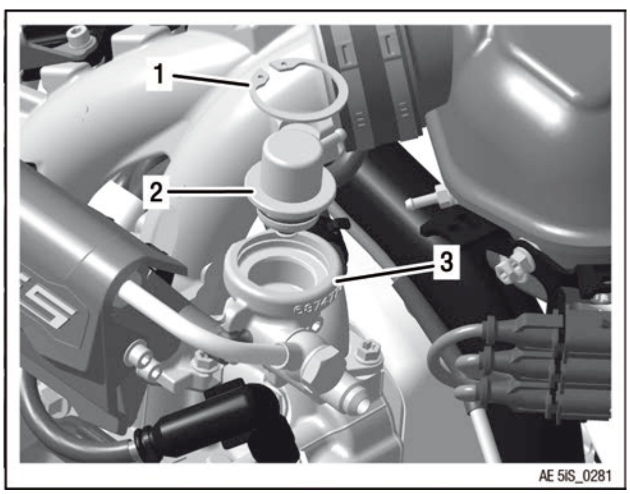


Figure 11.23

1 *Retaining ring*	2 *Fuel pressure regulator*
3 *Pressure regulator housing*	

FUEL RAIL — REMOVAL

Preparation

Drain the fuel.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

- Unscrew the feed hose to fuel rail 1/3 and the return hose to fuel rail 2/4 and fuel pressure regulator and close them with the appropriate caps.
- Loosen the Allen screw M6x16 of the fuel line assy.
- Remove the fuel line assy.

Step	Procedure
1	Loosen 2 Allen screws M5x12 from the cover of the fuel rail.
2	Lift off the cover.

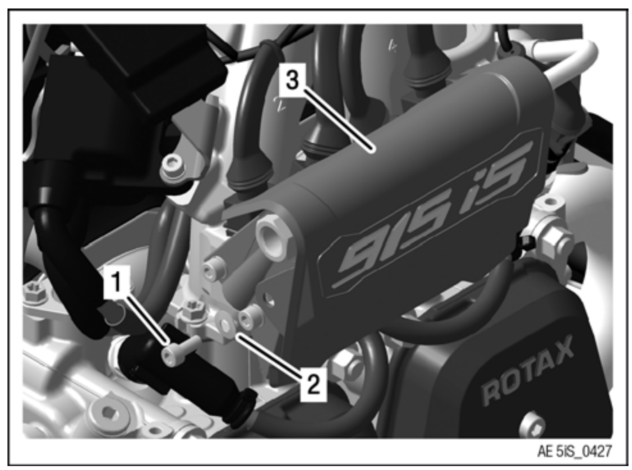


Figure 11.24

1 *Allen screw M5x12*	2 *Spring washer 5.3*
3 *Fuel rail cover*	

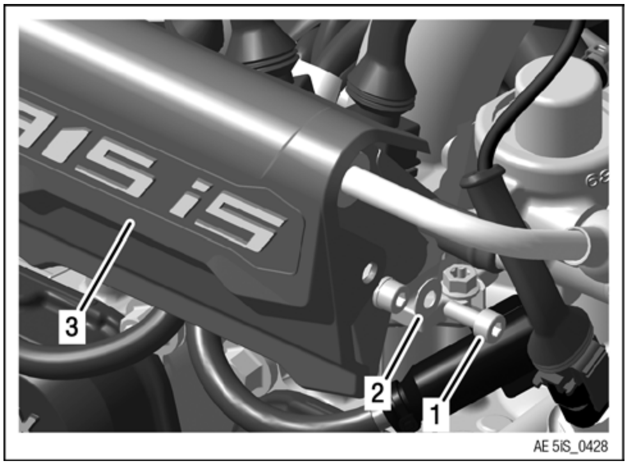


Figure 11.25

1 Allen screw M5x12 *2 Spring washer 5.3*
3 Fuel rail cover

Step	Procedure
3	Loosen 4 Allen screws M5x12.

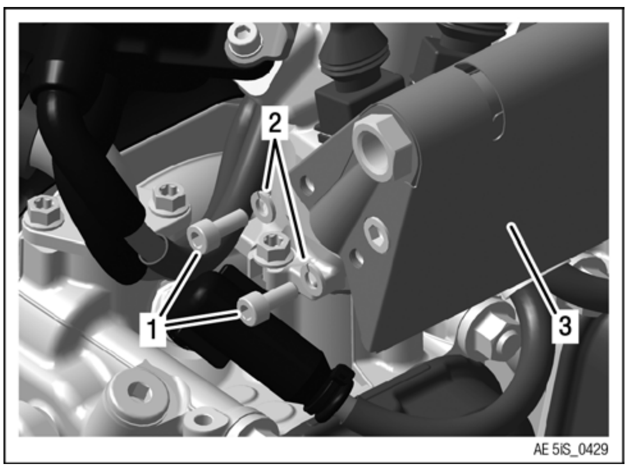


Figure 11.26

1 Allen screw M5x12 *2 Lock washer 5.3*
3 Heat shield

Step	Procedure
4	For cylinder 2 and cylinder 4, loosen the fuel pressure regulator and the Allen screw M5x35.
5	Lift off the heat shield on both sides in the region of the rivet nut.

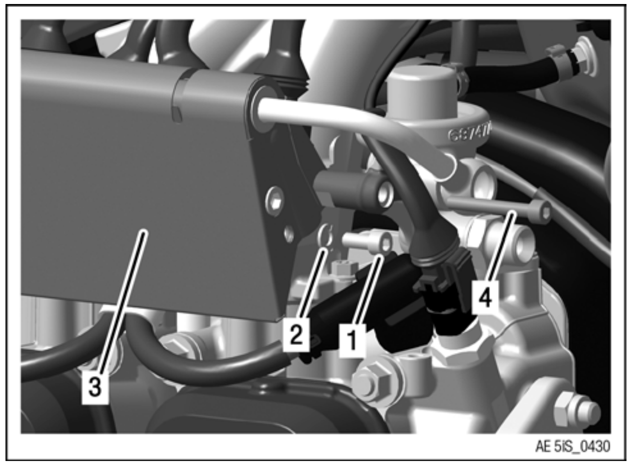


Figure 11.27

1 Allen screw M5x12 *2 Lock washer 5.3*
3 Heat shield *4 Allen screw M5x35*

Step	Procedure
6	Disconnect the injectors.

NOTE

The cables are labelled INJ_ 1 to INJ_8.

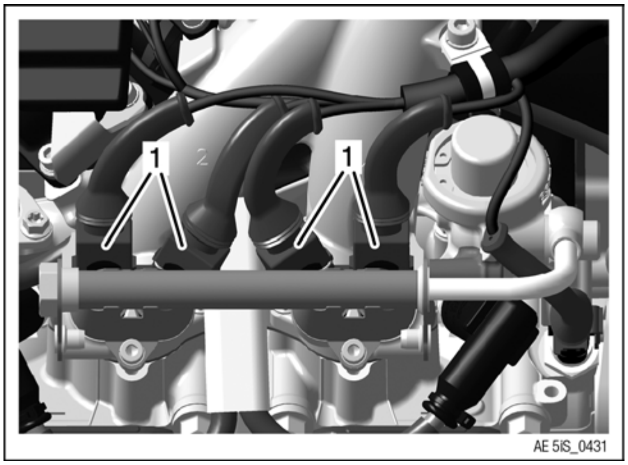


Figure 11.28

1 Injectors

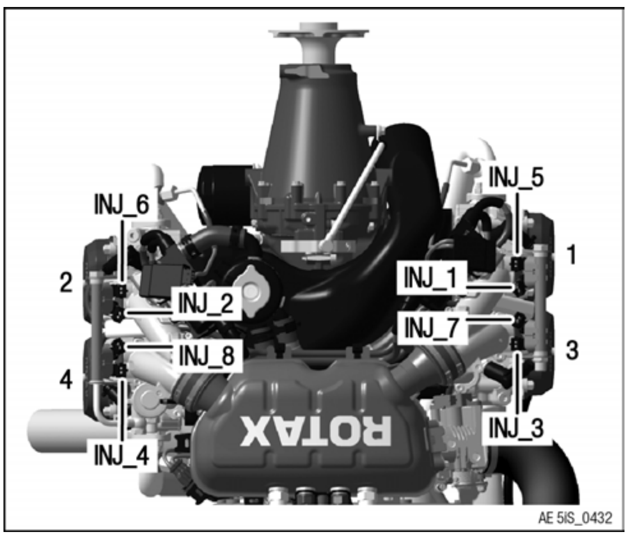


Figure 11.29: Labelling diagram

Step	Procedure
7	Use a screwdriver to lever out the spring clip and then unplug the connector.

NOTE

Let the wire clip snap back in after the connector has been disconnected so that it does not get lost.

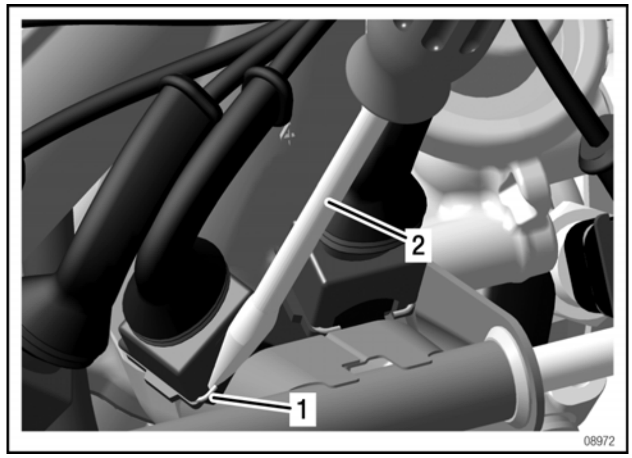


Figure 11.30

1 Injector connectors *2 Screwdriver*

Step	Procedure
8	Loosen the two Allen screws M5x12 of the left-hand fuel rail (2/4) attachment and the two Allen screws M5x12 of the right-hand fuel rail (1/3) with the lock washers.
9	Remove the fuel rail on the left and right of the intake manifold.

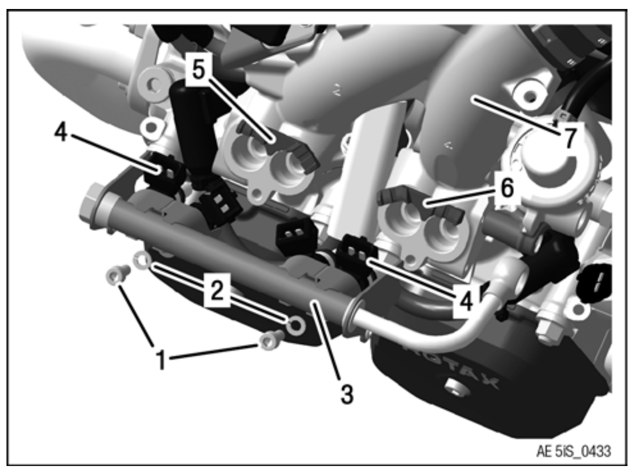


Figure 11.31

1	*Allen screw M5x12*	*2*	*Lock washer DIN 128–A5–FST*
3	*Fuel rail (2/4)*	*4*	*Injectors*

5	*Left damper*	6	*Right damper*
7	*Intake manifold*		

(2/4) AND (1/3) FUEL RAIL — DISASSEMBLY

Step	Procedure
1	Remove the injectors individually from the fuel rail.

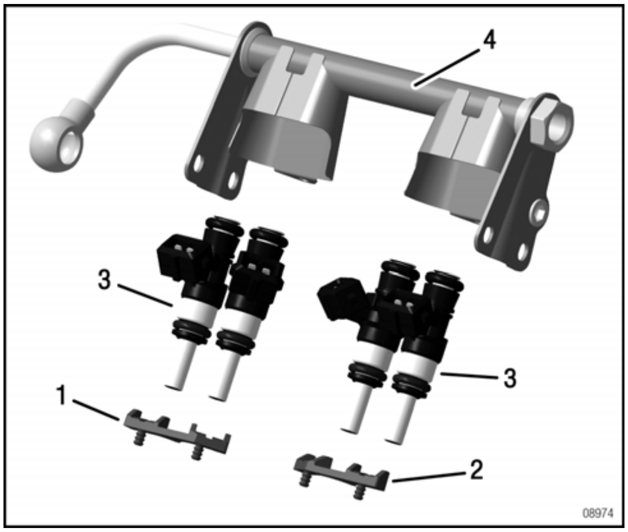


Figure 11.32

1	*Left damper*	2	*Right damper*
3	*Injectors*	4	*Fuel rail*

INTAKE MANIFOLD — REMOVAL

Preparation

Drain the fuel.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

- Unscrew the feed line to fuel rail 1/3 and the return line to fuel rail 2/4 and fuel pressure regulator and close them with the appropriate caps.
- Remove the (left and right) fuel rails.
- Remove the injectors from the fuel rails.
- Remove the fuel pressure regulator assy.

DOUBLE IGNITION COIL – REMOVAL

See Chapter 74–20–00 Double ignition coil - removal.

2/4 INTAKE MANIFOLD — REMOVAL

Step	Procedure
1	Remove the 1-ear clamps.

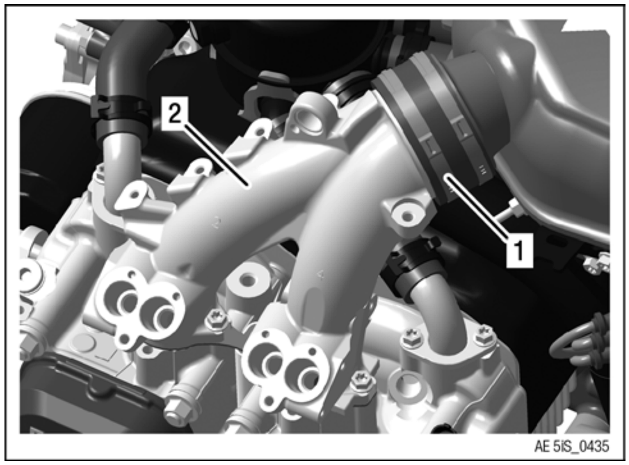


Figure 11.33

1	*1-ear clamps*	2	*Intake manifolds*

Step	Procedure
2	Loosen 4 hex./torx collar screws M6 inwards for attachment to the cylinder head 2/4. Use the special tool part no. 876180.
3	Loosen the two inner hex./torx collar screws.

ATTENTION

Screws cannot be completely unscrewed. To remove the screws, the intake manifold must be lifted after loosening all 4 hex./torx collar screws.

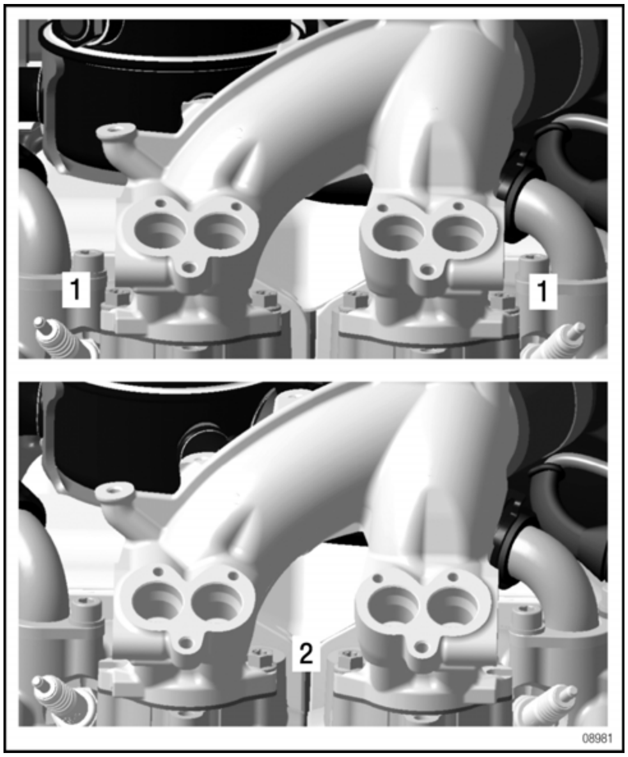


Figure 11.34

1 Outer screw-fastening 2 Inner screw-fastening

Step	Procedure
4	Remove the insulating flange of the cylinder
5	Close the intake duct using a plug (part no. 860397).

ATTENTION

Close the intake duct immediately so that no debris particles can get into the combustion chamber!

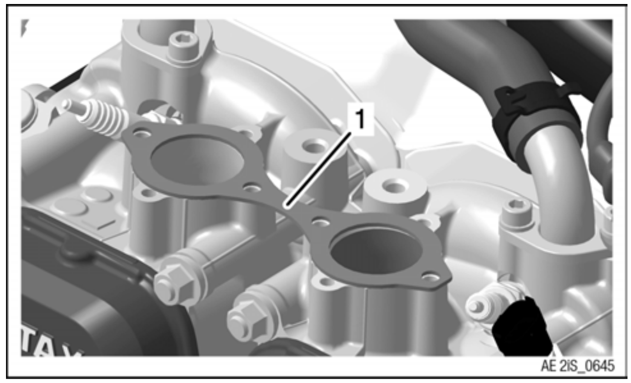


Figure 11.35

1 Insulating flange

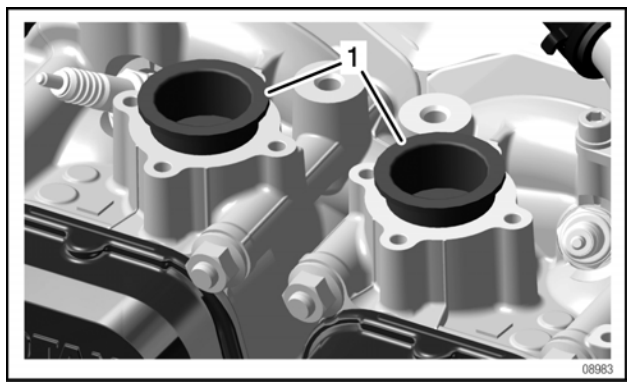


Figure 11.36

1 Plug part no. 860397

1/3 INTAKE MANIFOLD — REMOVAL

- It is removed in the same way as the 2/4 intake manifold.

PRESSURE AND TEMPERATURE SENSOR — DISCONNECTION

Preparation

- Unplug the connectors of the 2 pressure sensors and 2 temperature sensors. See Chapter 76-50-00 section Wiring harness.
- Loosen and detach the wiring harness (main strand) from all fastenings (cable ties, retaining fixtures) on the engine. See Chapter 76-50-00 section Wiring harness.
- For removal and installation of pressure and temperature sensors, see Chapter 76-70-00 section Sensors and actuators.

NOTE

The pressure and temperature sensors must only be removed if absolutely necessary!

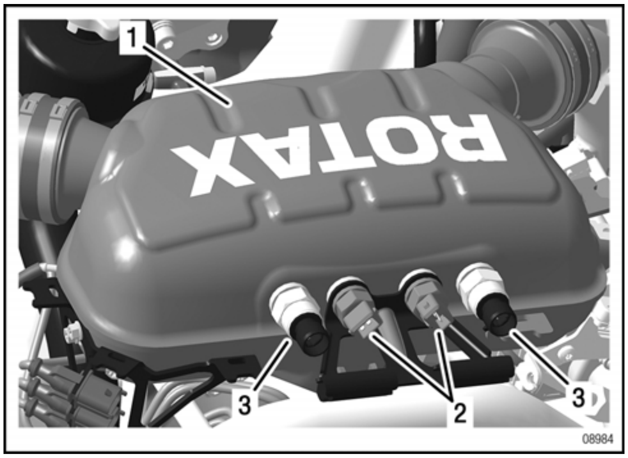


Figure 11.37

1 Airbox *2 Temperature sensor*

3 Pressure sensors

AIRBOX — REMOVAL

Step	Procedure
1	Remove the hex. nut M6 attaching the airbox to the ignition housing along with the washer.

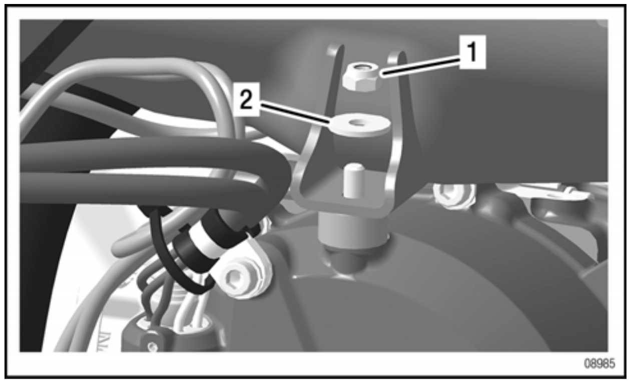


Figure 11.38

1 Hex. nut M6 *2 Washer 6.4*

Step	Procedure
2	Remove the two 1-ear clamps.
3	Remove the airbox.

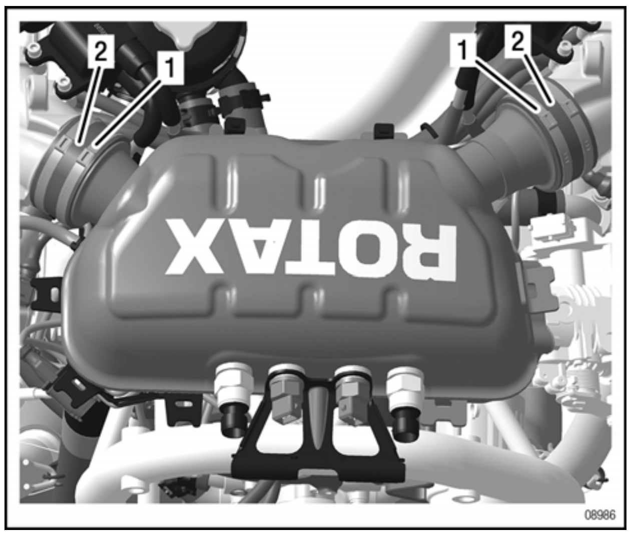


Figure 11.39

1 1-ear clamps *2 Connecting piece*

NOTE

Remove the nipple and M6x16 screw only if absolutely necessary!

Step	Procedure
4	Remove the nipple and M6x16 screw.

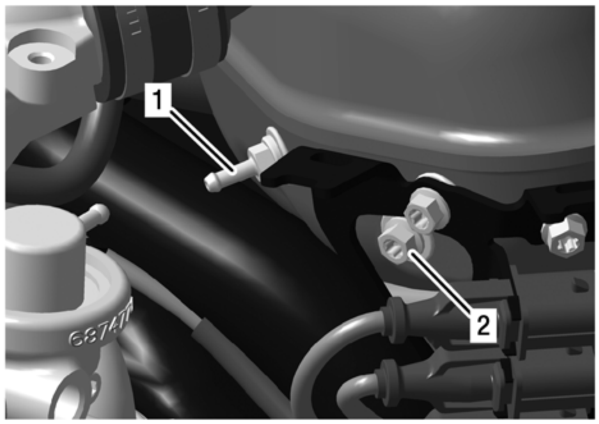


Figure 11.40

1	*Nipple*	2	*M6x16 screw*

THROTTLE BODY ASSY. — REMOVAL

Preparation

- General visual inspection. See relevant Maintenance Manual Line for the 915 i A Series type.

Step	Procedure
1	Remove the throttle body assy.
2	Remove the clamp and the air intake hose (delivered by manufacturer) from the throttle body assy.

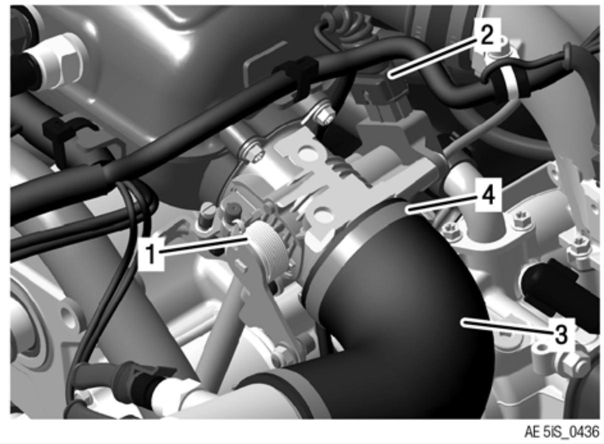


Figure 11.41

1	*Throttle body assy.*	2	*Connector*
3	*Air intake hose*	4	*Clamp*

Step	Procedure
3	Remove the throttle cable from the throttle body.
4	Loosen 3 hex./torx flange screws M6x12 with the fixation latch.

NOTE

They are installed with LOCTITE 243!

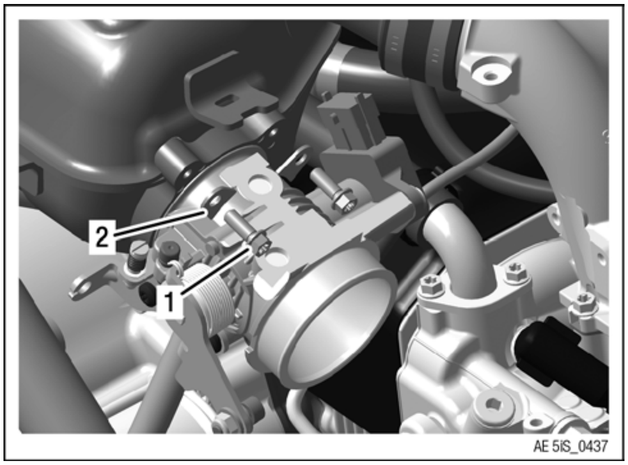


Figure 11.42

1	*Hex./torx flange screws M6x12*	2	*Fixation latch*

ATTENTION

Do not lose the rubber gasket ring and ensure that it does not remain in the airbox.

Step	Procedure
5	Remove the throttle body and the rubber gasket ring.

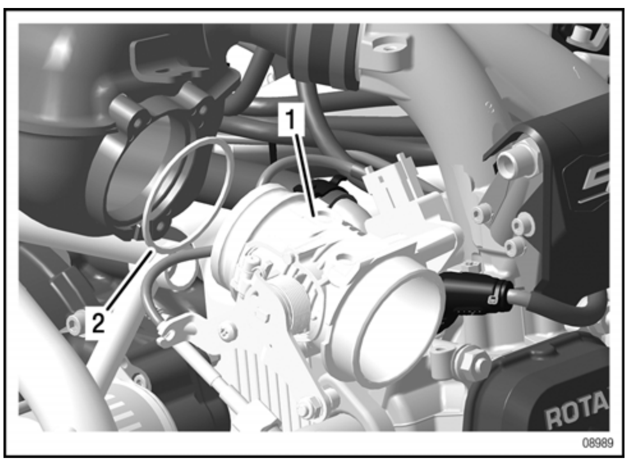


Figure 11.43

1	*Throttle body*	2	*Rubber gasket ring*

INSPECTION

POP OFF VALVE — CHECK

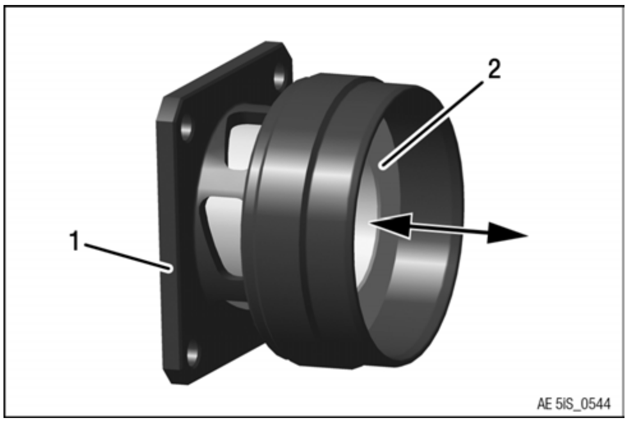
Preparation

- Clean all parts carefully

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

Check — assembled state:

Step	Procedure
1	Check free movement of valve piston.
2	Actuate piston manually several times till end stop and it must move back to initial position with spring tension.



1 Valve housing *2 Valve piston*

Figure 11.44

Check — disassembled state:

Step	Procedure
3	Check bore of the valve piston for dirt and foreign particles.
4	Check sealing ring of valve piston.
5	Assemble pop off valve and check with vacuum.

FUEL DISTRIBUTION SINGLE PARTS — CHECK

Preparation

Clean all parts carefully.
See Maintenance Manual Line the engine type 915 i A Series Chapter 05-00-00 section Procedure.

FUEL LINE ASSY. — INSPECTION

Step	Procedure
1	Check the fuel line assy. for cracks, scuffing marks and kinks.

ATTENTION

Cracks in the fuel distribution system, its components and hoses are not permissible!
If in doubt, check the affected parts for cracks with a florescent penetrant method.

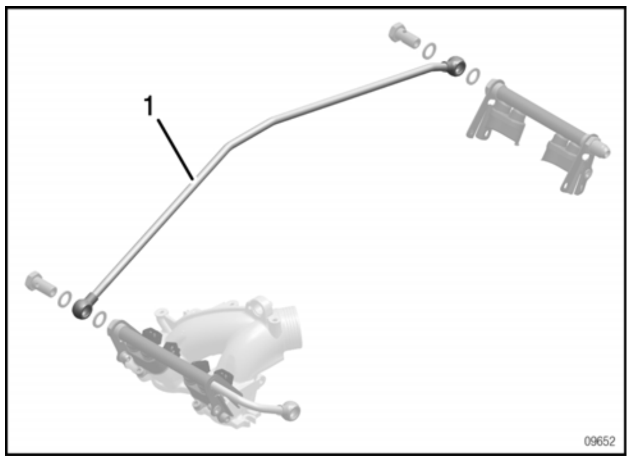


Figure 11.45

1 Fuel hose assy.

FUEL PRESSURE REGULATOR ASSY. — INSPECTION

Step	Procedure
1	Check all the O-rings.

NOTE

If an O-ring is damaged, the entire fuel pressure regulator must be replaced. O-rings are not available as spare parts.

Step	Procedure
2	Check the screen for dirt.

NOTE

If the screen is dirty, all the prefilter must be checked for function and dirt.

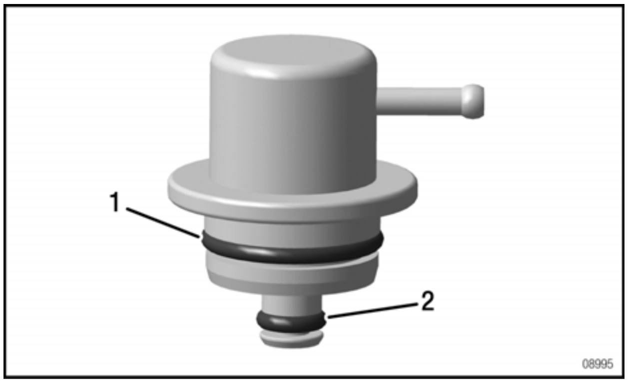


Figure 11.46

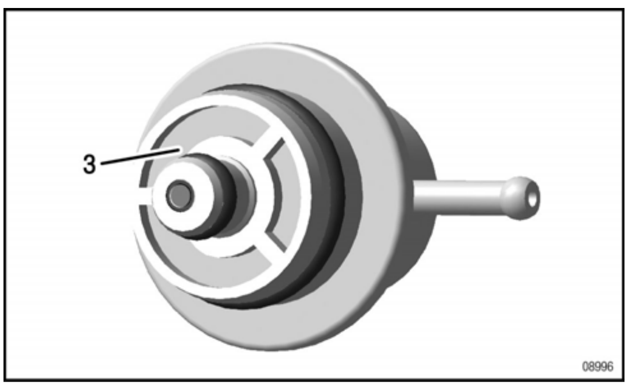


Figure 11.47

1	*20x2.5 O-ring*	*2*	*5x2.5 O-ring*
3	*Screen*		

PRESSURE REGULATOR HOUSING — INSPECTION

Step	Procedure
1	Check the sealing surfaces of the O-rings for striations.
2	Check the recess of the retaining ring for sharp edges and burrs.

NOTE

The depressions must not have sharp edges! Sharp edges can be carefully reworked with a sharpening stone. The surface roughness must not be changed!

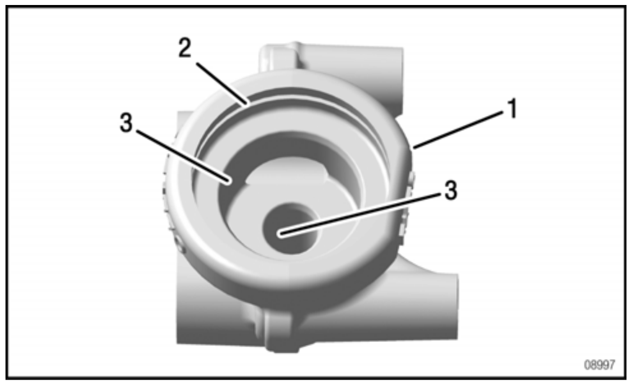


Figure 11.48

1	*Pressure regulator housing*	*2*	*Recess for retaining ring*
3	*Sealing surface for O-rings*		

FUEL RAIL — INSPECTION

Step	Procedure
1	Check the sealing surfaces for the O-rings of the injectors for scratches and burrs.
2	Visual inspection for dents, kinks and cracks.

ATTENTION

The fuel rail must be replaced if damaged!

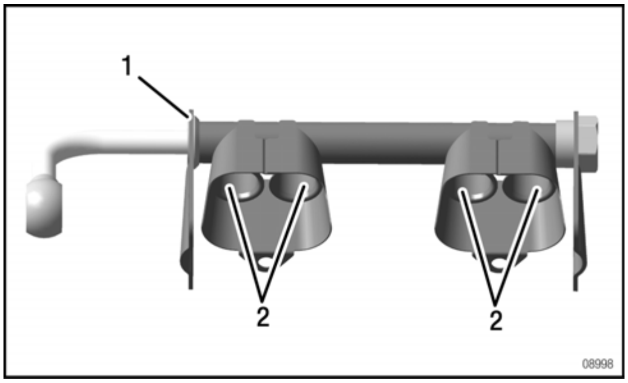


Figure 11.49

1	*Fuel rail*	2	*Sealing surface for O-rings*

INJECTOR — INSPECTION

Step	Procedure
1	Check the injectors for damage. • Scuffing marks (including scratches) on the valves are permissible up to a maximum depth of 0.2 mm (0.0079 in.).
2	All O-rings must be replaced if the injectors have been repaired.

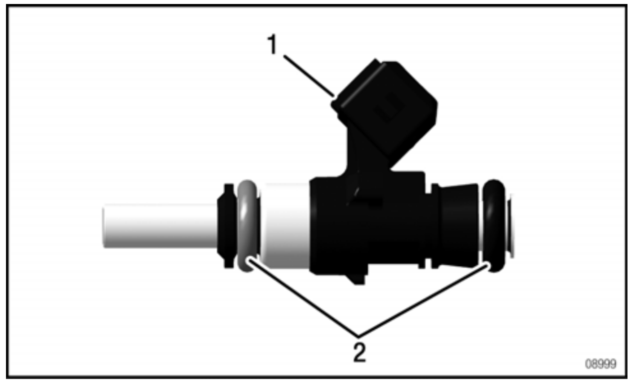


Figure 11.50

1	*Injector*	2	*O-rings*

INTAKE MANIFOLD — INSPECTION

Step	Procedure
1	Check the intake manifold for cracks and scuffing marks.
2	Check threaded bores for damage.
3	Check bores for injector for scuffing marks. Scuffing marks (including scratches) on the valves are permissible up to a maximum depth of 0.2 mm (0.0079 in.).

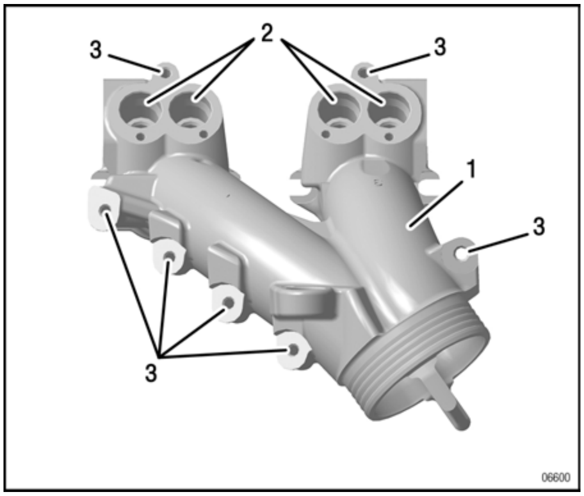


Figure 11.51

1 Intake manifold
2 Injector bore
3 Threaded bores

Step	Procedure
4	Check contact and flat surfaces for Allen/ hex. screws, nuts and sensors. • Indentations up to a maximum of 0.1 mm (0.0039 in.) are permissible. • Bumps up to a maximum of 0.1 mm (0.0039 in.) are permissible.

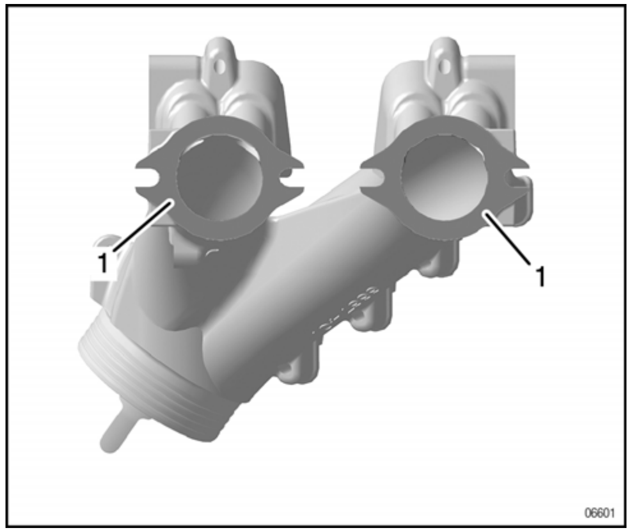


Figure 11.52

1 Contact face

AIRBOX — INSPECTION

Step	Procedure
1	Check the airbox for damage and wear.
2	Check the support plates for damage.
3	Check the connecting pieces for brittleness.
4	Check threaded bores for damage.

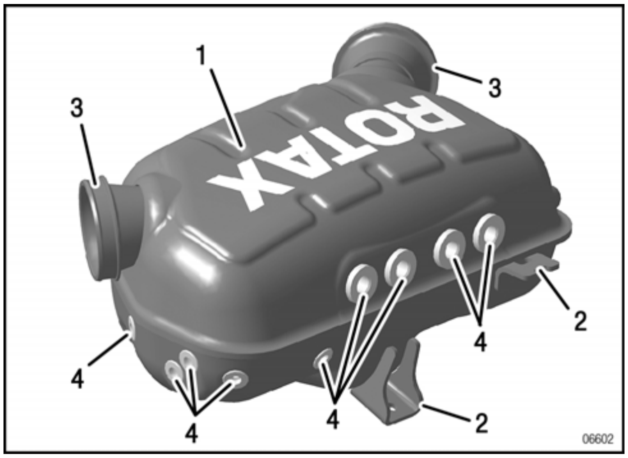


Figure 11.53

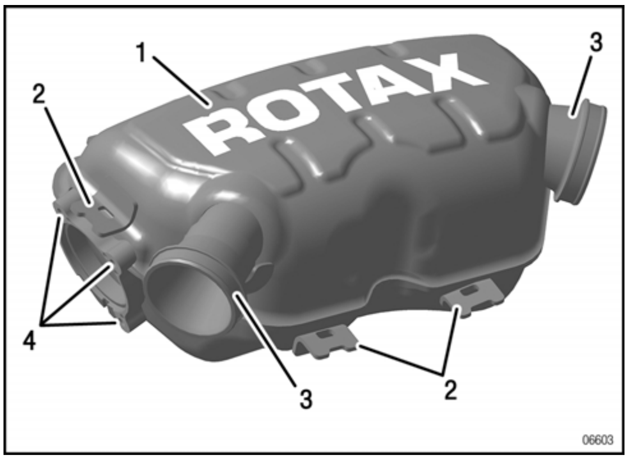


Figure 11.54

1	*Airbox*	*2*	*Support plate*
3	*Connecting piece*	*4*	*Threaded bores*

THROTTLE BODY — INSPECTION

ATTENTION

Danger of consequent damage to engine!
The throttle body must not be re-machined! If the throttle body is damaged or worn, it must be replaced with a new part.

Step	Procedure
1	Check the throttle body for damage and wear.
2	Check the bearing of the throttle shaft for damage.

NOTE

Wear of more than 0.1 mm (0.0039 in.) is not permissible.

Step	Procedure
3	Check the throttle flap for damage.

NOTE

Traces of wear up to a maximum of 0.05 mm (0.0020 in.) in depth are permissible.

Step	Procedure
4	Check the evenness of the flat and contact surfaces of the throttle body and bent socket with respect to each other.

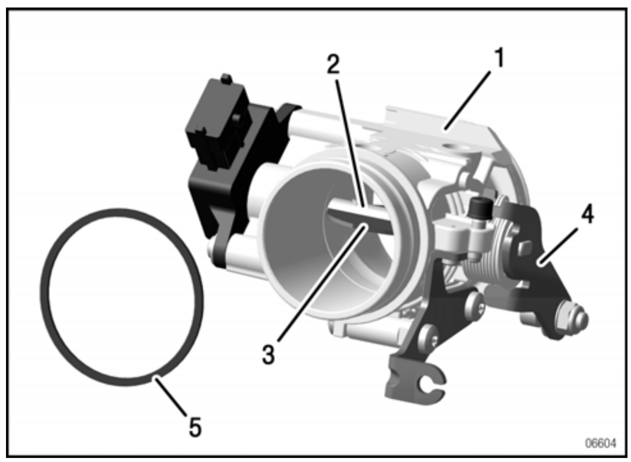


Figure 11.55

1	*Throttle body assy.*	*2*	*Throttle shaft*
3	*Throttle valve*	*4*	*Throttle cable*
5	*Rubber gasket ring*		

Step	Procedure
5	Ensure that the throttle valve and the Bowden cable can move freely.
6	Check that the fastening and securing elements are secure.

FUEL PUMP ASSY. SINGLE PARTS — CHECK

Preparation

Clean all parts carefully.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-00-00 section Procedures

Carry out a visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-20-00 section Maintenance.

FUEL PUMP — INSPECTION

Step	Procedure
1	Check the fuel pumps for damage and wear.

ATTENTION

No longitudinal scratches are allowed on the connections!

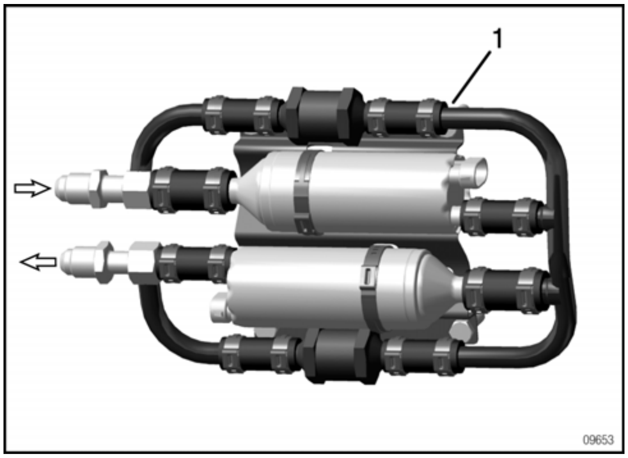


Figure 11.56

1 *Fuel pump assy.*

LINE AND HOSE — INSPECTION

Standard inspection

Step	Procedure
1	Check the lines and hoses for damage and wear.

5 year exchange with new ROTAX® fuel pump service kit

Step	Procedure
1	Check the ROTAX® fuel pump service kit for completeness, damage and/or scratch marks.

AIR FILTER — INSPECTION

Step	Procedure
1	Check the air filter according to the aircraft manufacturer's instructions. See relevant Maintenance Manual Line Chapter 12-20-00.

ASSEMBLY

FUEL PRESSURE REGULATOR — ASSEMBLY

The fuel pressure regulator is assembled and disassembled in the same way. The following should be noted.

Step	Procedure
1	Lubricate the O-rings lightly with Lithium-base grease.

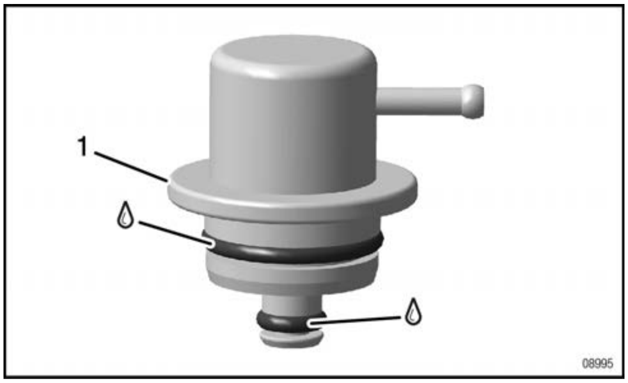


Figure 11.57

1 Fuel pressure regulator

Step	Procedure
2	Install the fuel pressure regulator in the pressure regulator housing until it stops.
3	Install the retaining ring.

NOTE

When the retaining ring is mounted, it must be possible to rotate the fuel pressure regulator manually.

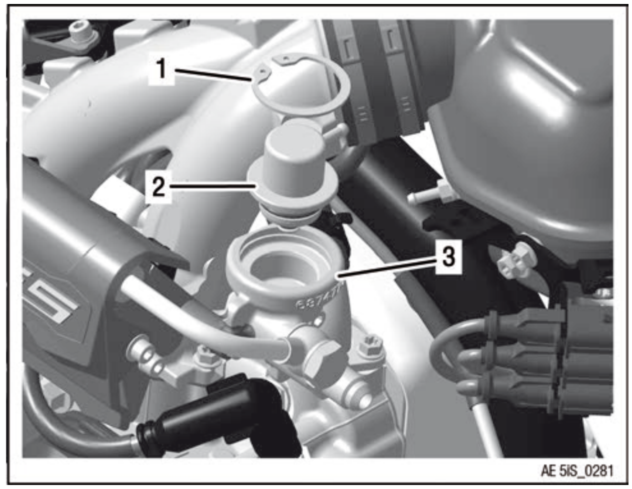


Figure 11.58

1 Retaining ring 36x1.5
2 Fuel pressure regulator
3 Pressure regulator housing

AIRBOX — ASSEMBLY

Step	Procedure
1	Secure the nipple with LOCTITE 243. Tightening torque 5 Nm (44 in. lb.)
2	Secure the screw M6x12 and with LOCTITE 243. Tightening torque 5 Nm (44 in. lb.)

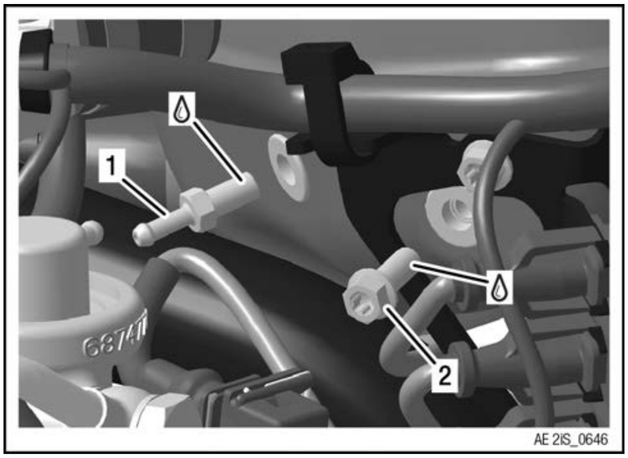


Figure 11.59

1 Nipple *2 Screw M6x12*

Step	Procedure
3	For pressure sensor and temperature sensor installation, see Chapter 76-70-00.

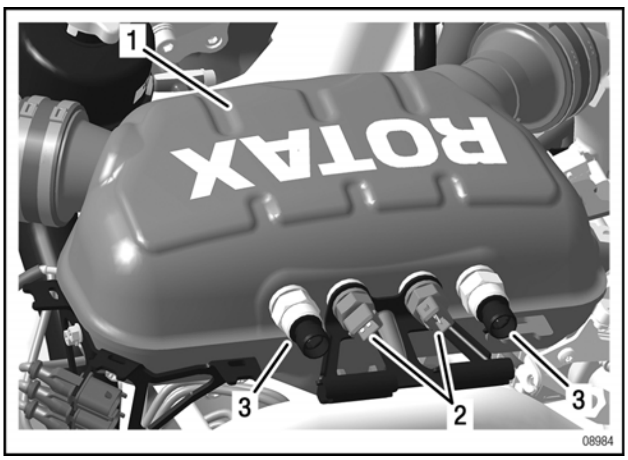


Figure 11.60

1 Airbox *2 Temperature sensor*

3 Pressure sensors

INTAKE MANIFOLD — INSTALLATION

Step	Procedure
1	Place the insulating flange on the cylinder heads.
2	Place on the 2/4 and 1/3 intake manifolds.

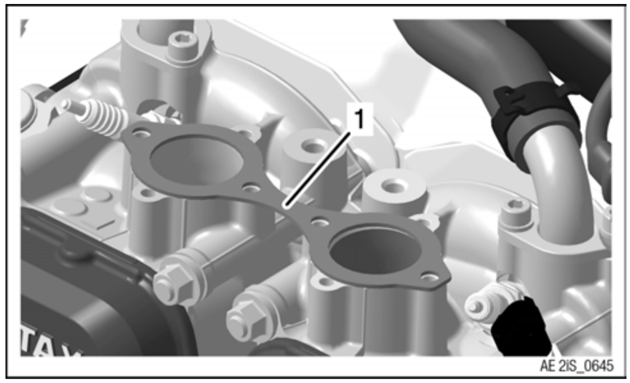


Figure 11.61

1 Insulating flange

ATTENTION

1-ear clamps may only be used once!

Step	Procedure
3	Fix the 2/4, 1/3 intake manifolds with 8 hex./torx collar screws M6x20 from the inside outwards, using special tool part no. 876180. Tightening torque 10 Nm (89 in. lb.). **NOTE** *Check tightening torque after test run again.*
4	Install new 1-ear clamps.

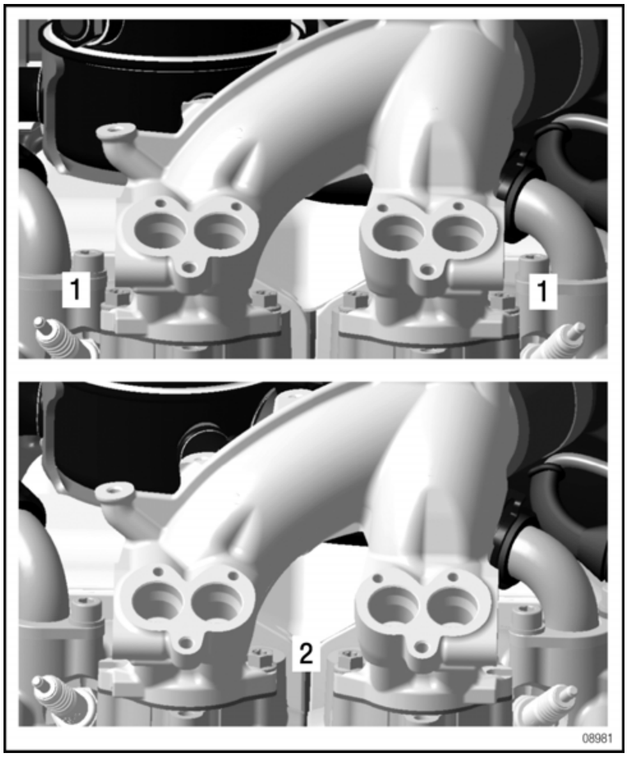


Figure 11.62

1 Outer screw-fastening 2 Inner screw-fastening

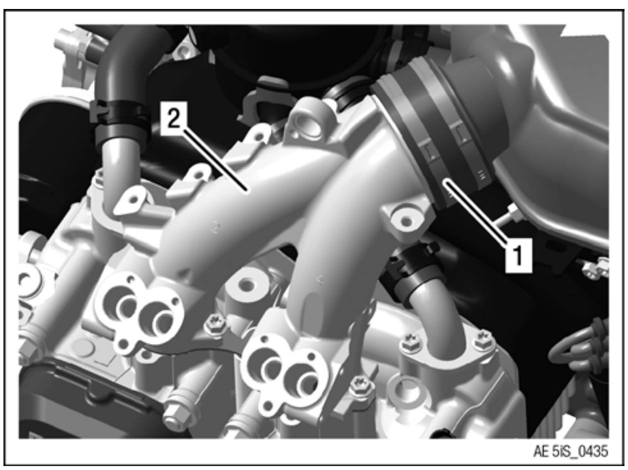


Figure 11.63

1 1-ear clamp 2 Intake manifold

- Install double ignition coil. To do this, see Chapter 74–20–00 section Double ignition coil.

INSTALLATION OF (2/4) AND (1/3) FUEL RAILS

The fuel rails (2/4) and (1/3) are installed and removed in the same way. The following should be noted.

Step	Procedure
1	Lubricate the O-rings of the injectors lightly with Lithium-base grease.

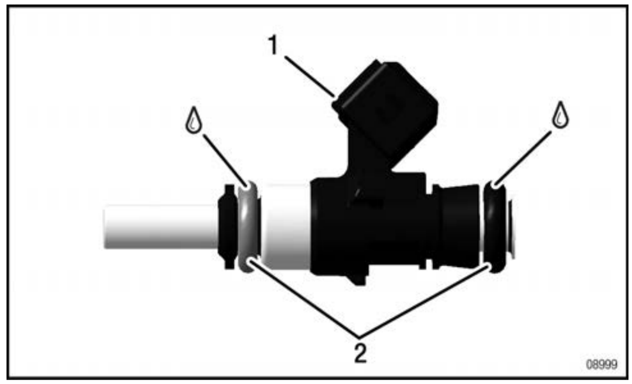


Figure 11.64

1 Injector 2 O-rings

NOTE

When a used injector is reinstalled, new O-rings must be installed, and the injector must be inserted by hand.

Step	Procedure
2	Install the injectors and rubber dampers.

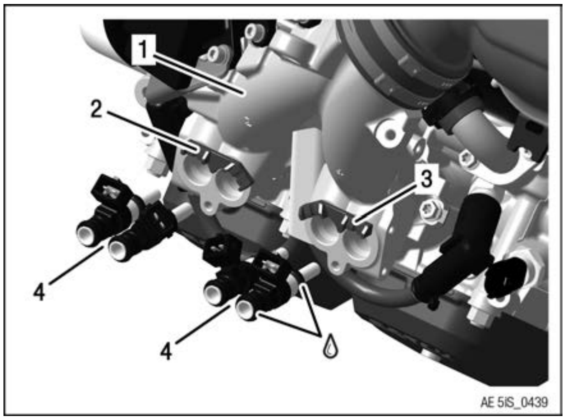


Figure 11.65

1	*Intake manifold*	2	*Left damper*
3	*Right damper*	4	*Injectors*

NOTE

The left-hand and right-hand dampers are different and are used to position and fix the injectors.

Step	Procedure
3	Fix the fuel rail on the left and right of the intake manifold with Allen screws M5x12 and washers 5.3. Tightening torque 5 Nm (44 in. lb.)

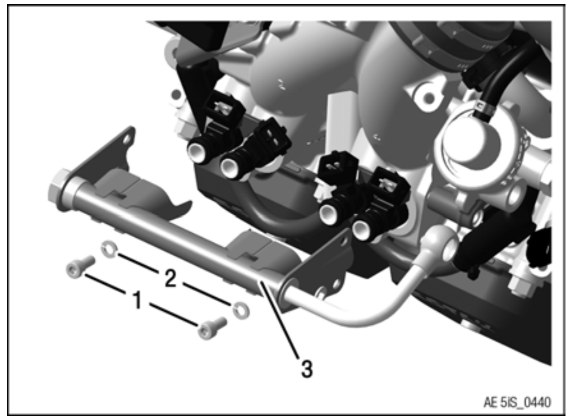


Figure 11.66

1	*Allen screws M5x12*	2	*Lock washers DIN 128-A5-FST*
3	*Fuel rail*		

Step	Procedure
4	Insert in the injectors.
5	Re-install connectors.

NOTE

The cables are labelled INJ_1 to INJ_8.

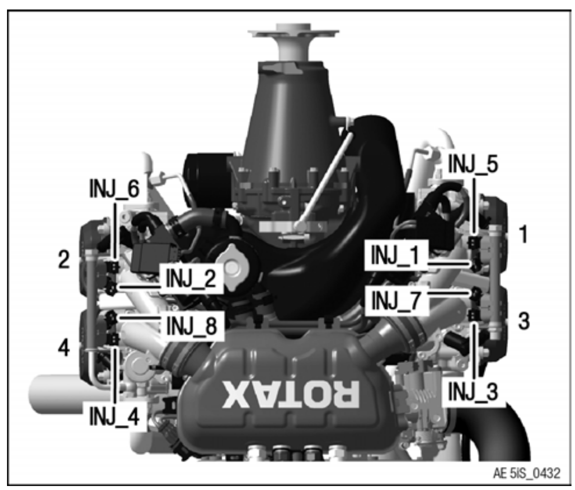


Figure 11.67

Step	Procedure
6	Fasten the heat shield with 4 Allen screws M5x12 and lock washers 5.3. Tightening torque 5 Nm (44 in. lb.)

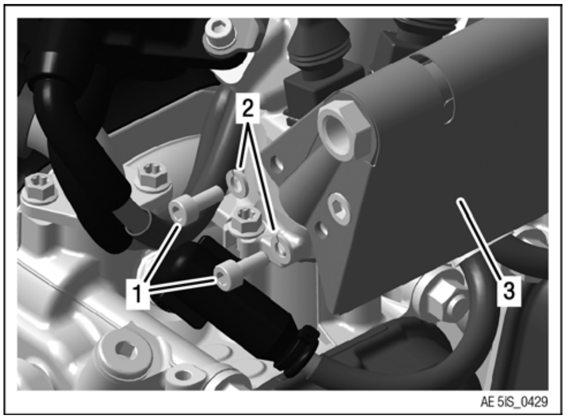


Figure 11.68

1 Allen screw M5x12 *2 Washer 5.3*
3 Heat shield

Step	Procedure
7	Fix the fuel pressure regulator for cylinders 2 and 4 with an Allen screw M5x35. Tightening torque 5 Nm (44 in. lb.).

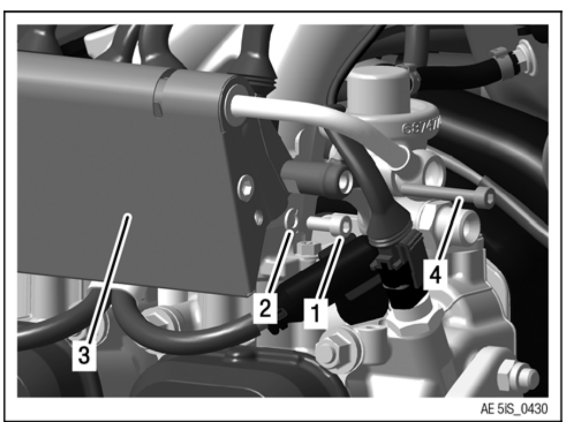


Figure 11.69

1 Allen screw M5x12 *2 Washer 5.3*
3 Cover *4 Allen screw M5x35*

Step	Procedure
8	Install the cover with an Allen screw M5x12 and lock washer 5.3. Tightening torque 5 Nm (44 in. lb.)

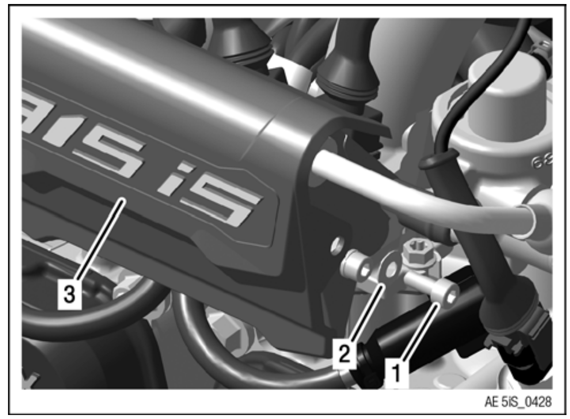


Figure 11.70

1 Allen screw M5x12 *2 Washer 5.3*
3 Cover

FUEL PRESSURE REGULATOR ASSY. — INSTALLATION

The fuel pressure regulator assy. is installed and removed in the same way. The following should be noted.

Step	Procedure
1	Fix the fuel pressure regulator assy. with an Allen screw M5x35 and an Allen screw M5x45. Tightening torque 8 Nm (70 in. lb.).

NOTE

Tighten the Allen screw M5x45 first. The heat shield is screwed on along with the front Allen screw M5x35.

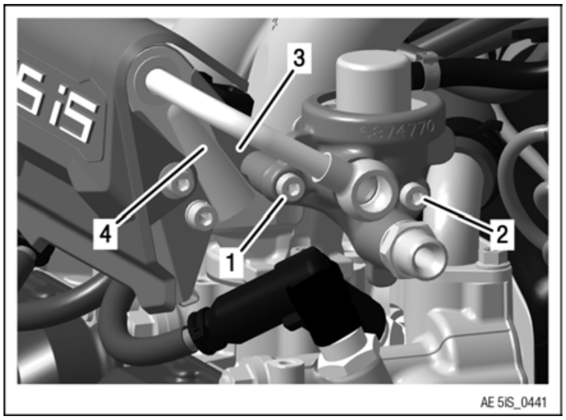


Figure 11.71

1	*Allen screw M5x35*	2	*Allen screw M5x45*
3	*Heat shield*	4	*Fuel rail*

Step	Procedure
2	Install the banjo bolt M12x1.5x24 with two gasket rings A12x18. Tightening torque 25 Nm (18 ft. lb.).

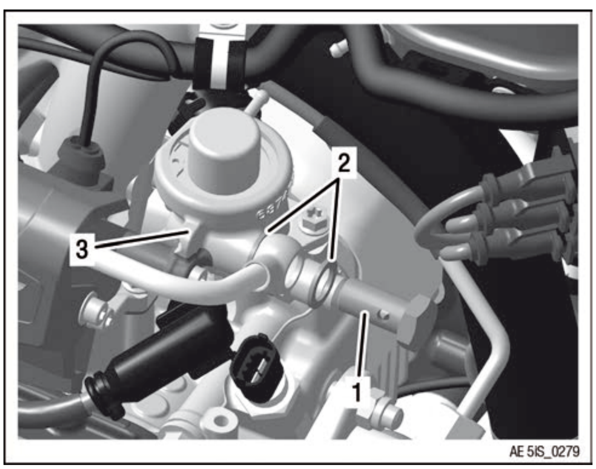


Figure 11.72

1	*Banjo bolt M12x1.5x24*	2	*Gasket rings A12x18*
3	*Fuel pressure regula-tor assy.*		

Step	Procedure
3	Fix tube 60 (regulator/airbox) with 2 cable ties.
4	Plug in temperature sensor CTS.

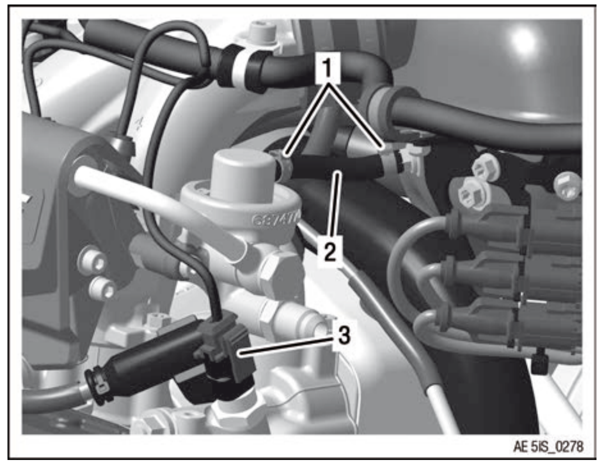


Figure 11.73

1	*Cable ties 94x2.5 mm*	2	*Tube 60 +/-3mm*
3	*Temperature sensor CTS*		

FUEL PUMP ASSY. SINGLE PARTS — ASSEMBLY

NOTE

Always use new parts for assembly.

For understanding the position numbers see illustration “fuel pump single parts” at the beginning of this chapter.

Step	Procedure
1	Position new hoses (pos. 12) on connection line (pos. 15).
2	Slip on new 1-ear clamps (pos. 13).
3	Install the check valves (pos. 14) and the fuel pumps (pos. 8).
4	Position new hoses (pos. 10, 12) on check valves (pos. 14) and the fuel pumps (pos. 8).
5	Install new 1-ear clamp (pos. 9) on the fuel pump bracket assy. (pos. 2).
6	Slide in the check valves and fuel pumps accordingly.
7	Slip on new 1-ear clamps (pos. 11, 13).
8	Install suction line (pos. 16).
9	Install pressure line (pos. 17).
10	Temporarily position complete fuel pump module assy. (pump bracket assy. pos. 2 with fuel pumps pos. 8 etc.) in the fuel pump housing (pos. 1).
11	Arrange the position of the fuel pumps, check valves, hoses etc. accordingly to fit within the fuel pump housing.

ATTENTION

Do not overtighten the 1-ear clamps, otherwise the fuel pump rotor may stick and pump does not work.

Step	Procedure
12	Mount and crimp the two fuel pump 1-ear-clamps (pos. 9). **NOTE** *Use e.g. ear clamp pliers KNIPEX 1099.*
13	For easier work on the consequent job tasks, remove the complete fuel pump module assy. from the fuel pump housing without relocating hoses, check valves, fuel pumps etc.
14	Mount and crimp 1-ear-clamps (pos. 11, 13). **NOTE** *Use e.g. ear clamp pliers KNIPEX 1099.*
15	Place complete fuel pump module assy. (pump bracket assy. (pos. 2) with fuel pumps (pos. 8) etc.) in the fuel pump housing.
16	Install hex. nuts M6 (pos. 3) with LOCTITE 243. Tightening torque 10 Nm (90 in. lb.).
17	Before installing the fuel pump cover, perform a leakage check. See section Leakage check.
18	Install the wiring and rubber grommets (pos. 6) into fuel pump housing (pos. 1).
19	Connect electrical connectors to MAIN and AUX fuel pump (pos. 8).
20	If still installed in aircraft: Connect the fuel lines from aircraft system.
21	If there is enough fuel in the tank, switch on the fuel pumps.

Step	Procedure
	NOTE *Engine is still turned off.*
22	Let the fuel pumps run for a minute.
23	Check if fuel is leaking out of the system. If a leakage occurs, fix that problem before going on.
24	Install fuel pump cover (pos. 4) using 4 Allen screws M5x12 (pos. 7). Tightening torque 6 Nm (55 in. lb.).

Leakage check

Step	Procedure
1	Block the OUTLET of the fuel pump assembly with suitable connector.
2	Connect the INLET of the fuel pump assembly to a differential pressure gauge.
3	Apply 6 bar (87 psi) to the fuel pump assembly.
4	NO pressure loss is allowed on the differential pressure gauge.
5	Submerge the pressurized fuel pump assembly in a suitable fluid, e.g. fuel, universal solvent.
6	If any air bubbles are present at rubber hose connections, replace the clamp and ensure proper crimp. An extra clamp of each size is provided in the service kit.

NOTE

Assemble with clean parts only in a clean environment!

NOTE

Ensure that check valves and fuel pumps remain in original orientation.

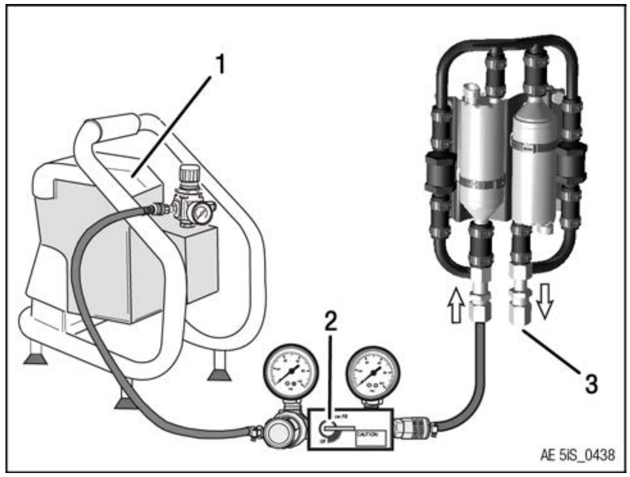


Figure 11.74: Leakage check

1 Air compressor *2 Differential pressure tester*

3 Outlet (to engine)

FUEL PUMP ASSY. — ASSEMBLY

Step	Procedure
1	Fix the fuel pump unit in the housing with 4 hex. nuts M6. Tightening torque 10 Nm (89 in. lb.)

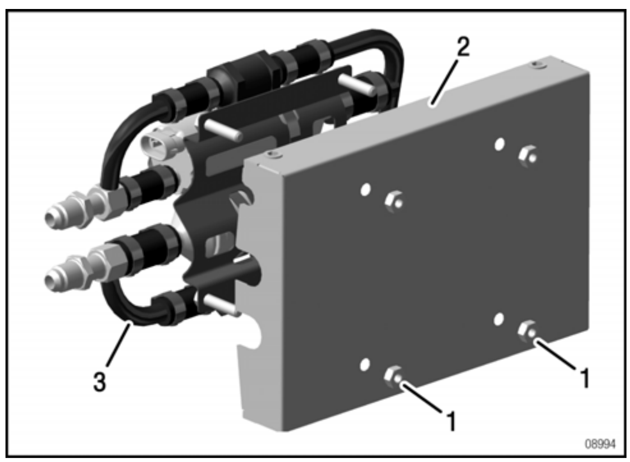


Figure 11.75

1 Hex. nut M6 *2 Housing*

3 Fuel pump unit

Step	Procedure
2	Connect the wiring harness connector appropriately. See Chapter 76-50-00 Wiring harness.
3	Fix the cover with 4 Allen screws. Tightening torque 6 Nm (53 in. lb.)
4	Install the fuel line assy.

NOTE

The position and type of positioning and attachment of the fuel pump depends on the aircraft type. See aircraft manufacturer documentation.

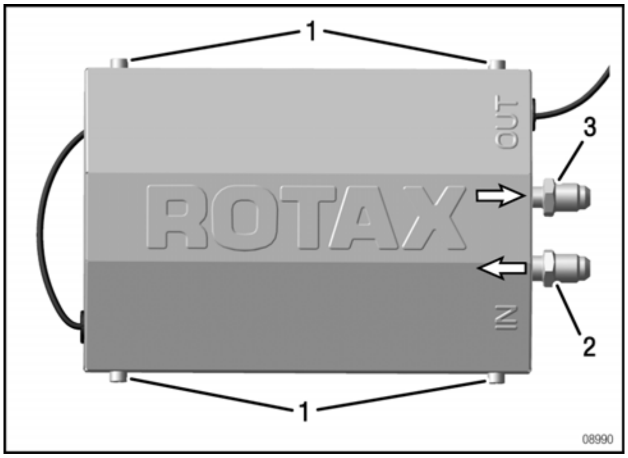


Figure 11.76

1 *Allen screws*
2 *Intake system*
3 *Pressure line*

THROTTLE BODY ASSY. — INSTALLATION

NOTE

When the throttle body is installed, a new rubber gasket ring must be used!

Step	Procedure
1	Install the rubber gasket ring.

NOTE

The rubber gasket ring is installed dry!

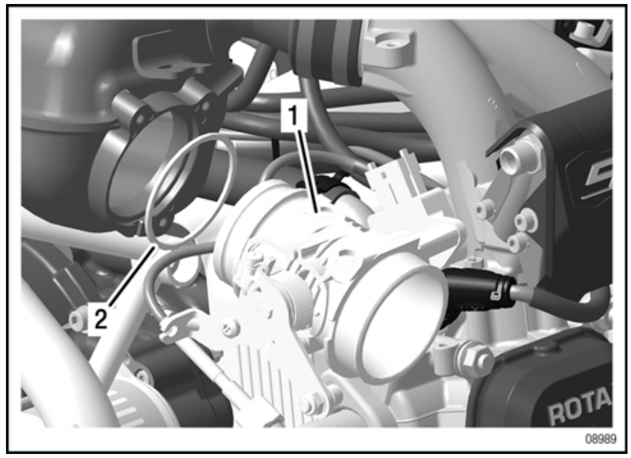


Figure 11.77

1 *Throttle body assy.*
2 *Rubber gasket ring*

Step	Procedure
2	Push the throttle body into the airbox. Secure 3 hex./torx flange screws and fixation latch with LOCTITE 243. Tightening torque 8 Nm (70 in. lb.).

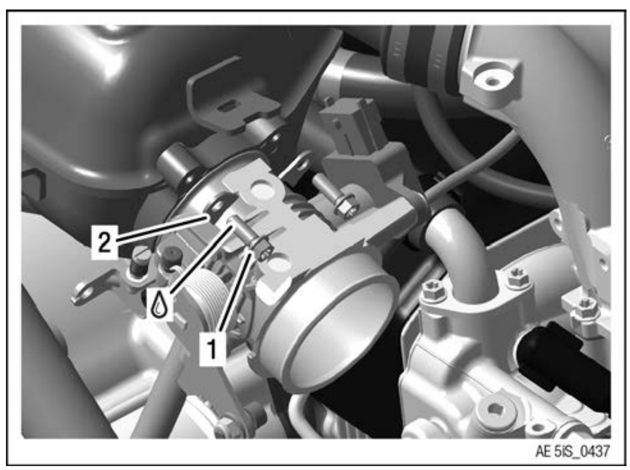


Figure 11.78

1 *Hex./torx flange screws M6x16*
2 *Fixation latch*

Step	Procedure
3	Install the air intake hose (supplied by manufacturer) on the throttle body assy. with a clamp, and plug in the EGT connector.

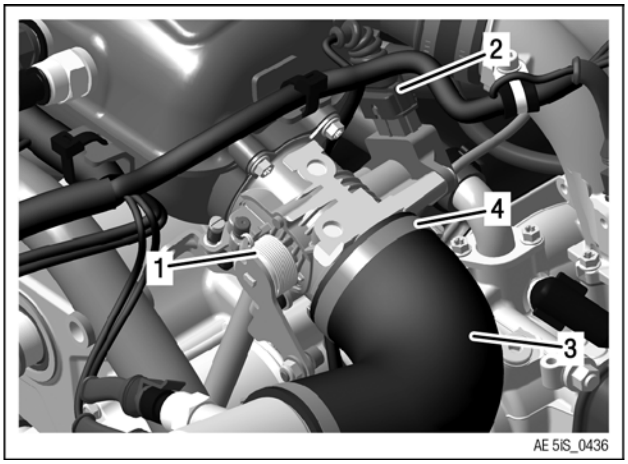


Figure 11.79

1 Throttle body assy. *2 EGT connector*
3 Air intake hose *4 Clamp 60-80*

AIRBOX — INSTALLATION

Step	Procedure
1	Install a new 1-ear clamp on the connecting piece.
2	Insert the airbox in the connecting piece.

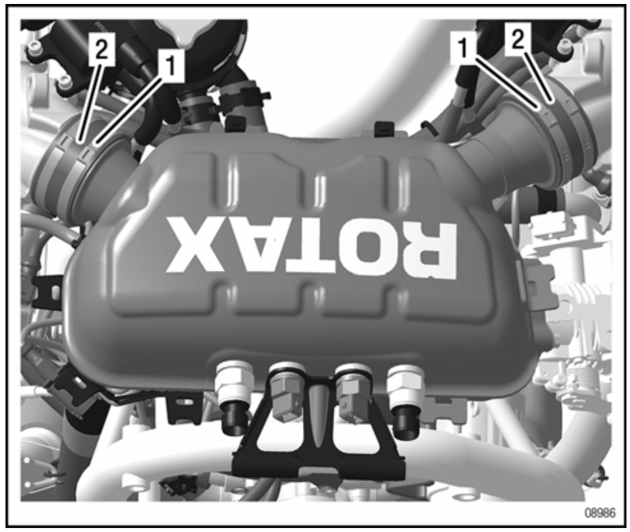


Figure 11.80

1 1-ear clamps *2 Connecting piece*

Step	Procedure
3	Fix the airbox with a new hex. nut M6 on the ignition housing. Tightening torque 10 Nm (89 in. lb.).
4	Crimp the 1-ear clamps.

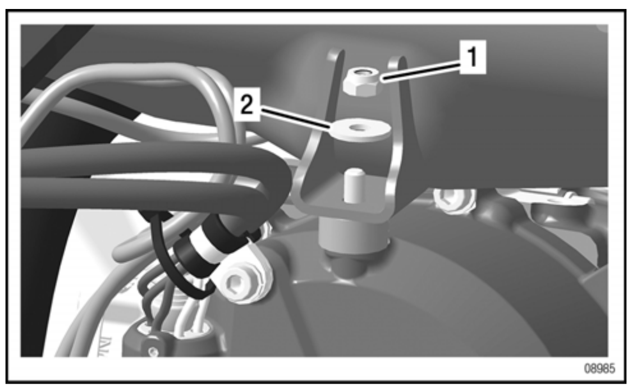


Figure 11.81

1 Hex. nut M6 *2 Washer 6.4*

Step	Procedure
5	Install double ignition coils, see Chapter 74-20-00 section Double ignition coil installation.
6	Plug in the wiring harness connector appropriately. See Chapter 76-50-00 section Wiring harness.
7	Install fuel regulator reference hose.

FUEL LINE ASSY. — INSTALLATION

The fuel line is installed and removed in the same way. The following should be noted.

ATTENTION

Install the fuel line assy. in a tension-free manner. If the line is too far away from the fuel rail, the fuel line must be adjusted. The sealing surfaces must be parallel.To be sure: The banjo bolts must fit without twisting (fuel line) and must be able to be hand tightened.

Step	Procedure
1	Fix the fuel line assy. on the left and right of the fuel rails with banjo bolts. Tightening torque 25 Nm (18 ft. lb.).

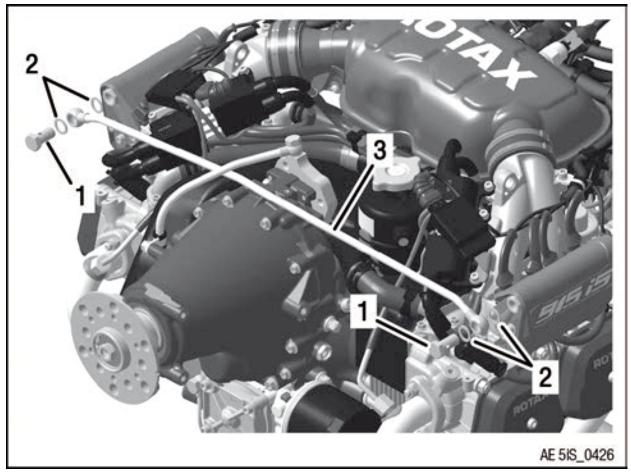


Figure 11.82

1 Banjo bolt M12x1.5 *2 Gasket ring A12x18*
3 Fuel hose assy.

Step	Procedure
2	Secure the cable clamp 8/M6 with an Allen screw M6x16 and washer 6.4 to the propeller gearbox with LOCTITE 243. Tightening torque 10 Nm (89 in. lb.).

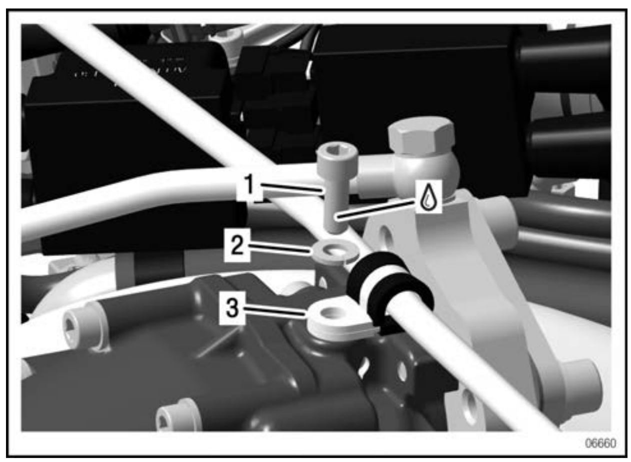


Figure 11.83

1 Allen screw M6x16 *2 Washer 6.4*
3 Cable clamp 8/M6

Step	Procedure
3	Install the inlet and outlet hoses on the 1/ 3 and 2/4 fuel rails.

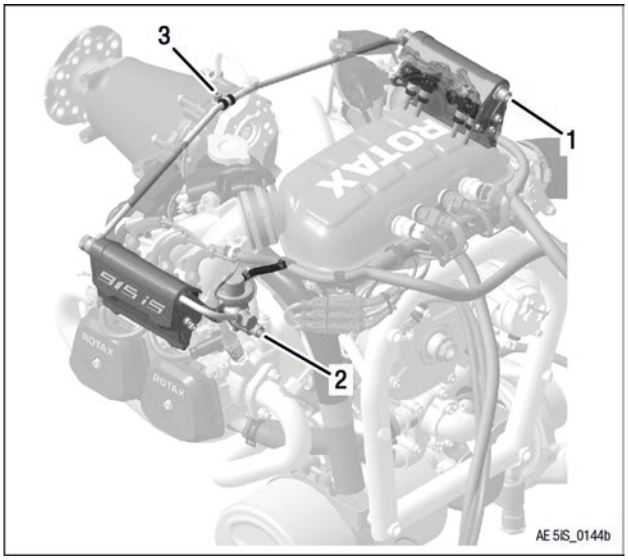


Figure 11.84

1 Inlet hose *2 Outlet hose*

POP OFF VALVE — INSTALLATION

Reduction sleeve - installation (if necessary)

- Install air intake hose and the hose to intercooler and fix with clamps.
- Install low pressure hose and fix with hose clamp.

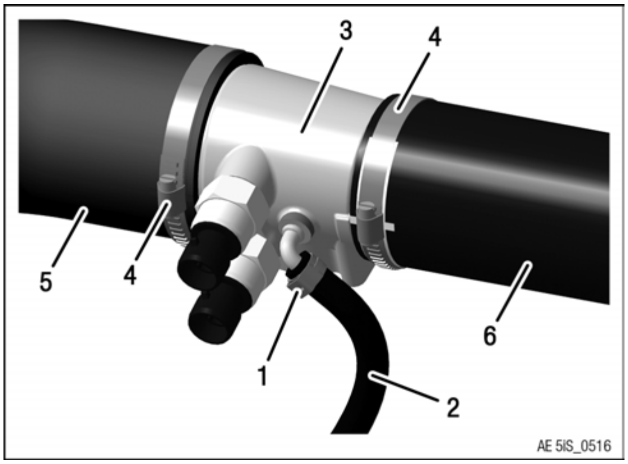
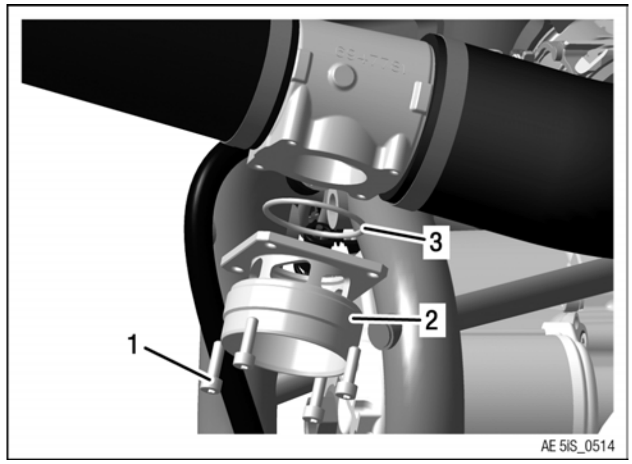


Figure 11.85

1	*Hose clamp (low pressure hose)*	*2*	*Low pressure hose*
3	*Reduction sleeve*	*4*	*Clamps (intercooler / air intake)*
5	*Air intake hose*	*6*	*Intercooler hose*

Step	Procedure
1	Install valve housing with new O-ring on reduction sleeve using 4 M5x16 Allen screws. Tightening torque 5 Nm (44 in. lb).



1	*M5x16 Allen screw*	*2*	*Valve housing*
3	*O-ring*		

Figure 11.86

Step	Procedure
2	Insert new O-ring 38x2.4 into the O-ring groove of the valve cover.

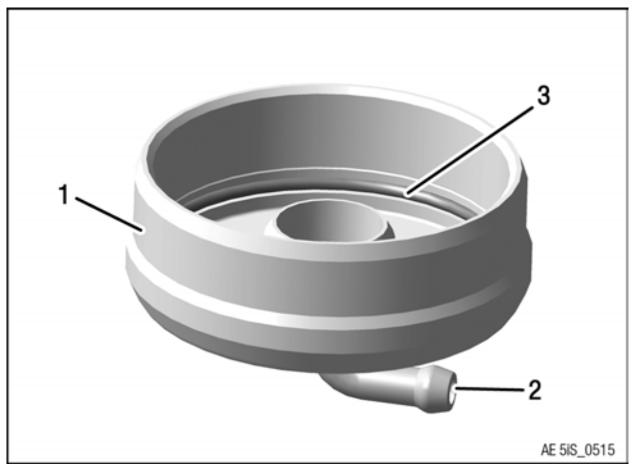


Figure 11.87

1	*Valve cover*	*2*	*Hose nipple*
3	*O-ring*		

Step	Procedure
3	Insert valve piston and valve spring. Install the valve cover.

NOTE

If the hose nipple of the valve cover points to the wrong direction, the valve housing can be unscrewed and displaced by 90°.

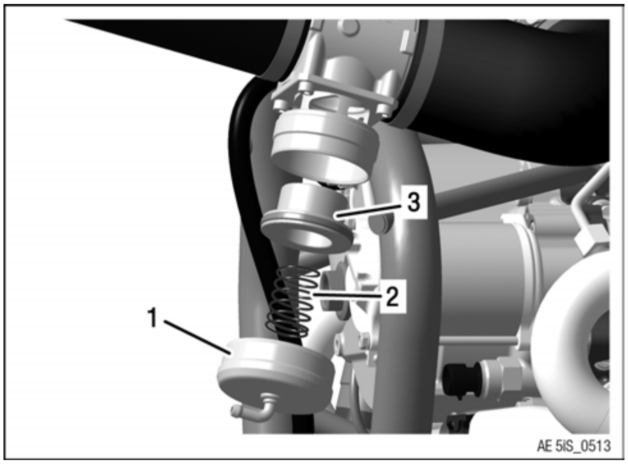


Figure 11.88

1 *Valve cover*	2 *Valve spring*
3 *Valve piston*	

Step	Procedure
4	Install low pressure hoses and fix with hose clamps.

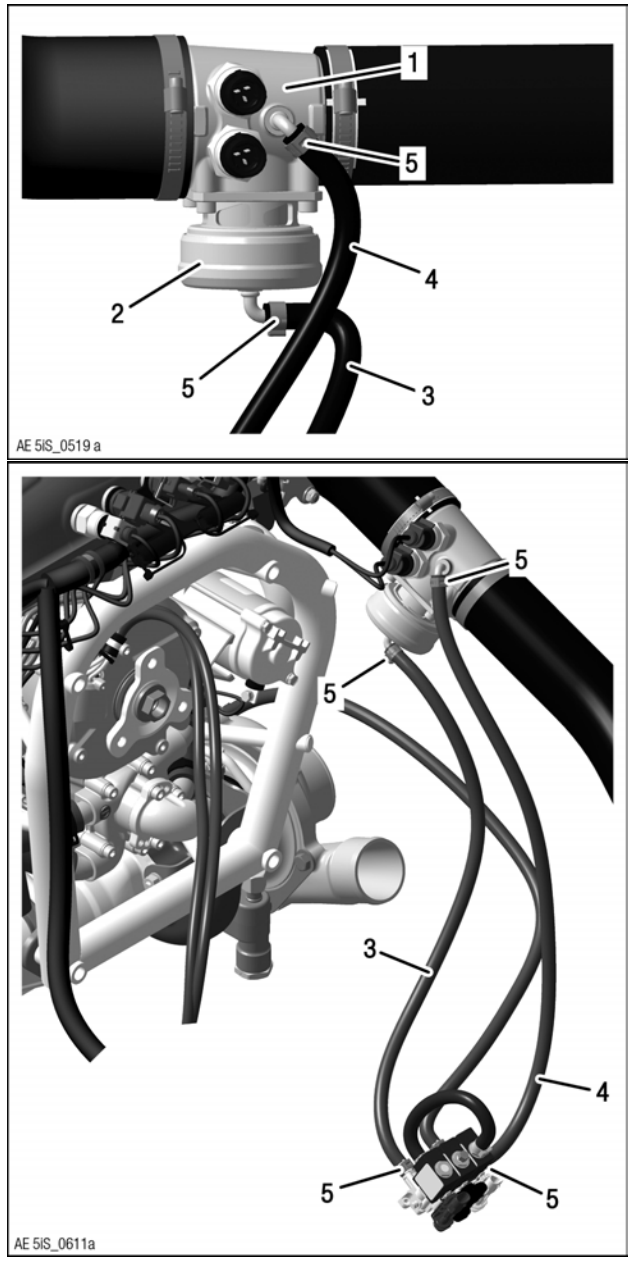


Figure 11.89

1 *Reduction sleeve*	2 *Valve cover*
3 *Low pressure hose (valve cover)*	4 *Low pressure hose (reduction sleeve)*
5 *Hose clamp*	

PRESSURE CONTROL VALVE HOSES - INSTALLATION

Step	Procedure
1	Install PCV hoses and fix with hose clamps.

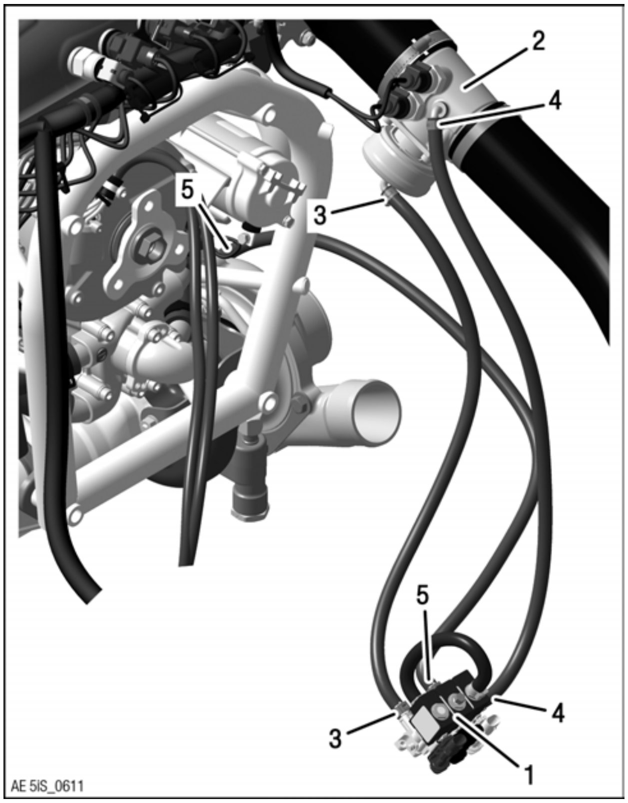


Figure 11.90: PCV hoses

1	*Pressure control valve*	2	*Pop-off valve*
3	*Connection valve cover – PCV*	4	*Connection pop-off valve – PCV*
5	*Connection turbocharger – PCV*		

FINISHING WORK

Fill the fuel and coolant systems.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

- Install the Bowden cable on the throttle body.
- Adjustment of the throttle position, sensor position and idle speed.

INTENTIONALLY LEFT
BLANK

Chapter: 74–00–00
IGNITION UNIT

TOPICS IN THIS CHAPTER

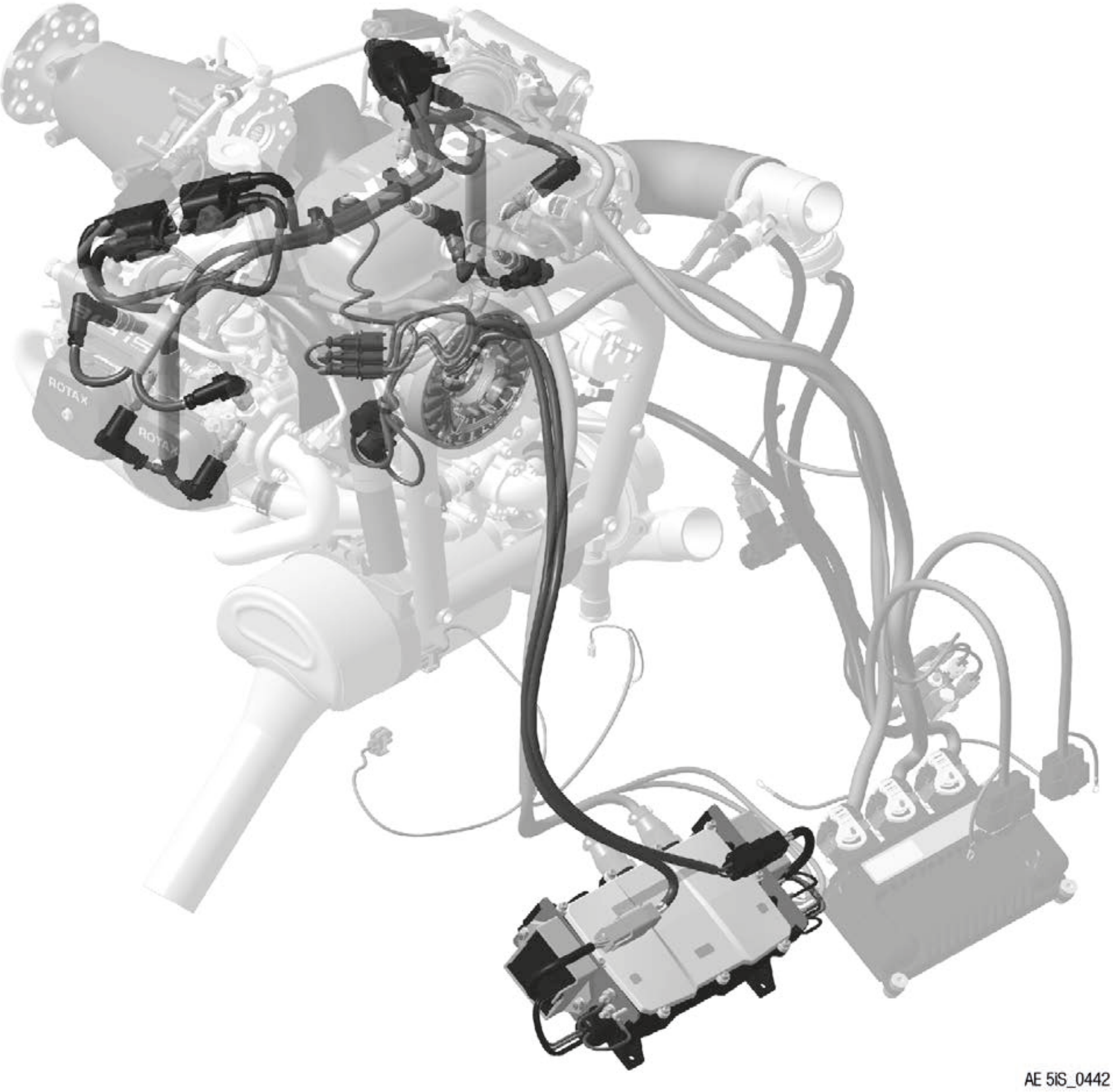


Figure 12.1: Ignition unit

SYSTEM DESCRIPTION

The ignition unit operates with four double ignition coils with double ignition. If the LANE selector switches are both ON, the active LANE controls all four double ignition coils which are connected to the eight spark plugs. In normal Dual LANE Mode (both ON), both spark plugs ignite each cylinder at the same time. In LANE A or LANE B Mode, only one spark plug ignites per cylinder (one LANE switched OFF).

The ignition unit does not require an external power supply.

FIRING ORDER

1–4–2–3

INTERNAL GENERATORS A AND B

In normal operation generator A is supplying the double ignition coils via the fuse box. Generator B charges the battery via the fuse box.
When engine is started at first generator B supplies the double ignition coils. If throttle is opened and engine revs more than 2700 rpm for a few seconds, the fuse box switches to generator A to supply the double ignition coils and generator B starts charging the battery.
If more electric energy for the non-engine consumers of the aircraft is needed, an external generator (optional available) can be used.

SAFETY INSTRUCTION

⚠ WARNING
Follow the general safety instructions during all work on the engine and the assemblies around it. See section Introduction.

CONNECTIONS FOR DISPLAY SYSTEMS

ATTENTION

Follow the instructions in the installation manual regarding connections for instrumentation.

KNOCK SENSOR

The knock sensor is situated directly on the engine block and helps to prevent any uncontrolled combustion (engine knocking).

See Chapter 76-70-00 Sensors and actuators and Chapter 76-50-00 Wiring harness.

Chapter: 74–20–00
DISTRIBUTION

TOPICS IN THIS CHAPTER

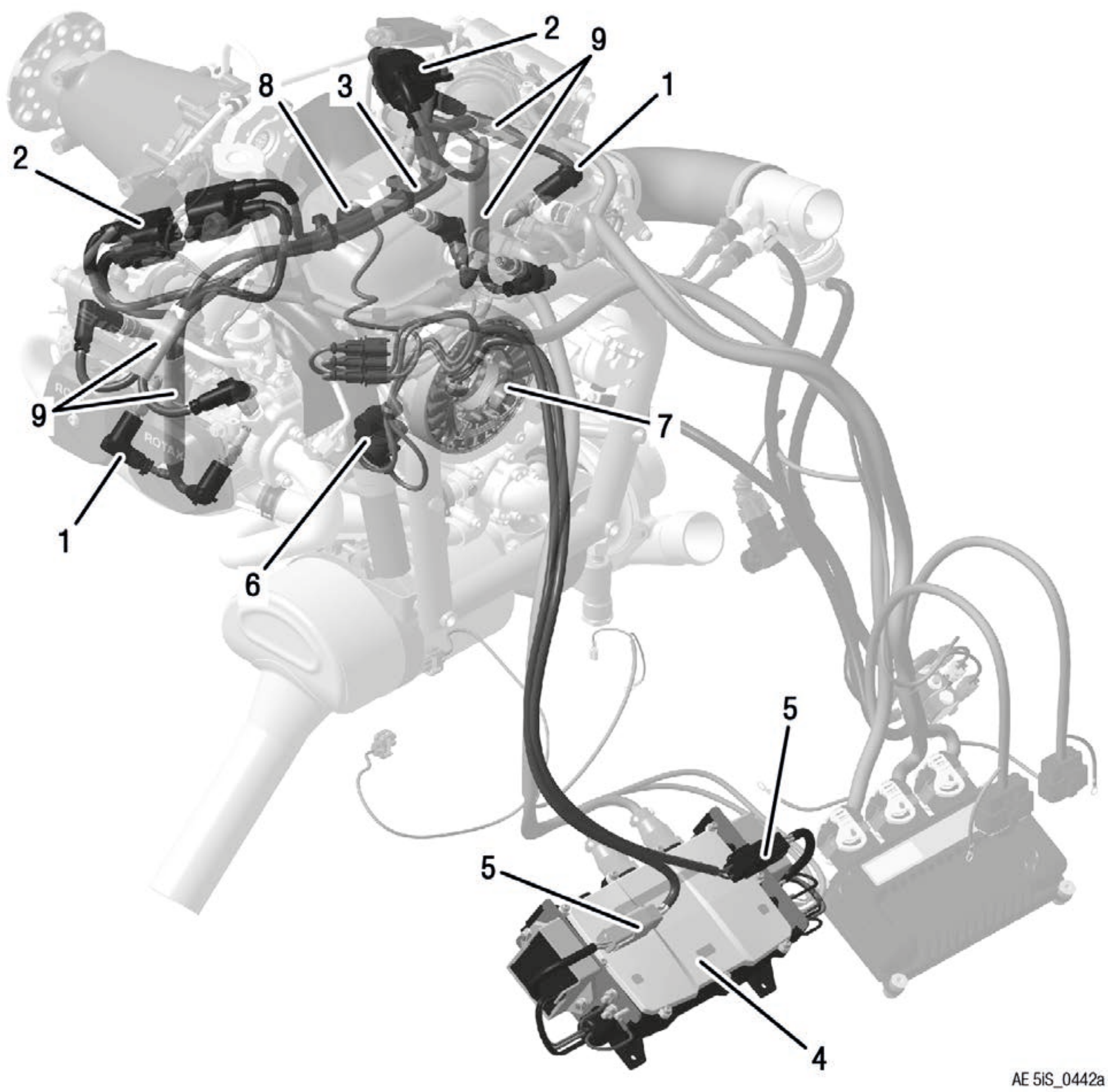


Figure 13.1: Ignition unit

1	*Spark plug connector*	2	*Double ignition coil*
3	*Ignition cable assy.*	4	*Fuse box assy.*
5	*Connector*	6	*Crankshaft position sensor assy.*
7	*Generator A and B*	8	*Knock sensor*
9	*Silicon coated glass fibre sleeve*		

SERVICE PRODUCTS

Description	Part number
SILICON heat conduction compound	897186

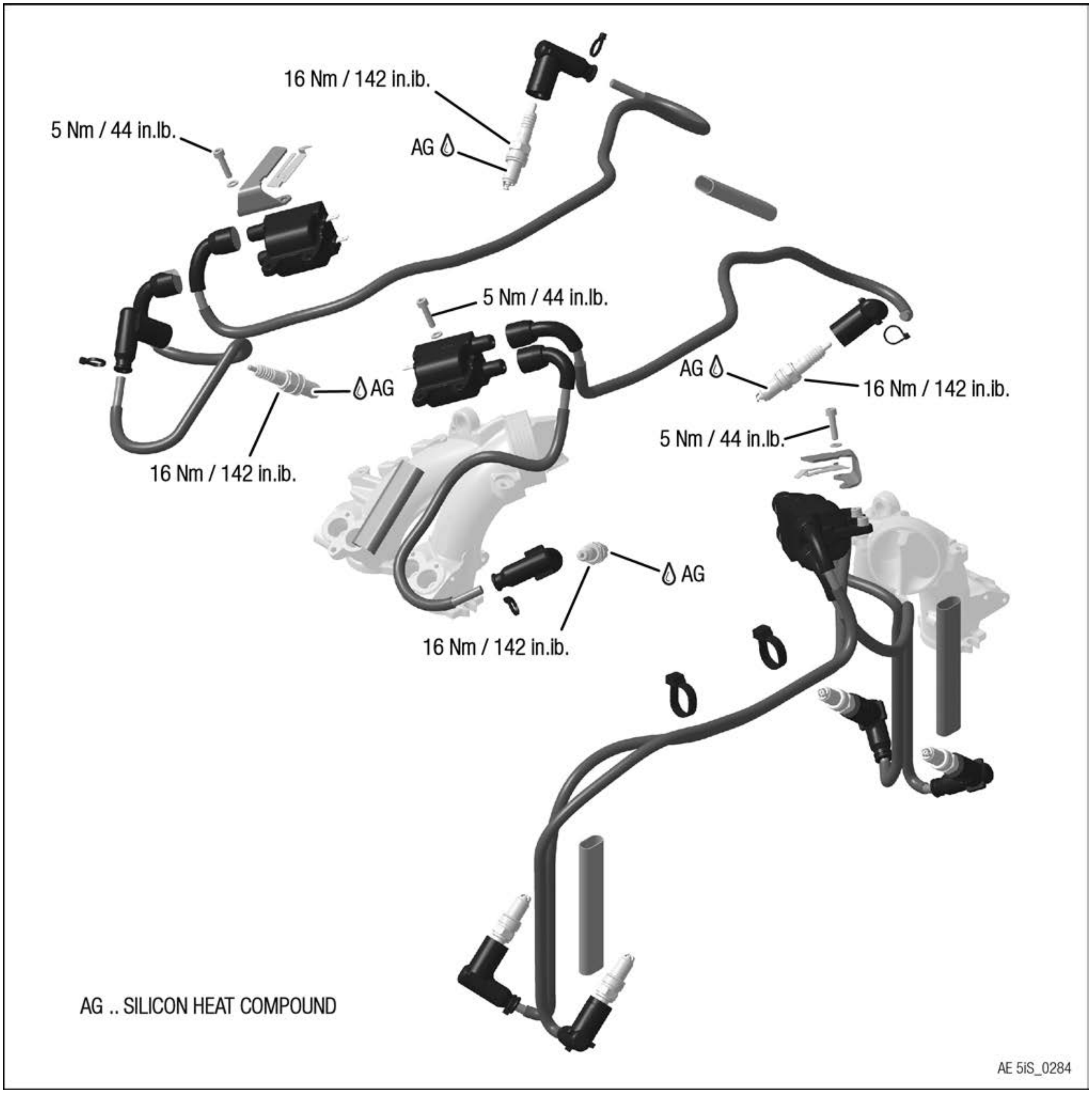


Figure 13.2: Distribution

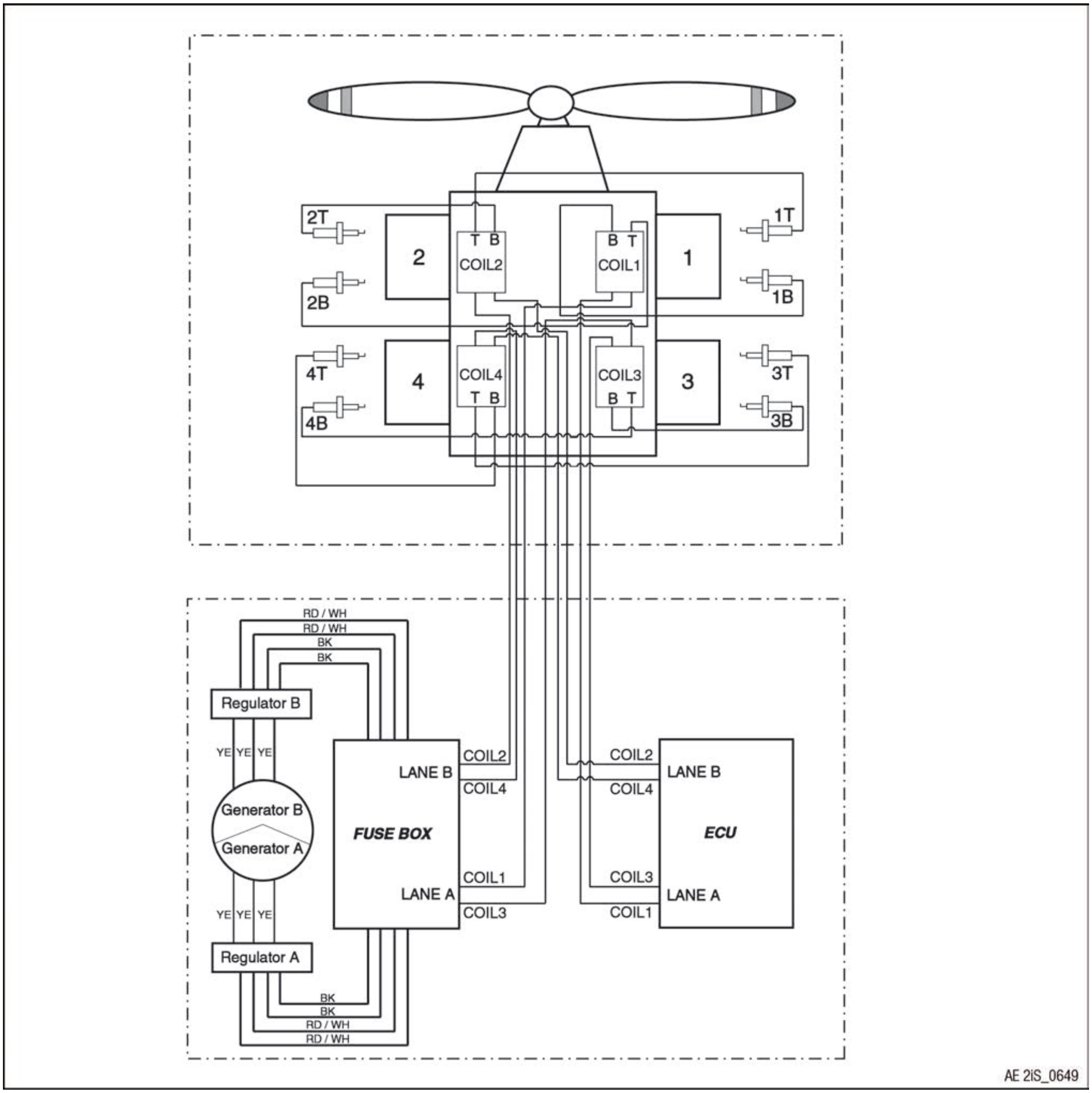


Figure 13.3: Layout plan allocation (cylinder/LANE)

SYSTEM DESCRIPTION

The ignition voltage is distributed directly to the cylinders by stationary, electronically controlled components.
The ignition voltage is generated by four double ignition coils which are situated above the spark plugs.
The ignition unit is synchronised by the signals of the position sensors (see Chapter 76- 70-00 section Sensors and actuators) of the crankshaft, which are sent to the control unit (ECU) (see Chapter 76- 10-00 section Control unit (ECU)). To determine the optimal ignition point, the ECU uses its programmed ignition map to adapt to the different operating states, taking into account the signals of the knock sensor.

INTERNAL GENERATORS

See Chapter 24-20-00 section Internal generator.

DOUBLE IGNITION COILS

The four double ignition coils are fastened to the intake manifolds.

NOTE

The connections are labelled according to the closest cylinder designation.

IGNITION CABLE ASSY.

The high voltage ignition cable consist of copper alloys for applications at high ignition temperatures.

Protection hose identification

The protection hoses of the ignition cables are labelled on both ends:

- On the spark plug connector side the hose is labelled with a number/Letter combination (1 T, 1. B...)
- On the coil end the label marks the position of the ignition cable on the ignition coil and on the cylinder head.

1, 2, 3 and 4 = cylinder
T, B = Top, Bottom

Example:

	Coil 1 T	Cyl. 2 B
Explanation	Ignition coil side coil 1 top connector	Cylinder head 2 bottom spark plug

NOTE

The cables are only available as complete set (ignition cable, protection hose, ignition coil side connector).

SPARK PLUGS

The spark plugs are not shielded but use a resistance type suppressor to prevent interference.

WIRING HARNESS

All the electrical components necessary for the engine are connected to the wiring harness. See Chapter 76-00-00 section Engine management.

FUSE BOX

The fuse box contains the capacitors and all the fuses. See Chapter 76-00-00 section Engine management.

CRANKSHAFT POSITION SENSOR

The crankshaft position sensor sends information to the control unit about the rotation speed and crankshaft position.

SAFETY INFORMATION

⚠ WARNING

Danger of electric shock!
Switch off the ignition and pull out the starter key!

⚠ WARNING

Danger of death due to high voltage!
Only carry out work on the ignition unit with the appropriate protective measures and devices!

⚠ WARNING

Follow the general safety instructions during all work on the engine and the assemblies around it. See section Introduction..

CONNECTIONS FOR DISPLAY SYSTEMS

ATTENTION

Follow the instructions in the installation manual regarding connections for instrumentation.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

Preparation

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

Engine cleaning.
See Maintenance Manual Line for the engine type 915 i A Series.

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series.

NOTE

Some work can only be carried out on the whole unit!

INTERNAL GENERATOR — REMOVAL

See Chapter 24-20-00 section Internal generator.

DOUBLE IGNITION COIL – REMOVAL

Step	Procedure
1	Remove the cable clamps from the wiring harness.

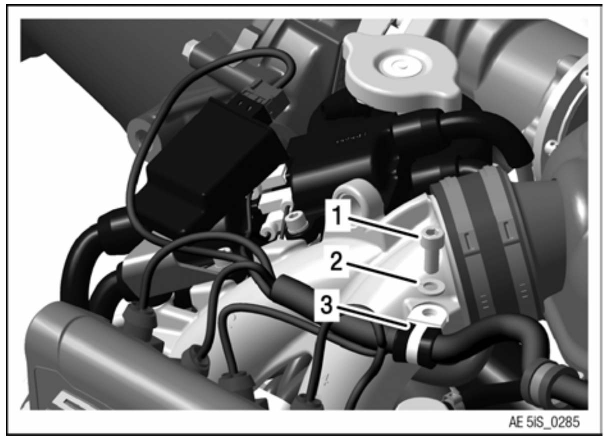


Figure 13.4

1 Allen screw M6x14
2 Lock washer
3 Cable clamp

NOTE

The high tension wires are connected to the coils by a threaded pin inside the coil housing.

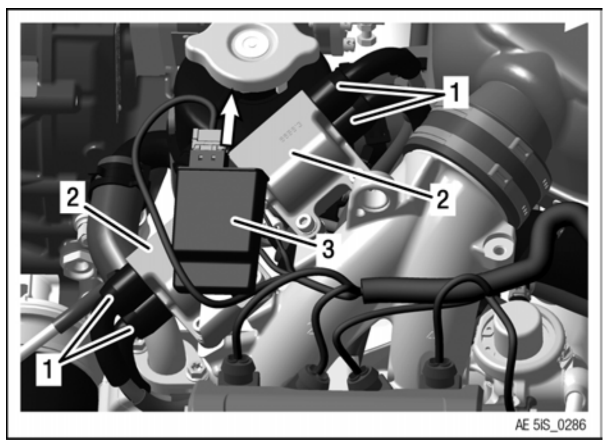


Figure 13.5

1 Ignition coil connector
2 Double ignition coils
3 EGT connector

Step	Procedure
2	Carefully pull EGT 1 and EGT 2 (cylinders 1 and 2) out of the locking plate.
3	Press the spring and unplug the connectors.

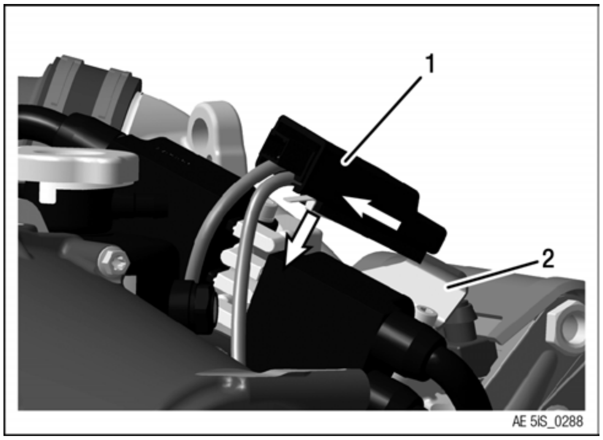


Figure 13.6

1 EGT connector *2 Connector bracket*

Step	Procedure
4	Loosen Allen screws M5x16 with lock washers A5.

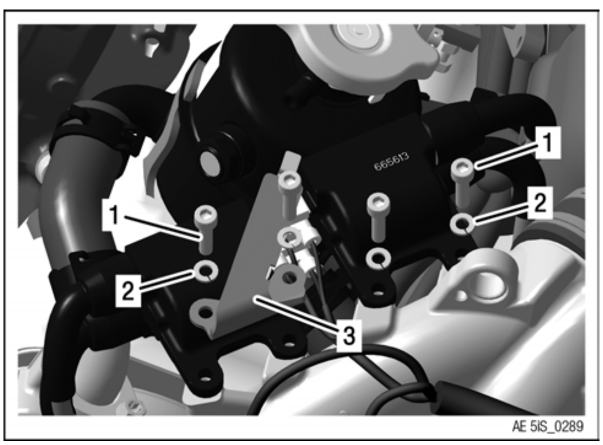


Figure 13.7

1 Allen screw M5x16 *2 Lock washerA5*

3 Cable holder

Step	Procedure
5	Remove the connectors to the double ignition coils.
6	Remove the double ignition coils

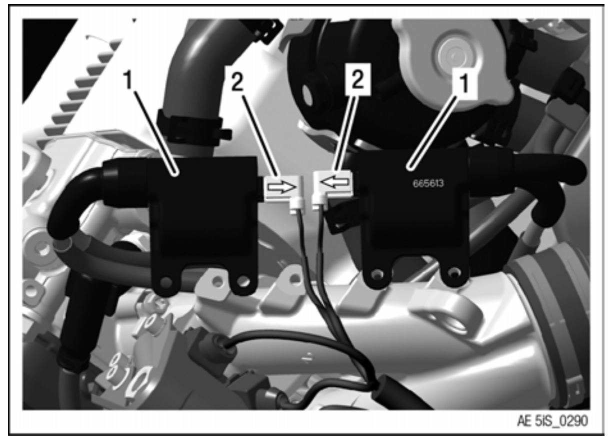


Figure 13.8

1 Double ignition coils *2 Ignition coil connector (coil 1, coil 2, coil 3, coil 4)*

NOTE

The red cable is positive (+), the black cable is negative (-). Double ignition coils are labelled + and -!

SPARK PLUG CONNECTOR AND IGNITION CABLE ASSY. — REMOVAL

Step	Procedure
1	Remove cable ties.
2	Unscrew the spark plug connector.
3	Unscrew ignition cable from ignition coils.

NOTE

The rubber seal may need to be pulled back off the coil in order to unscrew the cable.

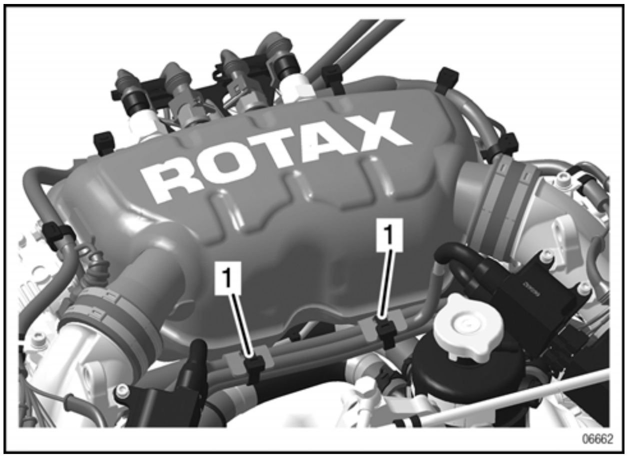


Figure 13.9

1 Cable ties

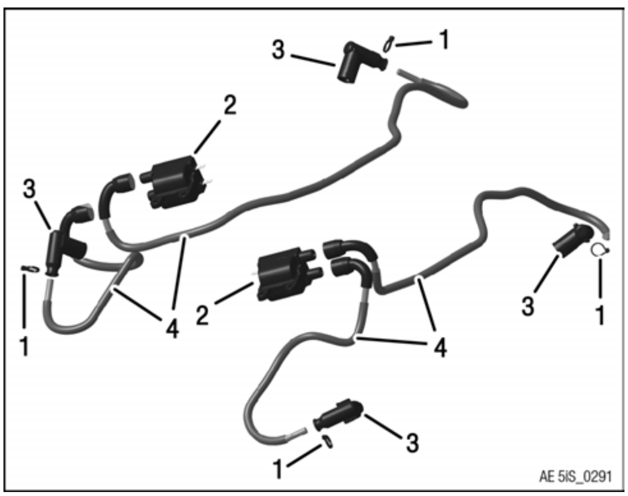


Figure 13.10

1 Cable ties *2 Ignition coils*

3 Spark plug connector *4 Ignition cable assy.*

SPARK PLUG — REMOVAL

Step	Procedure
1	Remove spark plugs from the cylinder head.

ATTENTION

Risk of damage to spark plugs!
The spark plugs must only be removed with a spark plug socket!

KNOCK SENSOR — REMOVAL

See Chapter 76-70-00 section Sensors and actuators and Chapter 76-50-00 section Wiring harness.

NOTE

The knock sensor must only be removed if necessary!

INSPECTION

Components can only be replaced, not repaired. If the ignition spark fails, search systematically for the possible cause of the fault. The B.U.D.S. Aircraft diagnostic tool can be used for this.

DOUBLE IGNITION COIL ASSY. INSPECTION

Preparation

Carry out a visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-20-00 section Visual inspection.

- Carry out a voltage and resistance test. To do this, see Chapter 76-70-00 section Sensors and actuators.

Step	Procedure
1	Check fastening elements (screws, washers and plug holders) for damage, corrosion and deformation.

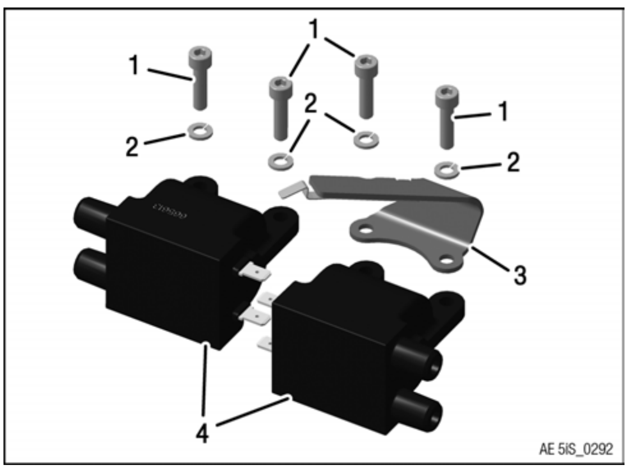


Figure 13.11: Double ignition coils

1 Allen screw M5x20 *2 Lock washer A5*
3 Plug holder *4 Double ignition coils*

Step	Procedure
2	Check double ignition coils for damage, corrosion and deformation.
3	Check contact faces: Indentations up to a max. of 0.5 mm (0.02 in.). Bumps up to a max. of 0.5 mm (0.02 in.).

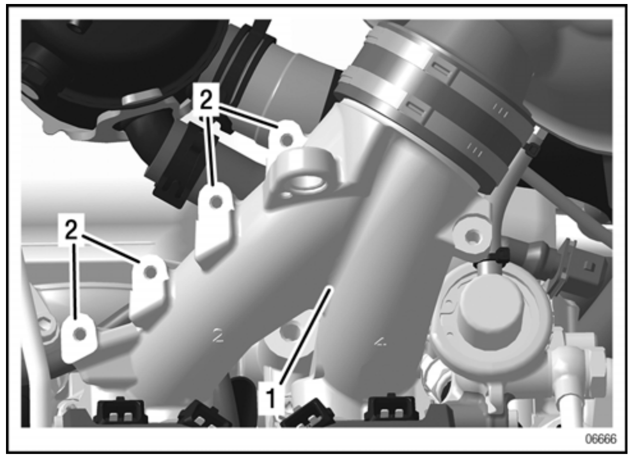


Figure 13.12

1 Intake manifold *2 Contact face*

SPARK PLUG CONNECTOR AND IGNITION CABLE ASSY. — INSPECTION

Carry out resistance test on ignition cable assy. To do this, see Chapter 76-70-00 section Sensors and actuators.

ATTENTION

Cracking and other obvious damage to the ignition cable is not permitted!
If in doubt, always replace the cable and connectors in question.

Step	Procedure
1	Check spark plug connector for corrosion and damage.

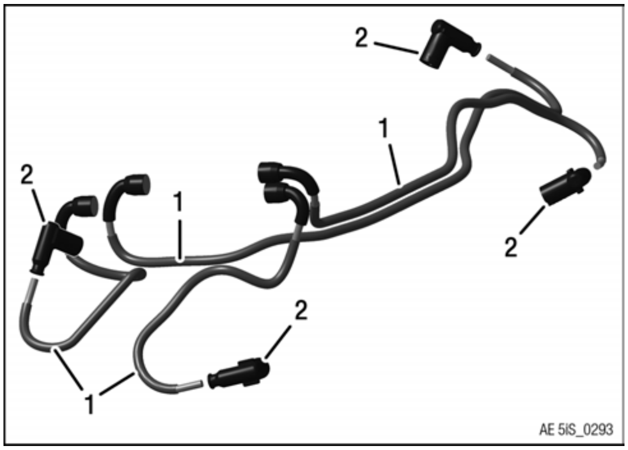


Figure 13.13

1 Ignition cable assy. *2 Spark plug connector*

SPARK PLUG — INSPECTION

See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 Inspection of spark plugs.

KNOCK SENSOR (KNOCK) — INSPECTION

To do this, see Chapter 76-70-00 section Sensors and actuators.

INSTALLATION

KNOCK SENSOR — INSTALLATION

See Chapter 76-70-00 section Sensors and actuators and Chapter 76-50-00 section Wiring harness.

SPARK PLUG — INSTALLATION

See Maintenance Manual Line for the engine type 915 i A Series. Chapter 12-20-00 Installation of spark plug.

SPARK PLUG CONNECTOR AND IGNITION CABLE ASSY. — INSTALLATION

ATTENTION

Risk of damage to spark plug connector!
The spark plug connectors must only be installed by hand or using an equivalent tool, that has no pointed or sharp edges.

Step	Procedure
1	Pull silicon coated glass-fibre sleeves on the ignition cables Top and Bottom.

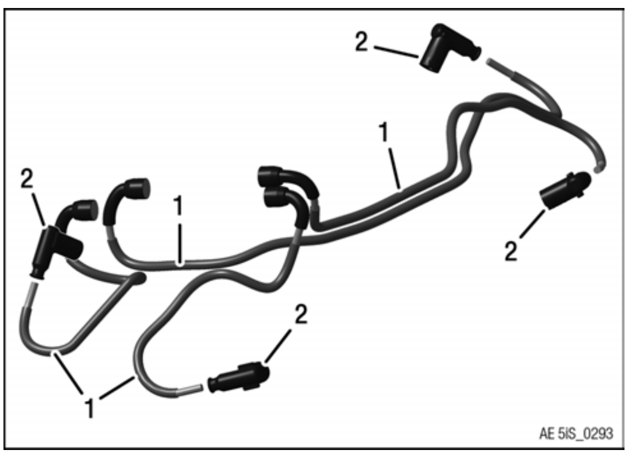


Figure 13.14

1 Spark plug connector *2 Ignition cable assy.*

Step	Procedure
2	Screw ignition cable into coil.
3	Slide rubber seal over coil.
4	Screw the spark plug connector on the ignition cable assy. and secure it with a cable tie.
5	Route the ignition cable assy. correctly and secure it with a cable tie.

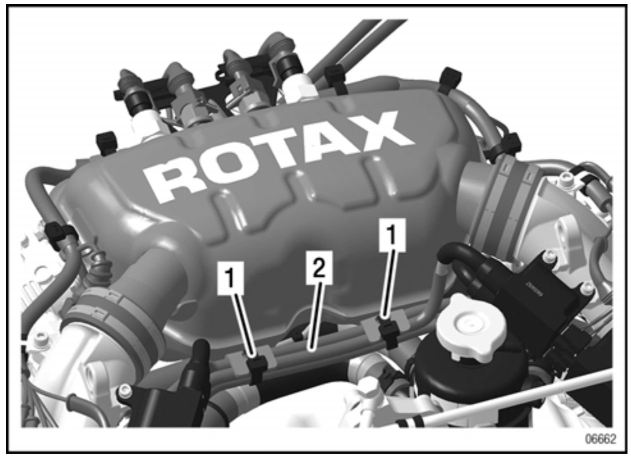


Figure 13.15

1 Cable ties *2 Ignition cable assy.*

DOUBLE IGNITION COIL — INSTALLATION

The double ignition coil is installed and removed in the same way. The following should be noted.

NOTE

The red cable is positive (+), the black cable is negative (-). Double ignition coils are labelled + and -!

Step	Procedure
1	Plug in the double ignition coil connectors.

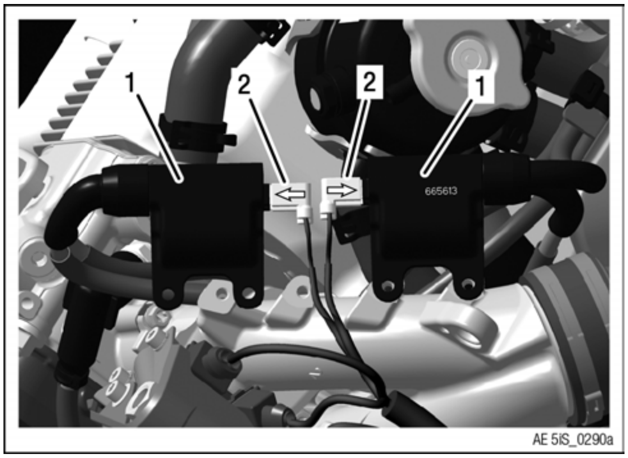


Figure 13.16

1	*Double ignition coils*	*2*	*Ignition coil connector (coil 1, coil 2, coil 3, coil 4)*

Step	Procedure
2	Fix the double ignition coils with Allen screws M5x20, connector bracket and A5 lock washers. Tightening torque 5 Nm (44 in. lb.).

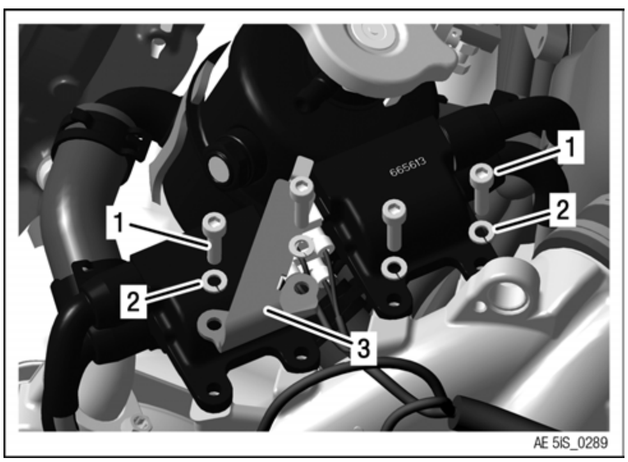


Figure 13.17

1	*Allen screw M5x20*	*2*	*Lock washer A5*
3	*Connector bracket*		

Step	Procedure
3	Plug in the connector to the EGT connector.

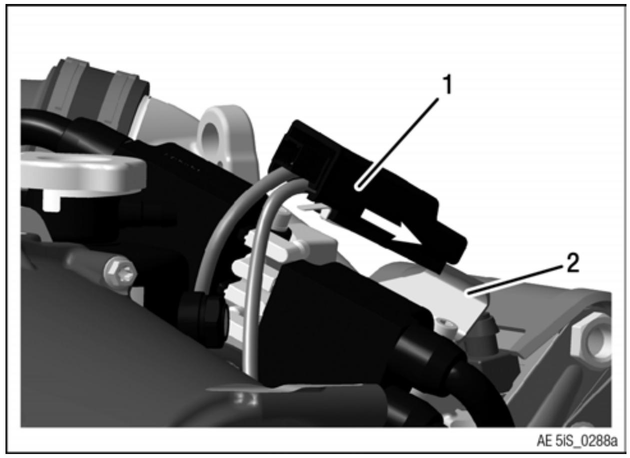


Figure 13.18

1	*EGT connector*	*2*	*Connector bracket*

Step	Procedure
4	Secure the cable clamp 12/M6 with an Allen screw M6x14 and washer with LOCTITE 243. Tightening torque 10 Nm (89 in. lb.).

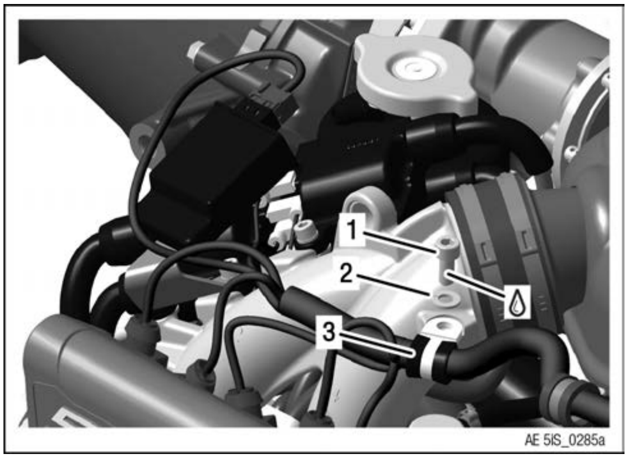


Figure 13.19

1 *Allen screw M6x14*
2 *Lock washer A6*
3 *Cable clamp 12/M6*

INTERNAL GENERATOR — INSTALLATION

See Chapter 24–20–00 section Internal generator.

FINISHING WORK

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

INTENTIONALLY LEFT
BLANK

Chapter: 75–00–00
COOLING SYSTEM

TOPICS IN THIS CHAPTER

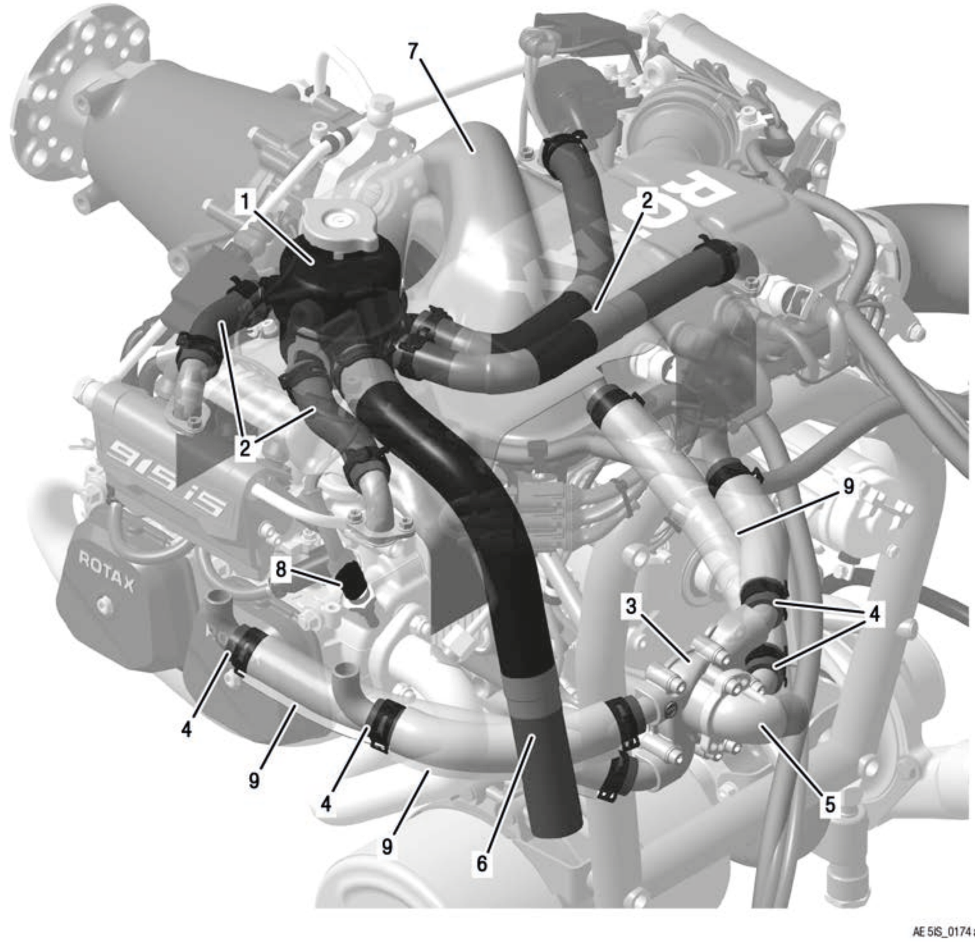


Figure 14.1: Position on the engine

1	*Expansion tank assy.*	2	*Form hose*	3	*Water pump*
4	*Water hose*	5	*Water inlet elbow*	6	*Form hose*
7	*Cooling air baffle (optional, pusher or tractor version)*	8	*Temperature sensor*	9	*Heat protection sleeve*

SPECIAL TOOLS

Description	Part number
Hose clamp pliers	877840
Impeller wrench assy.	877295
Insertion jig	876510
Insertion jig	877258
Socket driver T30 ball head	876180
Socket 19x12.5	876130

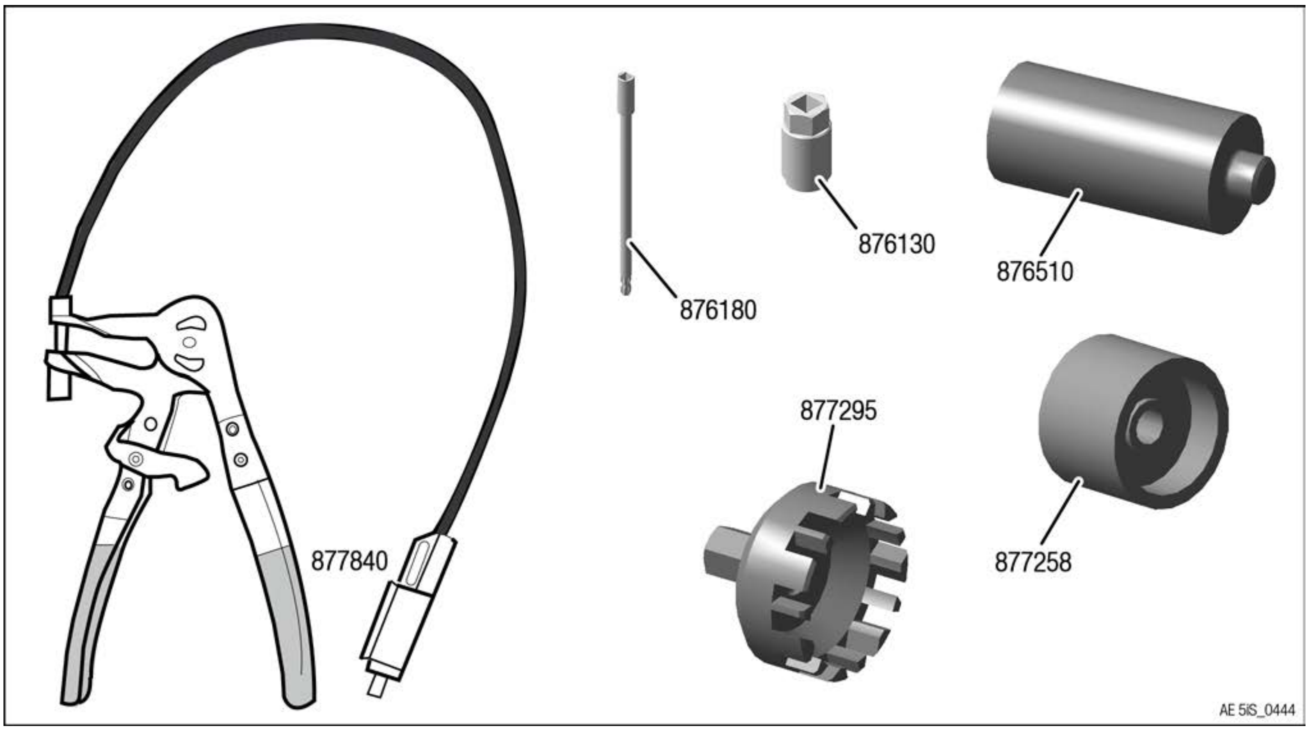


Figure 14.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
Engine oil	n.a.

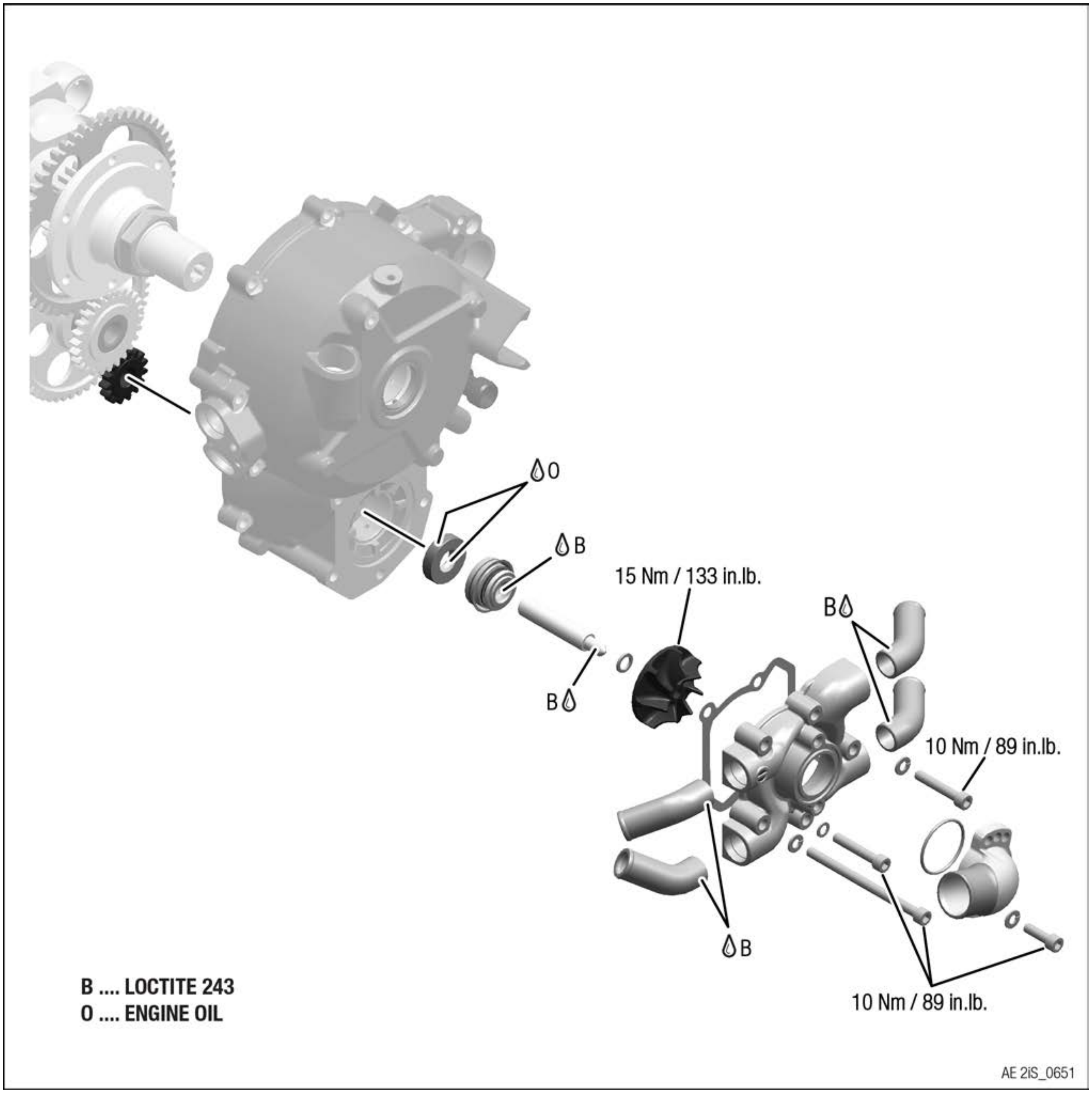


Figure 14.3: Cooling system

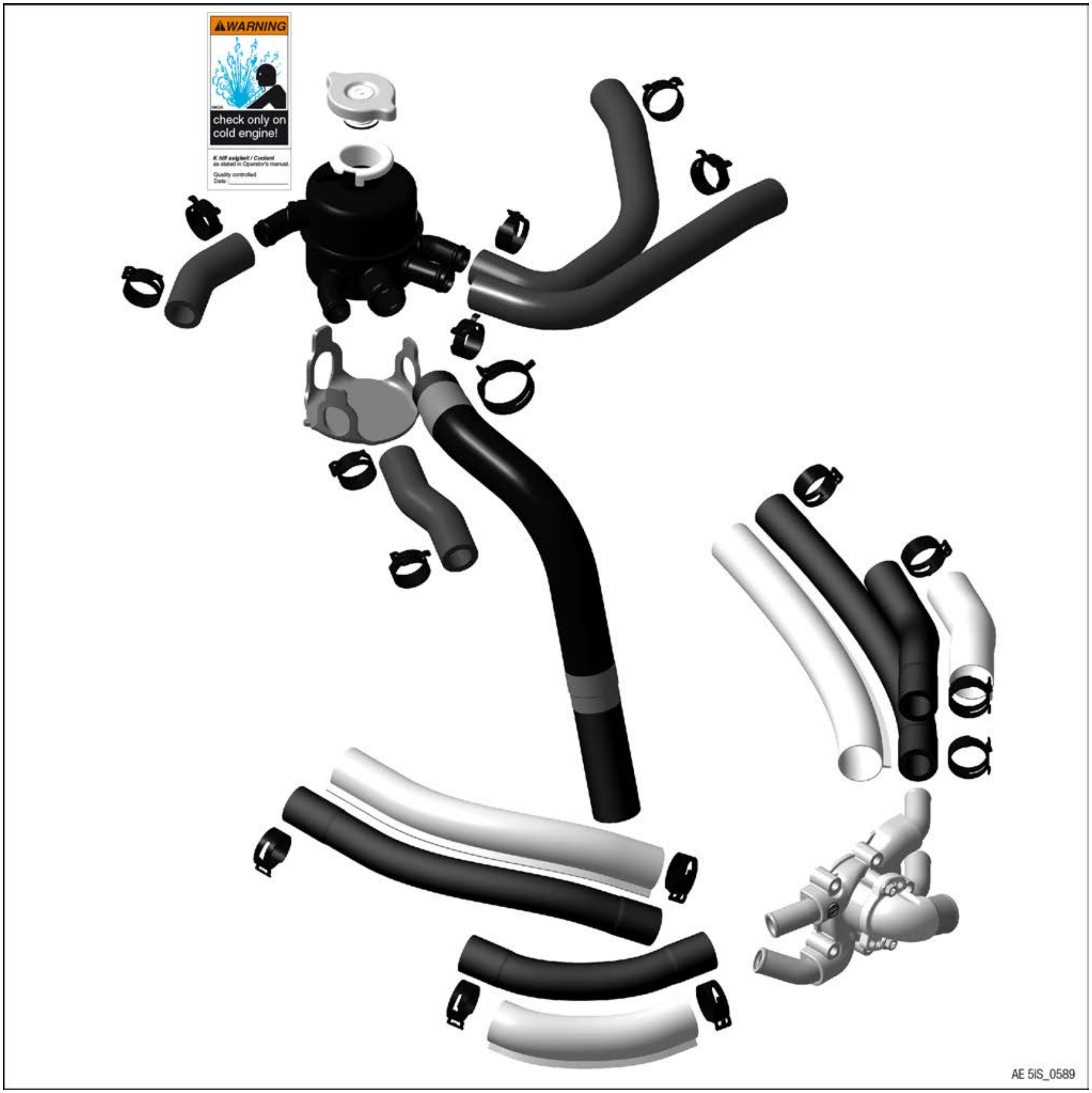


Figure 14.4

SYSTEM DESCRIPTION

The engine is cooled by liquid-cooled cylinder heads and ram-air-cooled cylinders. The cooling system of the cylinder heads is a closed cooling circuit with an expansion tank and overflow bottle.

COOLANT

The coolant is pumped by a camshaft-driven water pump, from the radiator to the individual cylinder heads. The coolant flows out of the top of the cylinder heads and is collected in the expansion tank. Since the standard location of the radiator is below engine level, the expansion tank located on top of the engine allows for coolant expansion.

RADIATOR

See the current 915 i A Series Installation Manual. For more detailed information on operation, maintenance, safety or flight, consult the documentation provided by the aircraft manufacturer and dealer.

WATER PUMP

The water pump is integrated in the ignition housing. The ignition housing must be removed for repair work on the water pump.
See Chapter 74-00-00 section Ignition unit.

EXPANSION TANK

The expansion tank is closed by a pressure cap (with pressure relief valve and return valve). When the coolant heats up and expands, it opens the pressure relief valve and flows via a hose at atmospheric pressure into the transparent overflow bottle. When the coolant cools down, it is sucked back into the cooling circuit.

OVERFLOW BOTTLE

See the current 915 i A Series Installation Manual. For more detailed information on operation, maintenance, safety or flight, consult the documentation provided by the aircraft manufacturer and dealer.

SAFETY INFORMATION

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work. The radiator cap on the expansion tank must only be opened when the engine has cooled down!

Ensure that the engine is in the horizontal position!

ENVIRONMENTAL NOTE

Please observe the disposal regulations applicable in your area.

ENVIRONMENTAL NOTE

Observe the safety instructions of the manufacturer of hazardous substances (coolant, oil) or fuels and the applicable regional waste disposal regulations.

ENVIRONMENTAL NOTE

Work with the utmost care to ensure that no water pollutants can penetrate into the soil, water or the sewerage system.

CONNECTIONS FOR DISPLAY SYSTEMS

Follow the instructions in the Installation Manual for the engine type 915 i A Series regarding connections for instrumentation.

TEMPERATURE SENSOR

Coolant flows around the temperature sensor, which measures the coolant temperature directly.

The temperature sensor is situated in cylinder head 4.

MAINTENANCE

As well as the maintenance and special checks, see the Maintenance Manual Line for the engine type 915 i A Series.

Before the cooling system is removed, the work described below must be carried out to identify any further malfunctions in the cooling system and rectify them as part of the repair work.

ATTENTION
If these checks are omitted, it may be necessary to dismantle the cooling system again to rectify any malfunctions after it has been repaired.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series.

Engine cleaning.
See Maintenance Manual Line for the engine type 915 i A Series.

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

Preparation

ATTENTION
Prevent the ingress of debris particles into all disconnected lines and connections. Use appropriate protective coverings.

- Switch the ignition key OFF

Drain coolant.
See Maintenance Manual Line for the engine type 915 i A Series.

Drain the fuel.
See the Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

- Disconnect the form hose from outlet in accordance with the aircraft manufacturer's specifications

NOTE

The assemblies and lines are only to be removed if necessary and only as far as is necessary!

Step	Procedure
1	Remove the fuel outlet and inlet hoses on the fuel rail.
2	Unplug temperature sensor CTS. See Chapter 76-70-00.
3	Remove temperature sensor EGT 1/3/4 from the cable bracket and unplug it. See Chapter 76-70-00.
4	Unplug throttle position sensor TPS. See Chapter 76-70-00..
5	Unscrew the resistance spark plug connector. See Chapter 74-20-00.
6	Remove the 1-ear clamp.
7	Remove the cable ties from the fuel pressure regulator referance hose.
8	Loosen the Allen screw M6x16 of the fuel line assy. with the lock washer.
9	Loosen the banjo bolt M12x1.5x24 from cyl. 2/4 and 1/3 and remove the fuel line assy.
10	Loosen 4 Allen screws on the intake manifold (cyl. 2/4 and 1/3). See Chapter 73-10-00.
11	Remove the intake manifold (cyl. 2/4 and 1/3) with all its attached parts.
12	Remove the air intake hose from throttle body.

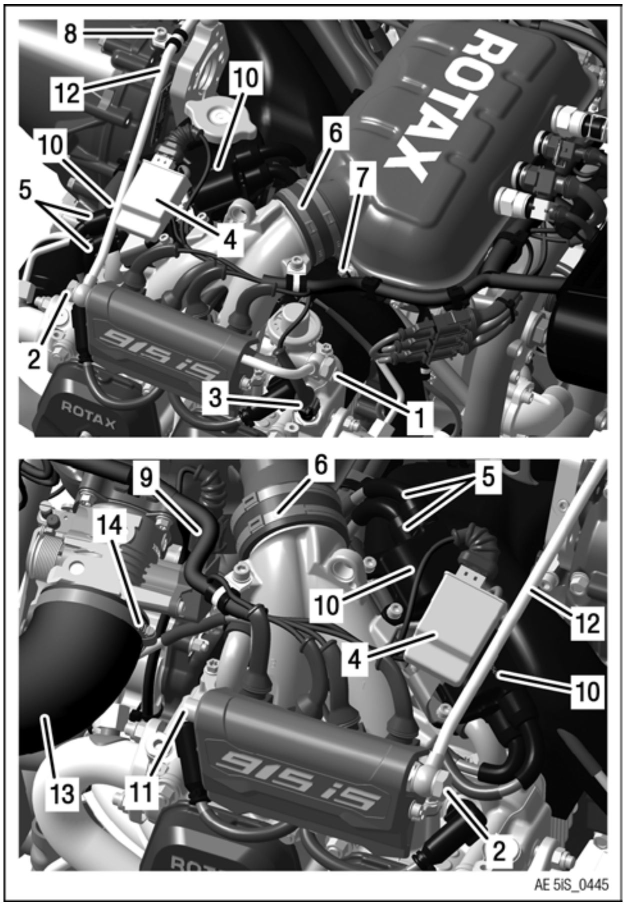


Figure 14.5

1	*Fuel outlet*	2	*Banjo bolt M12x1.5x24*
3	*Temperature sensor*	4	*Temperature sensor EGT*
5	*Spark plug connector*	6	*1-ear clamp*
7	*Fuel press referance hose*	8	*Allen screw M6x16*
9	*Throttle potentiometer TPS*	10	*Double ignition coil*
11	*Fuel inlet*	12	*Fuel hose assy.*
13	*Air intake hose*	14	*Clamp*

EXPANSION TANK AND COOLANT HOSE — REMOVAL

ATTENTION

Risk of pressure and scuffing marks!
Mark the position of the spring type hose clamps. The spring type hose clamps must be re-installed in the same position, otherwise it may not be possible to install the intake manifold.

ATTENTION

When removing the form hoses, ensure that the coolant elbows are not damaged!

Step	Procedure
1	Take off the spring type hose clamp using spring clamp pliers part no. 877840.
2	Remove the form hose from the bent socket with a suitable tool.

Form hose, cylinders 2 and 4

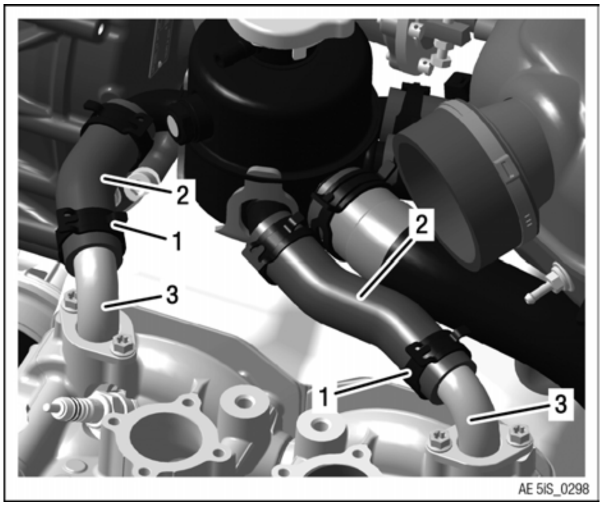


Figure 14.6

1	*Spring type hose clip*	*2*	*Form hose*
3	*Bent socket*		

Form hose, cylinder 1

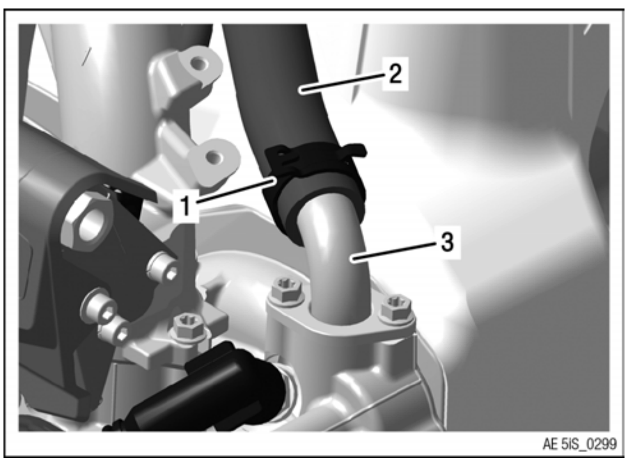


Figure 14.7

1	*Spring type hose clamp*	*2*	*Form hose*
3	*Bent socket*		

Form hose, cylinder 3

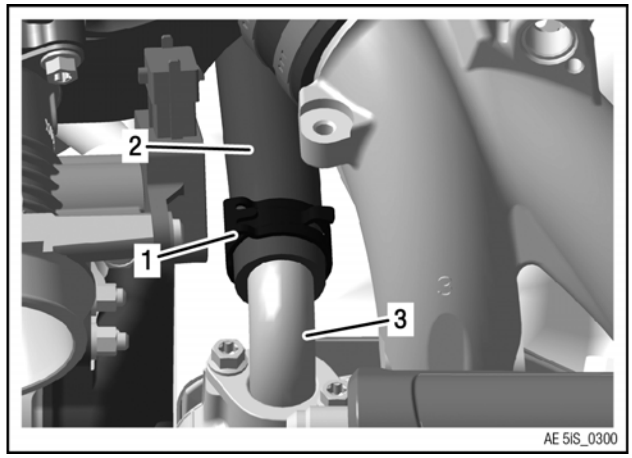


Figure 14.8

1	*Spring type hose clamp*	*2*	*Form hose*
3	*Bent socket*		

Step	Procedure
3	Remove the expansion tank assy. with all its form hoses.

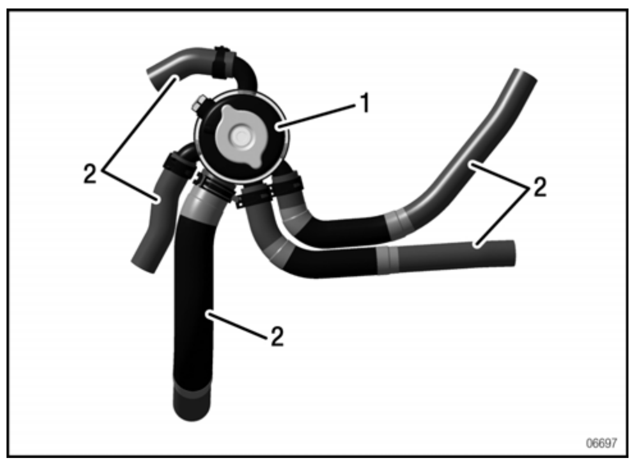


Figure 14.9

1	*Expansion tank assy.*	*2*	*Form hoses*

COOLING AIR-DUCT (OPTIONAL) — REMOVAL

Step	Procedure
1	Remove fuel inlet and outlet hoses.
2	Remove intake manifolds, airbox and cooling expansion tank assy.
3	Lift up and remove cooling air-duct.

WATER PUMP HOUSING — REMOVAL

Preparation

Remove the coolant hose from water inlet elbow according to the aircraft manufacturer's specifications.

NOTE

Mark the position of the coolant elbow with a suitable pen (touch-up pen).

Step	Procedure
1	Remove the coolant hoses with heat protection sleeves from coolant elbow using spring clamp pliers part no. 877840.

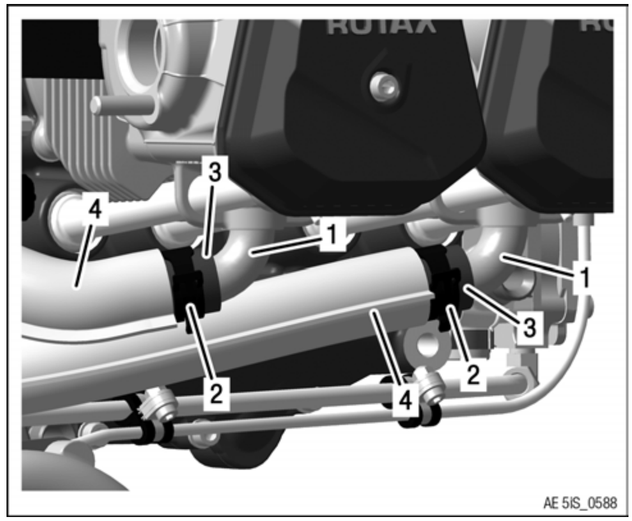


Figure 14.10

1	*Bent socket*	2	*Spring type hose clamp 25*
3	*Coolant hose*	4	*Heat protection tube*

Step	Procedure
2	Remove all 4 spring type hose clamps using spring clamp pliers part no. 877840 and detach the coolant hoses from the water pump housing.

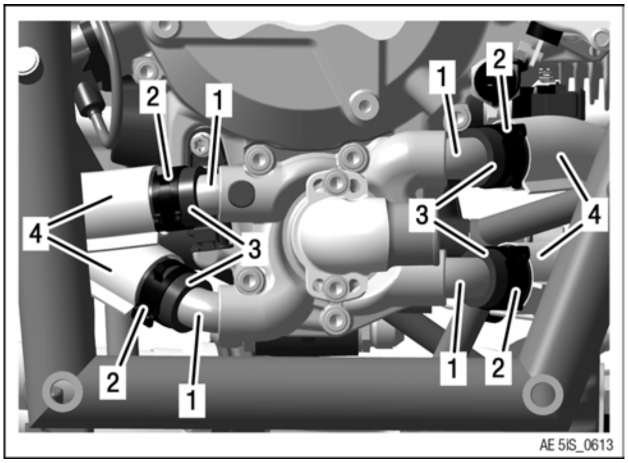


Figure 14.11

1	*Bent socket*	2	*Hose clamps*
3	*Coolant hoses*	4	*Heat protection sleeves*

Step	Procedure
3	Loosen the 2 Allen screws M6x20 of the water inlet elbow with washers and re-move the water inlet elbow with the 32x2 O-ring.

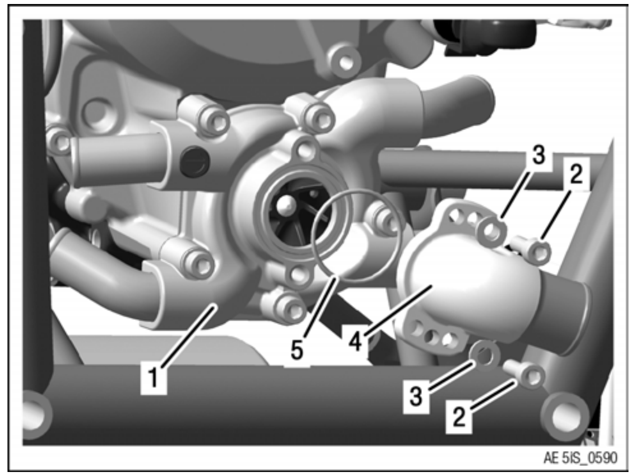


Figure 14.12

1	*Water pump housing*	2	*Allen screws M6x20*
3	*Washer 6.4*	4	*Water inlet elbow*
5	*O-ring 32x2*		

Step	Procedure
4	The water pump housing and gasket can be removed by loosening the other 5 screws M6.

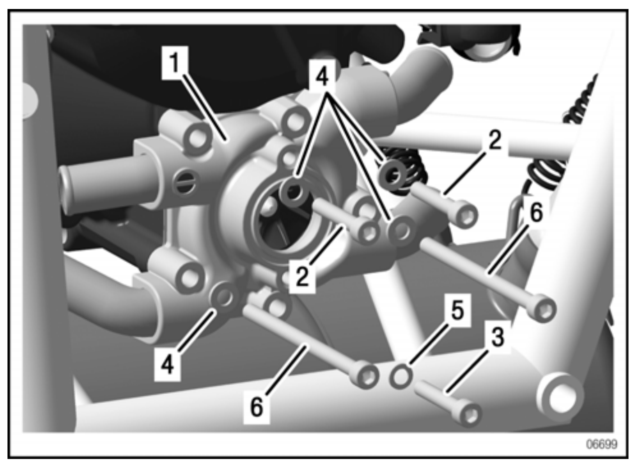


Figure 14.13: TYPICAL

1	*Water pump housing*	2	*Allen screw M6x35*
3	*Allen screw M6x35 (stainless steel)*	4	*Washer 6.4*
5	*Gasket ring 6x10*	6	*Allen screw M6x90*

Step	Procedure
5	Remove the impeller anti-clockwise with the special tool part no. 877295 with the crankshaft immobilised. See relevant Maintenance Manual Line Chapter 12–20–00.

To lock the crankshaft.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12–20–00.

NOTE

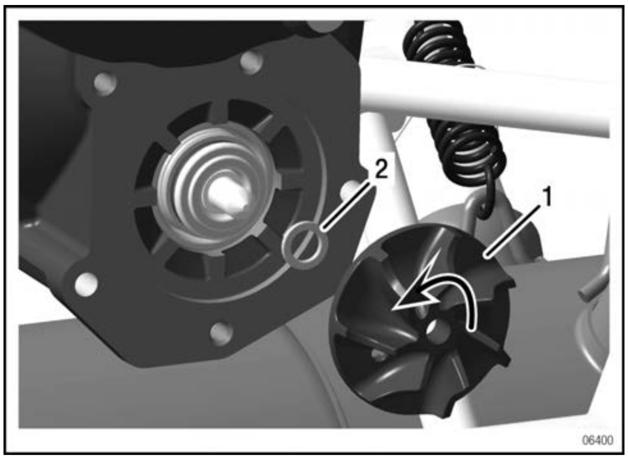


Figure 14.14: TYPICAL

1	*Impeller*	2	*Washer 8.2/12.5/1.5*

DISASSEMBLY

IGNITION HOUSING — DISASSEMBLY

Preparation

- Remove the ignition housing. See Chapter 24-20-00 section Internal generator.

WATER PUMP SHAFT — REMOVAL

Step	Procedure
1	Place the ignition cover on a suitable flat surface.
2	Press out the water pump shaft with a suitable tool.
3	Pull out the water pump gear.

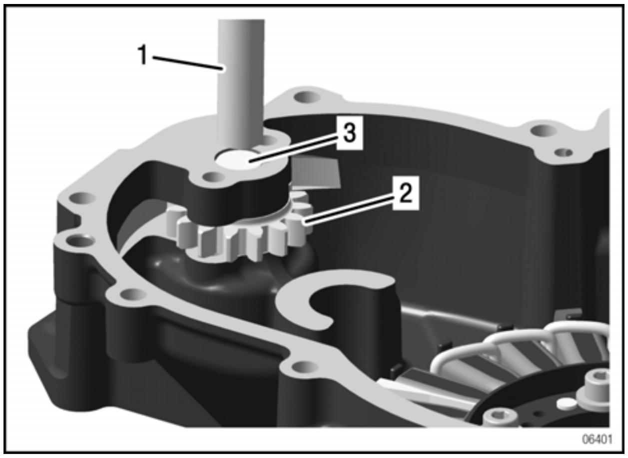


Figure 14.15

1 Press-out tool *2 Water pump gear 15T*
3 Water pump shaft

OIL SEAL AND ROTARY SEAL — REMOVAL

ATTENTION

The oil seal and rotary seal are destroyed by this process and must be replaced.

Step	Procedure
1	Press out the old oil seal and the rotary seal with two pins or bolts and a suitable jig.

NOTE

The diameter of the pins/bolt is 5 mm (0.1969 in.).

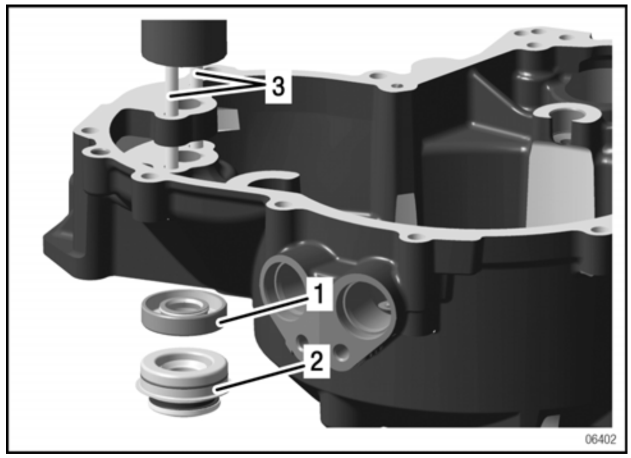


Figure 14.16

1 Oil seal *2 Rotary seal*
3 Press-out tool

COOLANT HOSES — REMOVAL

Step	Procedure
1	Take off the spring type hose clamps using spring clamp pliers part no. 877840.
2	Remove the preformed hoses from the coolant elbows on the expansion tank with a suitable tool.
3	Remove the rubber plate.

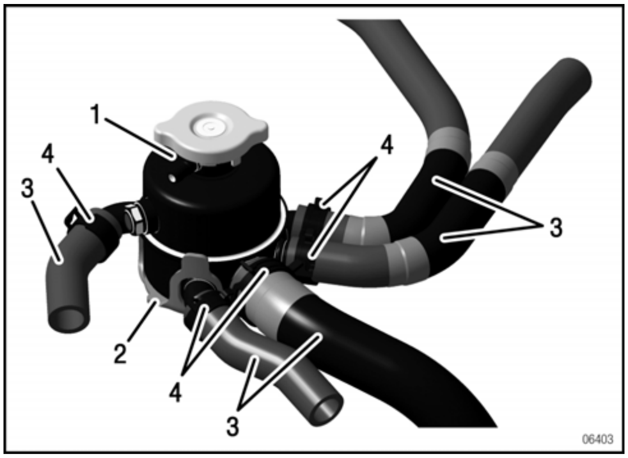


Figure 14.17

1	*Expansion tank*	2	*Rubber plate*
3	*Preformed hoses*	4	*Spring type hose clamps*

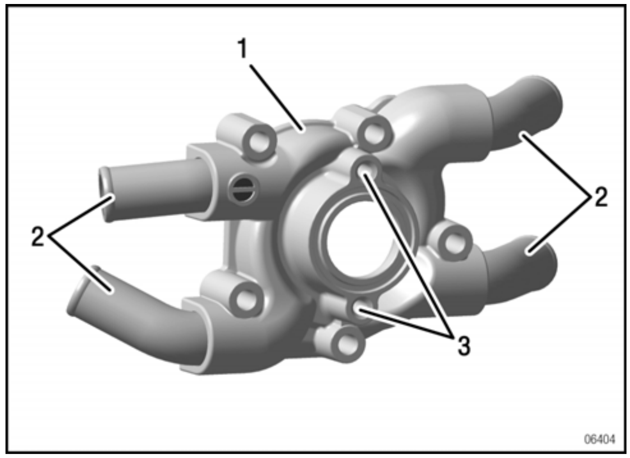


Figure 14.18

1	*Water pump housing*	2	*Bent socket*
3	*Thread*		

WATER PUMP HOUSING — DISASSEMBLY

NOTE

Only remove the bent sockets when absolutely necessary!

Step	Procedure
1	Mark the position of the bent sockets.
2	Heat the water pump housing to approx. 80 °C (176 °F) and unscrew the bent sockets.
3	Clean the thread (remove LOCTITE residues) inside the housing and on bent socket.

INSPECTION

COOLING SYSTEM SINGLE PARTS — CHECK

ATTENTION

Cracks in cooling system components are not permissible!
If in doubt, check the affected parts for cracks using the dye penetrant or similar method.

ATTENTION

Preformed hoses must not be shortened, as this affects the position of the expansion tank. Replace non-reusable or damaged hoses.

- Clean all parts carefully.
- Check the preformed hoses for damage and wear.
- Check the temperature sensor. To do this, see Chapter 76-70-00 section Sensors and actuators.

NOTE

Scuffing marks (including scratches) are permissible up to a maximum depth of 0.50 mm (0.0197 in.).

- Check the spring type hose clamps for damage or deformation.

AXIAL POSITION OF WATER PUMP SHAFT INSPECTION

See Chapter 75-00-00 section Wear limits.

- Check the water pump shaft for wear and corrosion.

NOTE

If corrosion is found, the water pump shaft must be replaced.

Step	Procedure
1	Check the axial position of the water pump shaft and pump gear.

NOTE

The shoulder of the gear points inwards towards the crankcase.

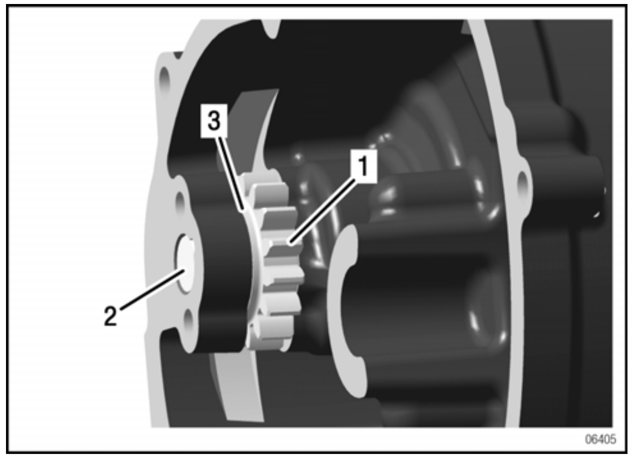


Figure 14.19

1 Water pump gear 15T 2 Water pump shaft

3 Shoulder of gear

EXPANSION TANK — INSPECTION

Step	Procedure
1	Check the expansion tank for damage, deformation and leaks.

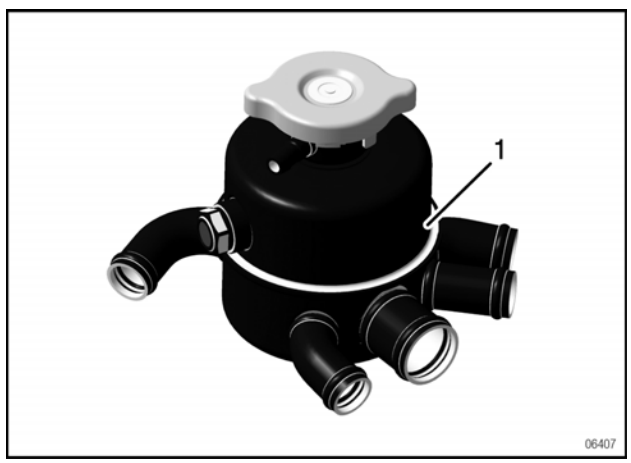


Figure 14.20

1 Expansion tank

WATER PUMP HOUSING — INSPECTION

Step	Procedure
1	Check the water pump housing for damage, deformation and leaks.
2	Check the inner side for any signs of contact with the impeller.

NOTE

If signs of contact are found, the water pump housing must be replaced.

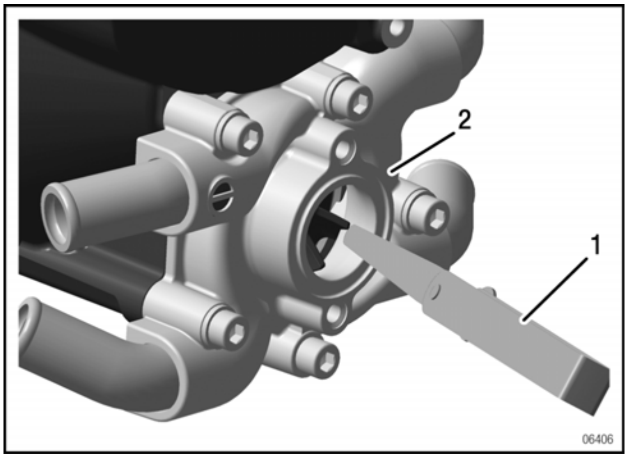


Figure 14.21

1 Feeler gauge *2 Water pump housing*

WEAR LIMITS

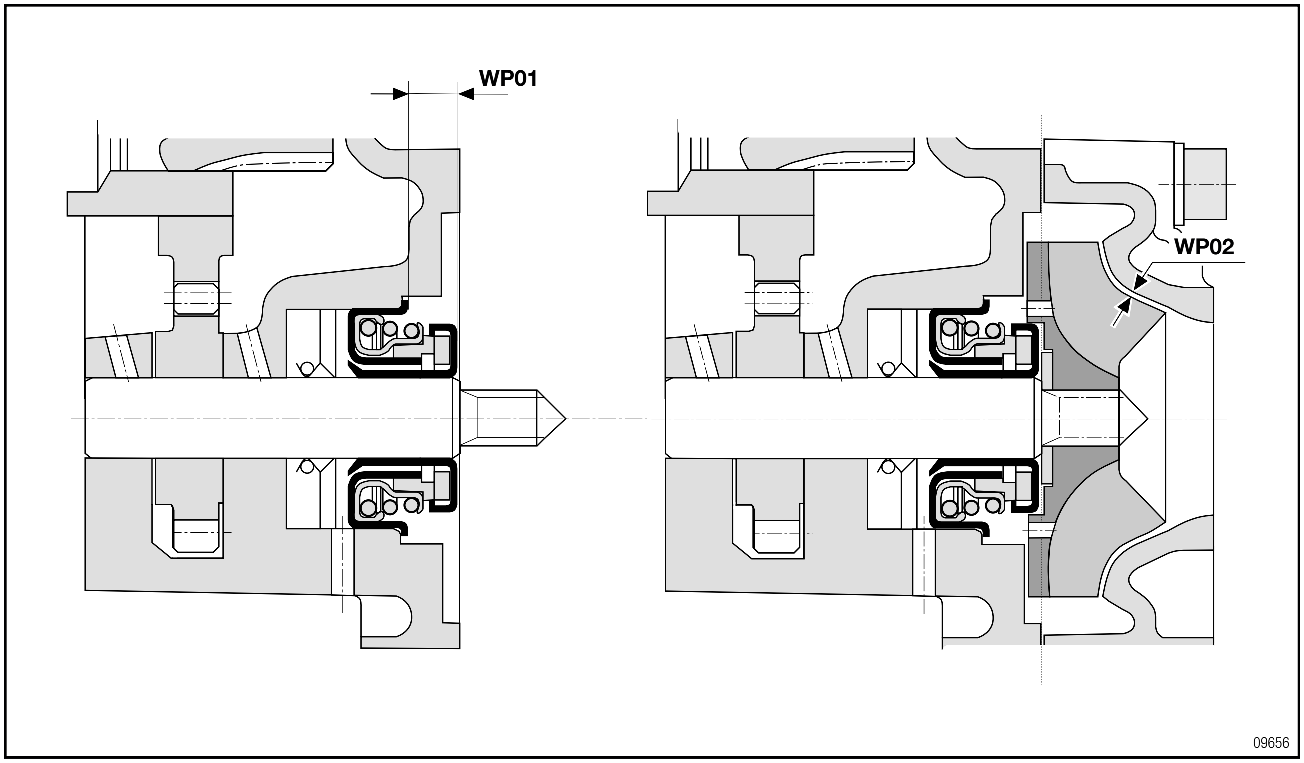


Figure 14.22

Description	Code	Reading new		Wear limit		Readings	
		min.	max.	100 %	50 %		
Water pump							
Reference to flat surface	WP01	8.55 mm 0.3366 in	8.85 mm 0.3484 in	8.85 mm 0.3484 in		actual	
						renewed	
Distance from impeller	WP02	0.3 mm 0.012 in	0.5 mm 0.020 in	0.7 mm 0.028 in	0.6 mm 0.024 in	actual	
						renewed	

ASSEMBLY

IGNITION HOUSING – ASSEMBLY

Oil seal – Installation

Step	Procedure
1	Lubricate the outside of a new oil seal and press it into the ignition housing as far as the bottom with a suitable jig part no. 876510.

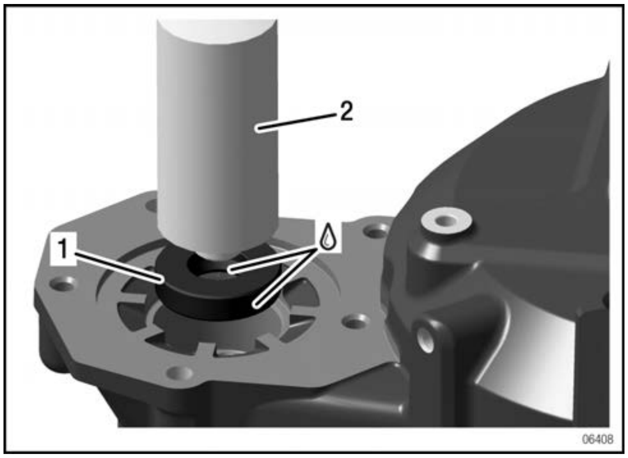


Figure 14.23

1 Oil seal *2 Insertion jig*

Water pump shaft – Installation

Step	Procedure
1	Apply small amount of LOCTITE 243 to the inner diameter of the rotary seal and press it into the insertion jig part no. 877258. Then press in the water pump shaft as far as it will go.
2	Insert the pump gear in the ignition housing.

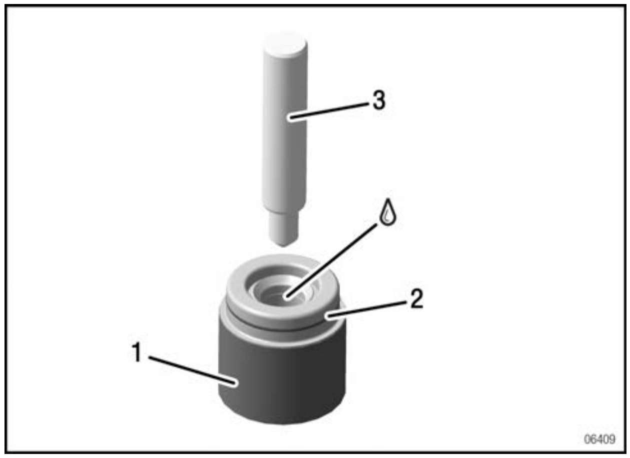


Figure 14.24

1 Insertion jig *2 Rotary seal*
3 Water pump shaft

Step	Procedure
3	Press the pump shaft with the rotary seal into the ignition housing using the insertion jig part no. 877258.

NOTE

Ensure that the pump gear is aligned with the pump shaft.

NOTE

The spacing WP01 is automatically established with insertion jig part no. 877258

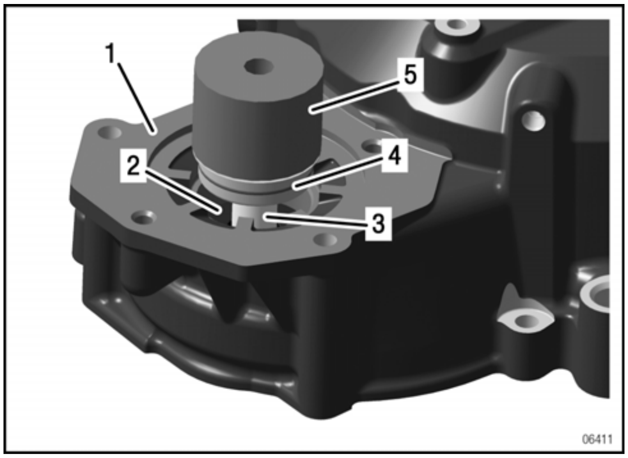


Figure 14.25

1	*Ignition housing*	2	*Oil seal*
3	*Pump shaft*	4	*Rotary seal*
5	*Insertion jig*		

Step	Procedure
4	Install the ignition housing. See Chapter 24-20-00 section Internal generator.
5	Push on the stainless compensating shim and apply LOCTITE 243 to the thread of the water pump shaft. Then fasten the impeller with the special tool part no. 877295 (with the crankshaft locked, see relevant Maintenance Manual Line chapter 12-20-00. Tightening torque 15 Nm (133 in. lb.).

NOTE

Ensure that the impeller runs true. If there is noticeable runout, this, and possibly also the pump shaft, must be replaced.

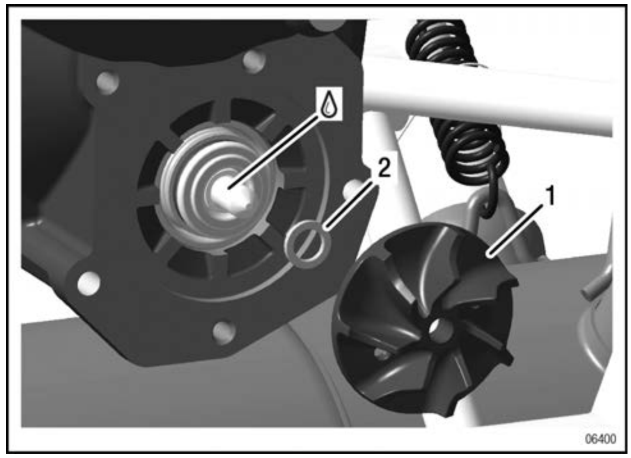


Figure 14.26: TYPICAL

1	*Impeller*	2	*Washer 8.2/12.5/1.5*

WATER PUMP HOUSING — ASSEMBLY

Step	Procedure
1	Lubricate the new bent socket with LOCTITE 243.
2	Screw the bent sockets at least 5 revolutions into the water pump housing and position it.

NOTE

Usually, 3 bent sockets with a bend angle of 45° and 1 bent sockets with a bend angle of 20° are installed.

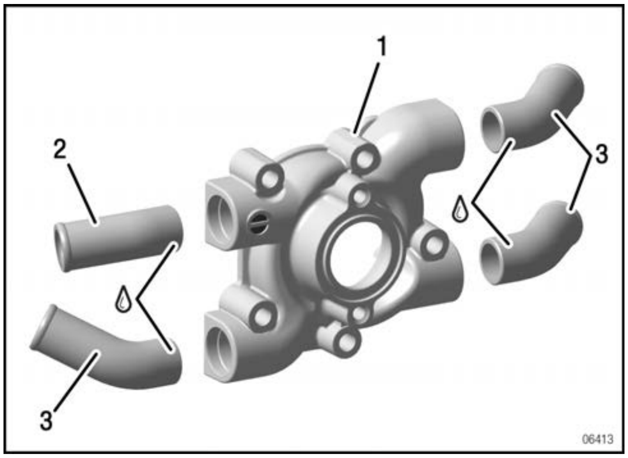


Figure 14.27

1	*Water pump housing*	*2*	*20° bent socket*
3	*45° bent socket*		

COOLANT HOSE — INSTALLATION

ATTENTION
The push-on length of the expansion tank is 25 mm (0.9843 in.)!

ATTENTION
Hoses must not be shortened!

NOTE

The hoses are all preformed and cut to length in the factory, and the hose length and push-on length therefore defines the position of the expansion tank. The correct position of the expansion tank ensures trouble-free installation of the governor.

NOTE

Mark the push-on lengths of the hoses on the water elbows.

Step	Procedure
1	Install a new rubber plate on preformed hose connection 2, 4 and 1.

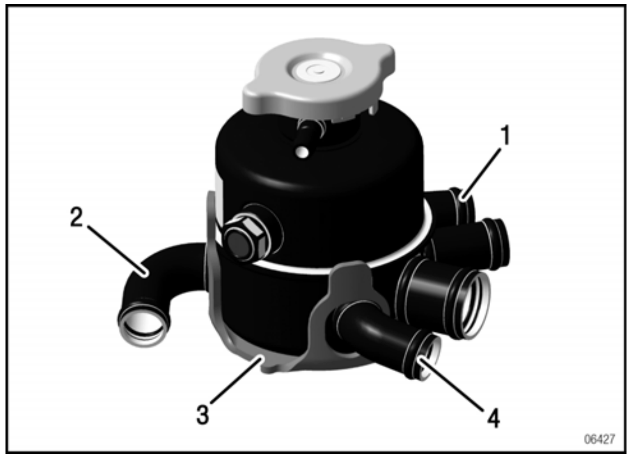


Figure 14.28

1	*Preformed hose connection 1*	*2*	*Preformed hose connection 2*
3	*Rubber plate*	*4*	*Preformed hose connection 4*

Step	Procedure
2	Install the spring type hose clamp 35 on the preformed hose radiator outlet.
3	Push on the preformed hose radiator outlet and align it vertically.

NOTE

Align the spring type hose clamp 35 vertically as well, so that the remaining coolant hoses can be installed.

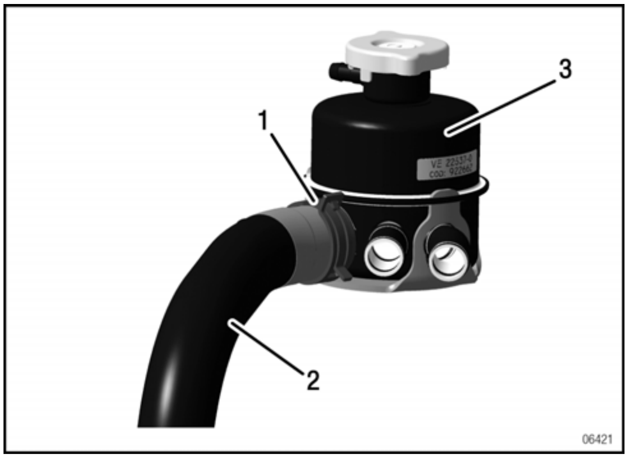


Figure 14.29

1	*spring type hose clamp 35*	*2*	*Preformed hose radiator outlet*
3	*Expansion tank*		

Step	Procedure
4	Install the spring type hose clamp 25 on the preformed hose 3 and align it vertically.

NOTE

Align the spring type hose clamp 25 so that it does not come into contact with the other spring type hose clamps.

Step	Procedure
5	Push on preformed hose 3 and align it horizontally.

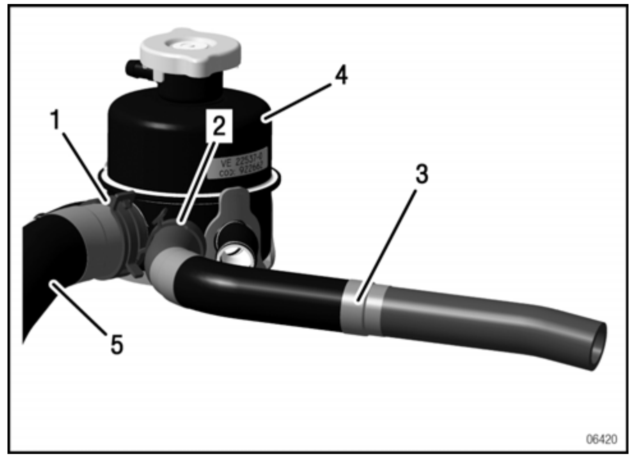


Figure 14.30

1	*Spring type hose clamp 35*	*2*	*Spring type hose clamp 25*
3	*Preformed hose 3*	*4*	*Expansion tank*
5	*Preformed hose radiator outlet*		

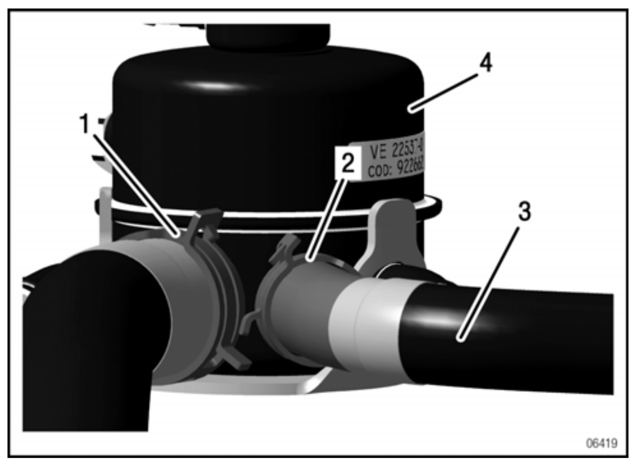


Figure 14.31

1	*Spring type hose clamp 35*	*2*	*Spring type hose clamp 25*
3	*Preformed hose 3*	*4*	*Expansion tank*

Step	Procedure
6	Install the spring type hose clamp 25 on preformed hose 1.

NOTE

Align the spring type hose clamp 25 so that it is 2 mm (0.0787 in.) away from the spring type hose clamp on preformed hose 3.

Step	Procedure
7	Push on preformed hose 1 and align it horizontally like preformed hose 3.

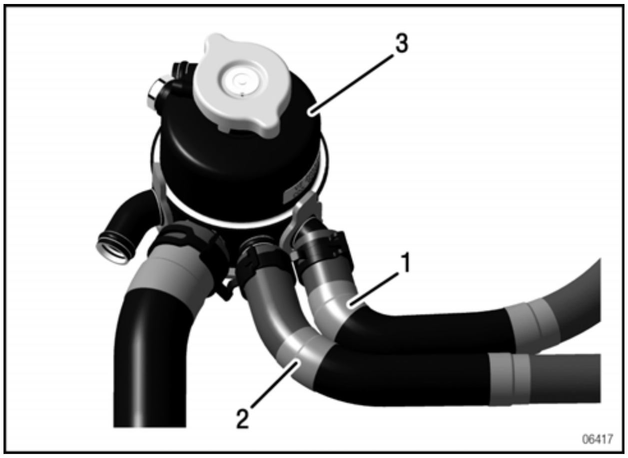


Figure 14.32

1	*Preformed hose 1*	2	*Preformed hose 3*
3	*Expansion tank*		

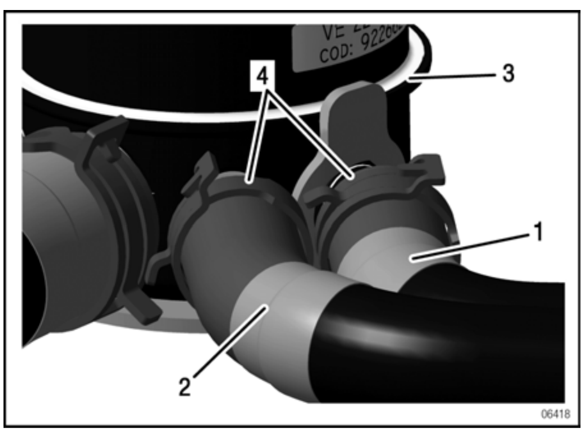


Figure 14.33

1	*Preformed hose 1*	2	*Preformed hose 3*
3	*Expansion tank*	4	*Spring type hose clamps*

Step	Procedure
8	Install the spring type hose clamp 25 on preformed hose 4.

NOTE

Align the spring type hose clamp 25 so that it does not come into contact with the other spring type hose clamps.

Step	Procedure
9	Push on preformed hose 4 and align it horizontally like preformed hoses 3 and 1.

NOTE

Preformed hose 4 is symmetrical.

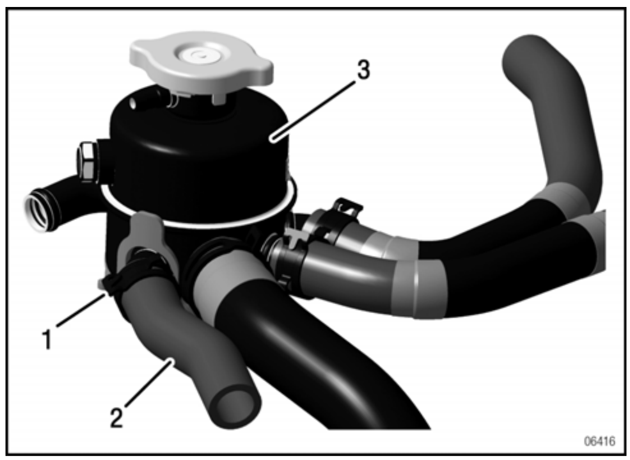


Figure 14.34

1	*Spring type hose clamp 25*	2	*Preformed hose 4*
3	*Expansion tank*		

Step	Procedure
10	Install the spring type hose clamp 25 on preformed hose 2 and position it vertically.
11	Push on preformed hose 2 and align it horizontally.

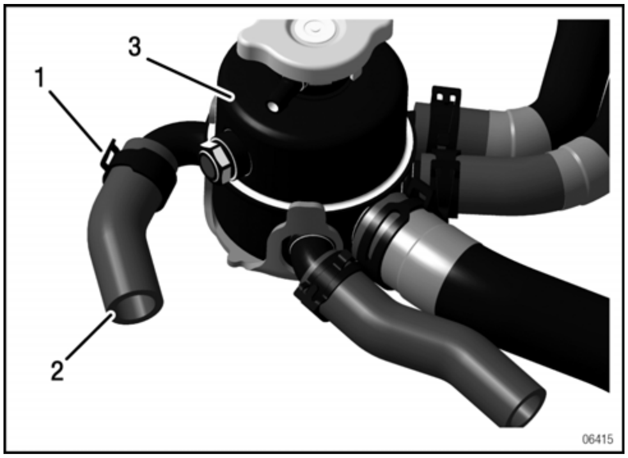


Figure 14.35

1	*Spring type hose clamp 25*	2	*Preformed hose 2*
3	*Expansion tank*		

NOTE

Preformed hose 2 is symmetrical.

INSTALLATION

IGNITION HOUSING — INSTALLATION

See Chapter 24–20–00

WATER PUMP HOUSING — INSTALLATION

ATTENTION

The bottom M6x35 Allen screw extends into the water chamber and is therefore stainless steel and sealed with a gasket ring.

ATTENTION

The impeller must not touch the pump housing.
If necessary, the axial position of the impeller must be adjusted.

See Chapter 75-00-00 section Water pump housing – inspection.

Step	Procedure
1	Put on a new gasket and fasten the water pump housing to the ignition housing with 2 Allen screws M6x90 and 3 Allen screws M6x35 with washers 6.4. Tightening torque 10 Nm (89 in. lb.).

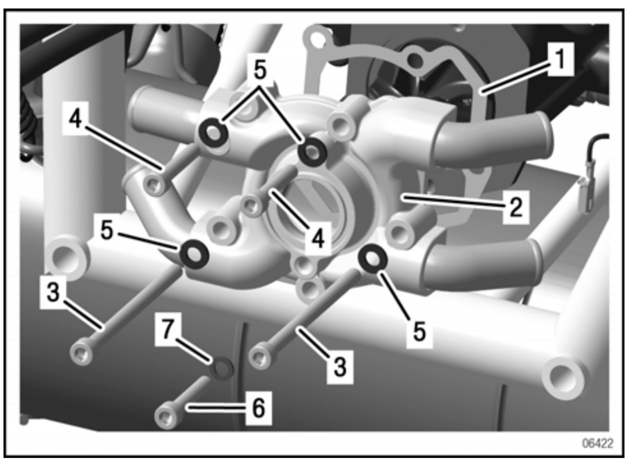


Figure 14.36: Typical

1	*Gasket*	*2*	*Water pump housing*
3	*Allen screw M6x90*	*4*	*Allen screw M6x35*
5	*Washers 6.4*	*6*	*Allen screw M6x35 (stainless)*
7	*Gasket ring*		

Step	Procedure
2	Insert the O-ring in the water pump housing and fasten the water inlet elbow in the marked position with 2 Allen screws M6x20 and washers 6.4. Tightening torque 10 Nm (89 in. lb.).

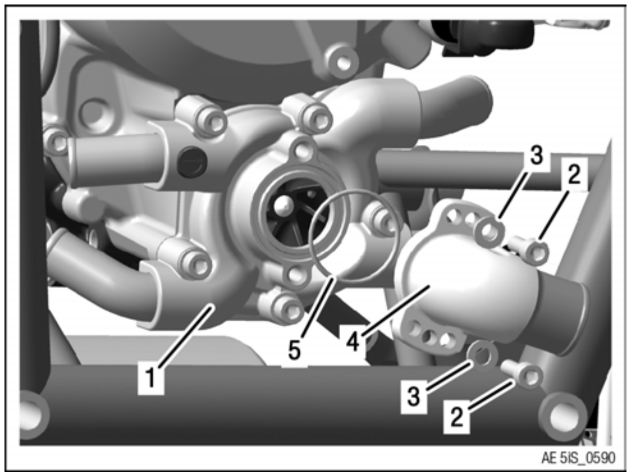


Figure 14.37: Typical

1	*Water pump housing*	*2*	*Allen screw M6x20*
3	*Washer 6.4*	*4*	*Water inlet elbow*
5	*O-ring*		

Step	Procedure
3	Install 4 coolant hoses and protection sleeves with spring type hose clamps 25 on the water pump housing. Use spring clamp pliers part no. 877840.

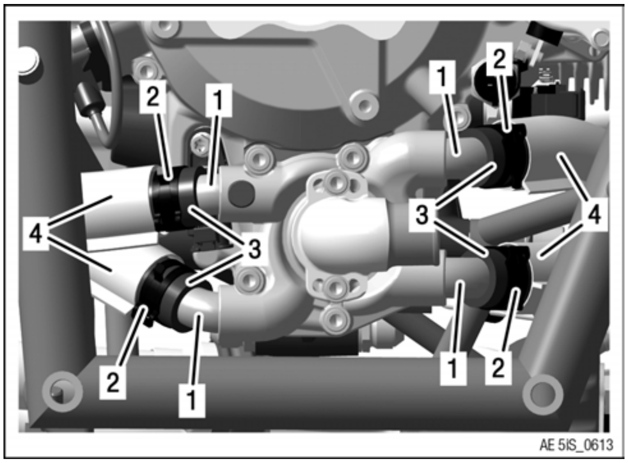


Figure 14.38

1	*Bent sockets*	*2*	*Hose clamps*
3	*Coolant hoses*	*4*	*Heat protection sleeves*

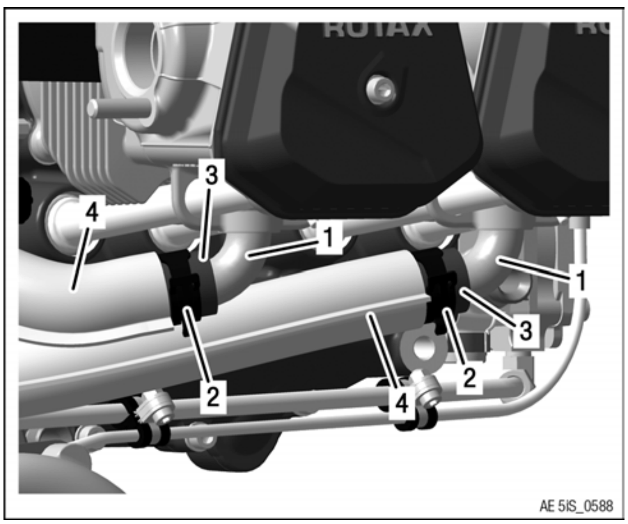


Figure 14.39

1	*Bent socket*	*2*	*Spring type hose clamp 25*
3	*Coolant hose*	*4*	*Heat protection sleeve*

COOLING AIR-DUCT (OPTIONAL) — INSTALLATION

Step	Procedure
1	Attach cooling air duct (is not mechanically held in place).
2	Install intake manifold, airbox and cooling expansion tank assy.

EXPANSION TANK AND COOLANT HOSE — INSTALLATION

ATTENTION

Ensure that the expansion tank is fixed without tension.

NOTE

Check the push-on lengths, readjust the preformed hoses if necessary.

Step	Procedure
1	Install coolant elbows 1 to 4. See Chapter 72-30-00 section Cylinder head.
2	Mount 1 spring type hose clamp 35 on the preformed hose radiator outlet and mount 1 spring type hose clamp 25 each on preformed hoses 1, 2, 3, and 4.
3	Position the expansion tank assy. with the 5 preformed hoses on the engine.

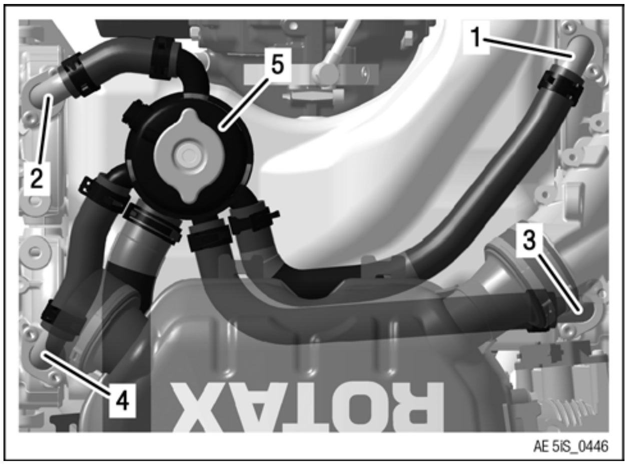


Figure 14.40

1	*Coolant elbow 1*	2	*Coolant elbow 2*
3	*Coolant elbow 3*	4	*Coolant elbow 4*
5	*Expansion tank*		

ATTENTION

Ensure that the push-on length is correct!
The push-on length onto the coolant elbow on the cylinder head is 27 mm (1.06 in.).

Step	Procedure
4	Fasten preformed hoses 1 to 4 with spring type hose clamps.

NOTE

Start with the shortest hose (preformed hose 2). Then preformed hose 1, then preformed hose 3 and preformed hose 4.

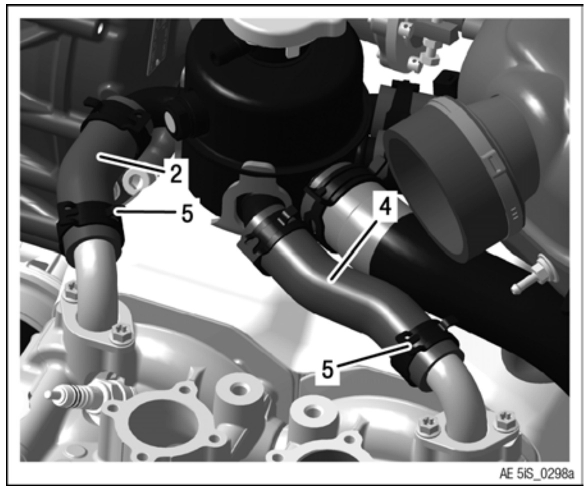


Figure 14.41

1	*Preformed hose 1*	2	*Preformed hose 2*
3	*Preformed hose 3*	4	*Preformed hose 4*
5	*Spring type hose clamp*		

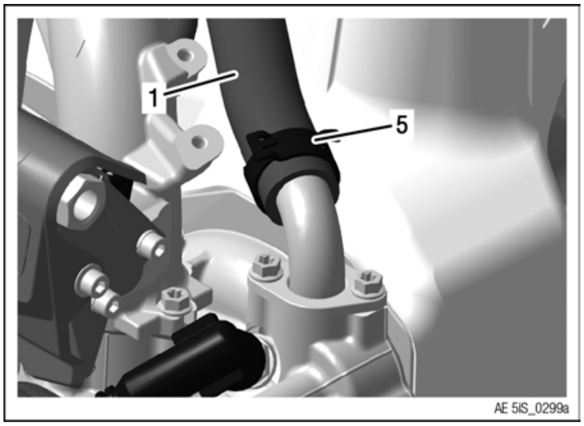


Figure 14.42

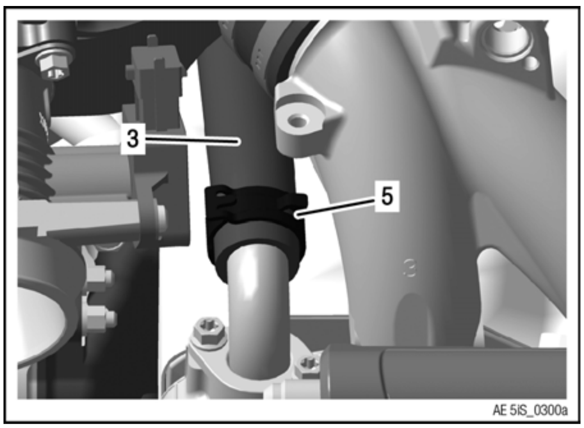


Figure 14.43

1	*Preformed hose 1*	2	*Preformed hose 2*
3	*Preformed hose 3*	4	*Preformed hose 4*
5	*Spring type hose clamp*		

FINISHING WORK

See Maintenance Manual Line for the engine type 915 i A Series.

- Put the 2 cable ties on the knock sensor line. See Chapter 76-50-00 section Wiring harness.
- Install the double ignition coils and spark plug connectors. See Chapter 74-20-00 section Ignition unit.
- Install the air filter with the heat shield. See the current Maintenance Manual Line.
- Fill with coolant. See relevant Maintenance Manual Line for the 915 i A Series engine type.
- Service the engine cooling system. See relevant Maintenance Manual Line for the 915 i A Series engine type.
- Fill with fuel. See relevant Maintenance Manual Line for the 915 i A Series engine type.
- Install the fuel line assy. See Chapter 73-10-00 section Fuel system.
- Install the 1-ear clamps.
- Install the cable ties for the fuel pressure regulator reference hose. See Chapter 73-10-00 section Fuel system.
- Install the wiring harness. See Chapter 76-50-00 section Wiring harness.
- Install the fuel hose inlet and return hose. See Chapter 73-10-00 section Fuel system.
- Carry out an engine test run. See relevant Maintenance Manual Line for the 915 i A Series engine type.

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Chapter: 76–00–00
ENGINE CONTROL

TOPICS IN THIS CHAPTER

Introduction

The Engine Management System (EMS) consists primarily of:

- Control unit (Electronic Control Unit = ECU)
- ECU signals
- EMS power supply
- Fuse box (FUSE BOX)
- Switches
- Wiring

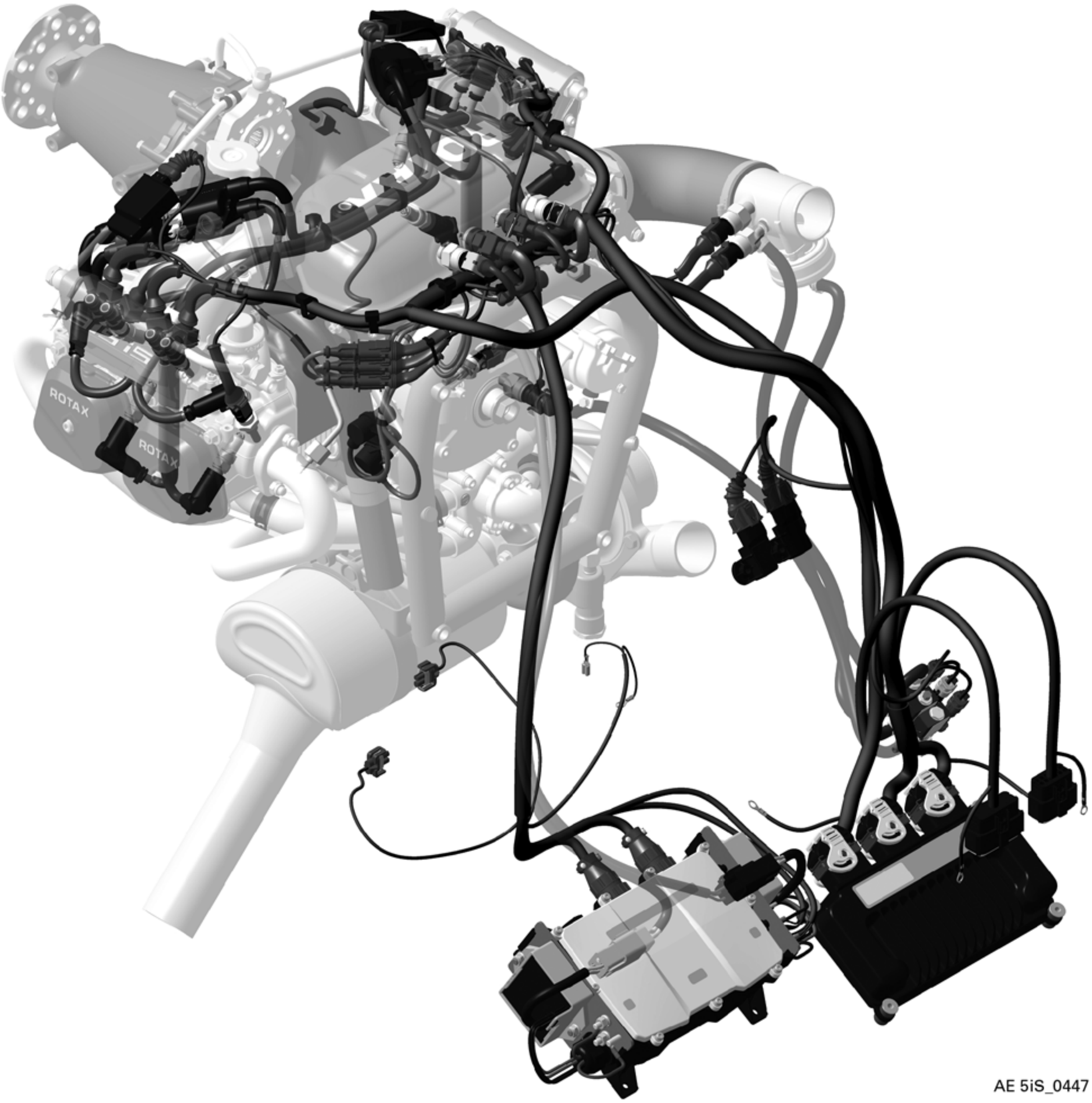

Figure 4.1: : Position on the engine

Chapter: 76–10–00
CONTROL UNIT (ECU)

TOPICS IN THIS CHAPTER

SPECIAL TOOLS

Description	Part number
B.U.D.S SET LEVEL 1	864021
B.U.D.S SET LEVEL 2	864022
B.U.D.S SET LEVEL 3	864023
ECU Adapter (for testing wire harness)	277012
Service Wiring Harness 1)	864280
Y-Cable (Sub-D DE9 female on male/male junction) 2) 3)	n.a.
B.U.D.S. Aircraft Software	n.a.
Computer/Notebook/Netbook	n.a.

1) Only required if ECU is detached from the wiring harness.

2) Only required if the aircraft has two separate Sub-D DE9 connectors.

3) The y-cable must be according to the wiring diagram in Fig. 1.

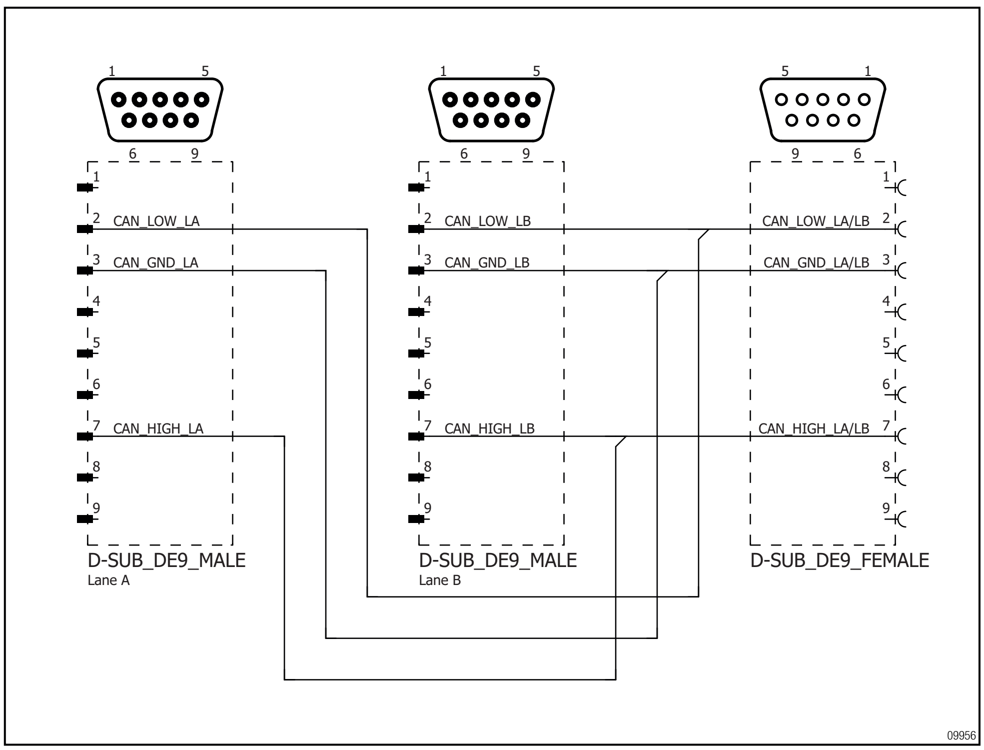

Figure 15.1

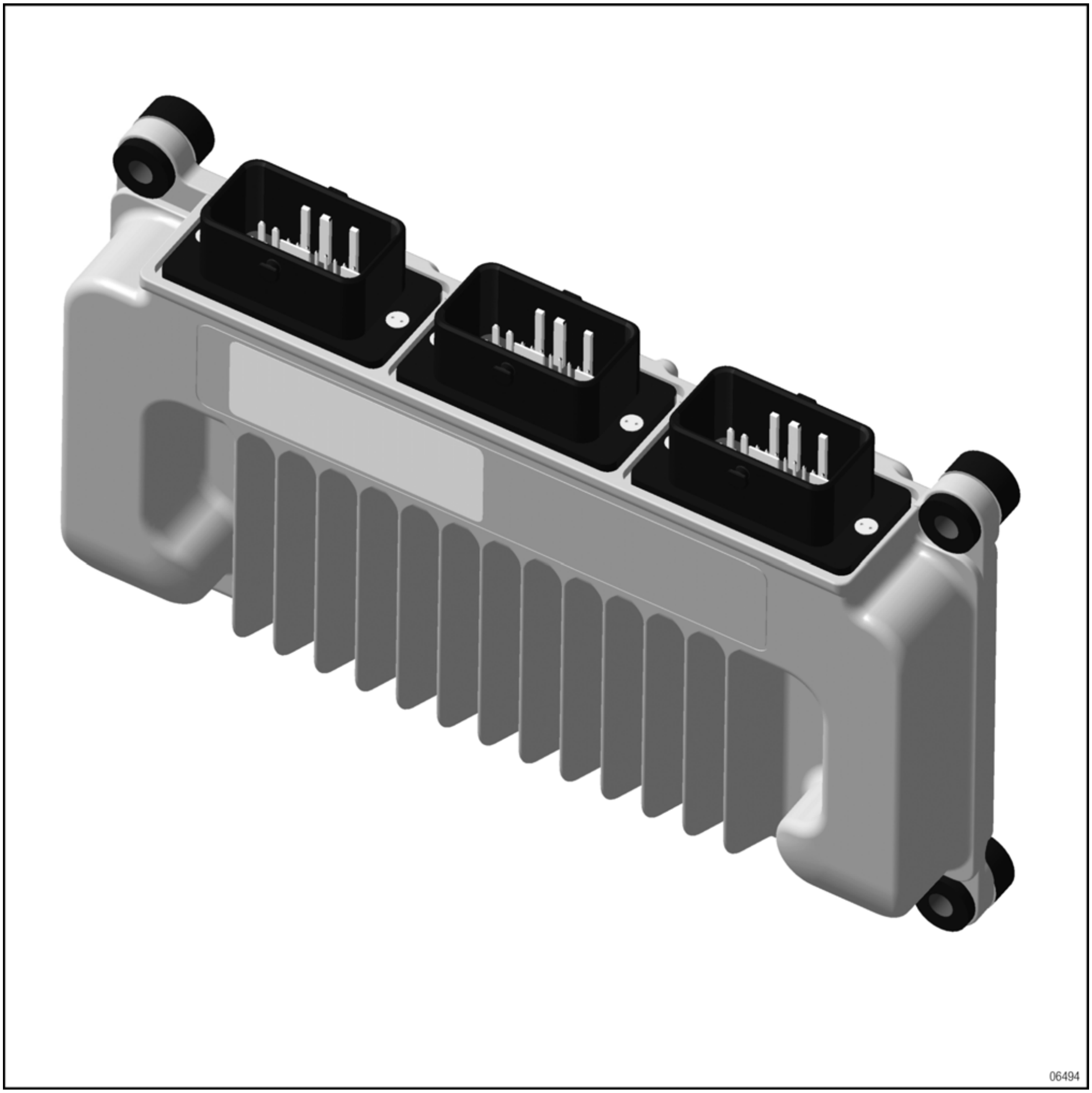

Figure 15.2: Control unit (ECU)

SYSTEM DESCRIPTION

GENERAL NOTE

The control unit is the central module in the engine management system.
Sensors continuously measure pressure, rotation speed, temperature, load and knock signals and send these measurement values to the ECU.
The digital ECU uses these measurement values to determine not only the mixture but also the optimum injection point for the fuel and ignition points specifically for each cylinder.

NOTE

The general safety instructions must be followed during all work on the ECU!

SAFETY INSTRUCTION

⚠ WARNING

Danger of damage to engine! There is a risk of short circuits and cable fires during work on the engine management system.
All installation work on the engine management system should be carried out with the engine switched off and the battery (negative terminal) disconnected. All engine controls (e.g. switches) must be set in a way that the engine in not supplied with electrical power.

ATTENTION

Danger of damage to the fuel distribution system and ignition unit!

MAINTENANCE

Beside maintenance and special checks, see the Maintenance Manual Line for the engine type 915 i A Series

ATTENTION

The wiring harness or service wiring harness connectors must be only installed into respective sockets of the ECU (pay attention to the marking). If excessive force is used or the position is wrong, the pins can be bent and the ECU must be replaced.

TECHNICAL DATA

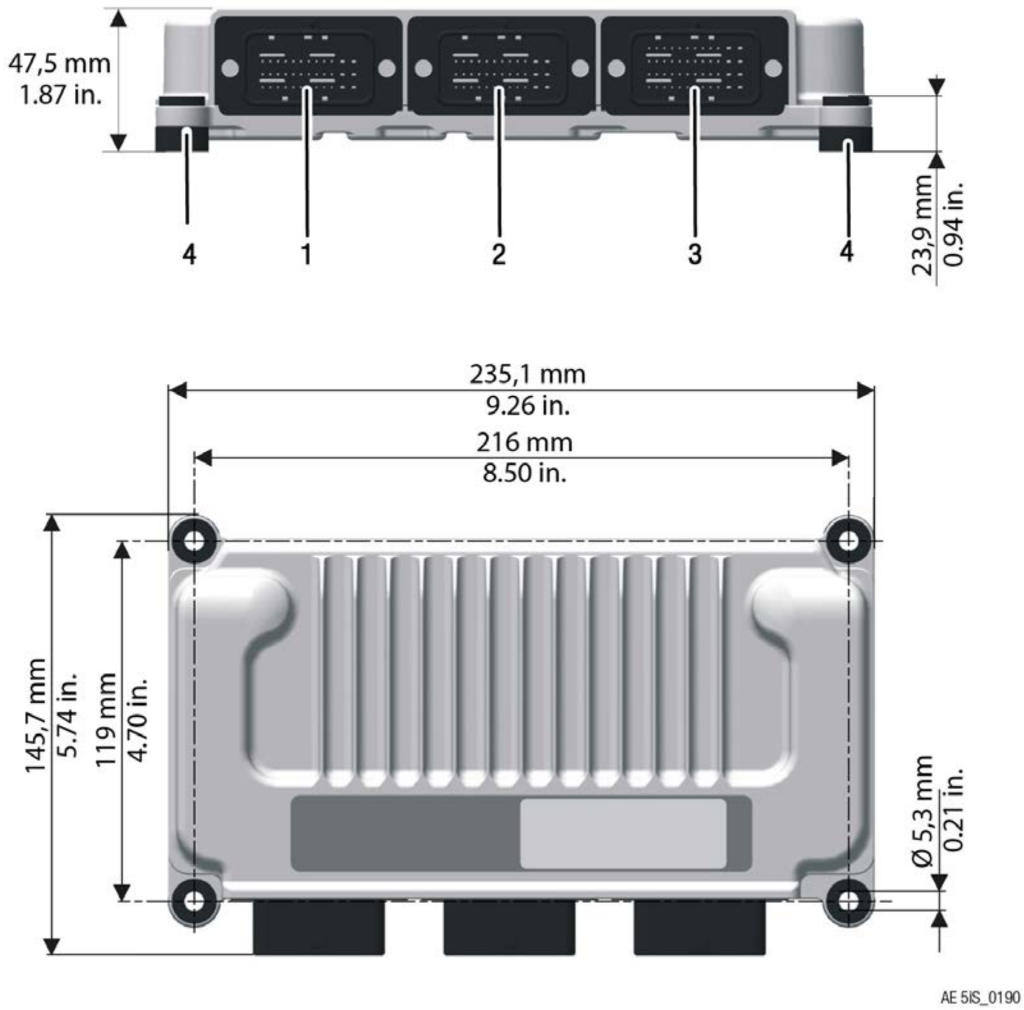

Figure 15.3

1 Connector socket A1

2 Connector socket A2

3 Connector socket B

4 Attachment points

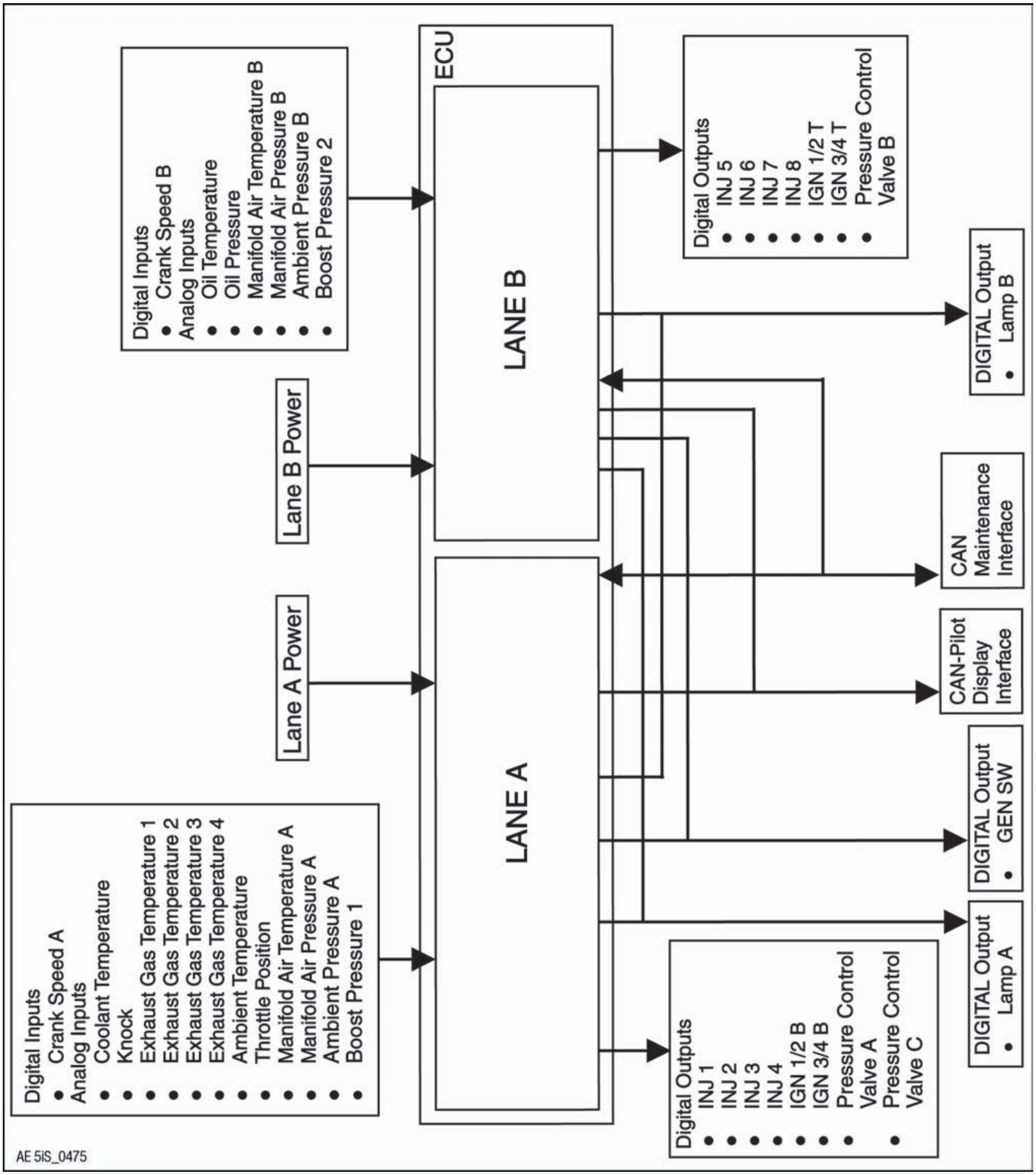

Figure 15.4: Control unit ECU

REMOVAL

Preparation

Before the ECU is removed, the work and checks described below must be carried out to identify any malfunctions and rectify them as part of the repair work.

- General visual inspection. See relevant Maintenance Manual Line Chapter 05-00-00 and 12-20-00.

ATTENTION

The wire connectors of the ECU must not be opened and closed more than 20 times! This must be shown on the device by a clearly visible label with a printed numerical sequence (1-20) and by documentation conforming to self-monitoring guidelines.

ECU - REMOVAL

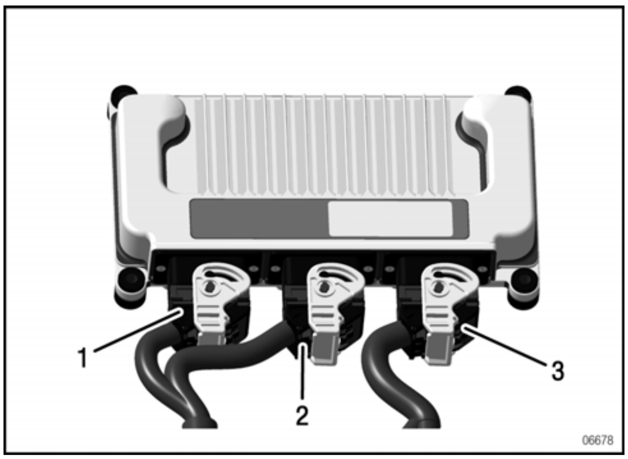

Figure 15.5

1 Coupler (LANE A1) *2 Coupler (LANE A2)*

3 Coupler (LANE B)

Step	Procedure
1	Remove the battery grounding cable according to the aircraft manufacturer's specifications.

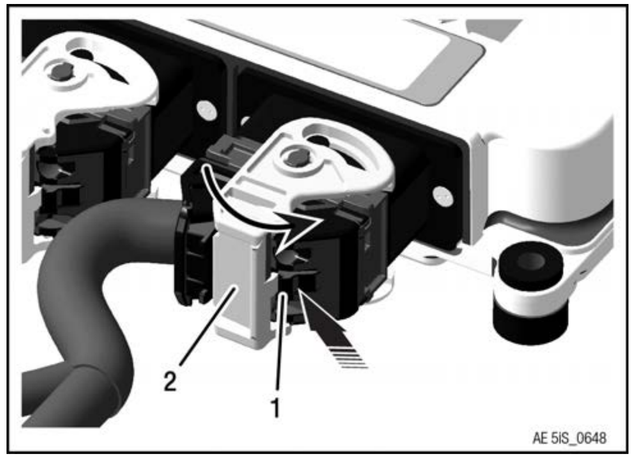

Figure 15.6

1 Lock *2 Lever*

ATTENTION

Removal must be carried out according to the aircraft manufacturer's instructions.

Step	Procedure
2	Unplug the connectors (LANE A1, LANE A2 and LANE B). • Press in the lock so to rotate the lever. • Press the lever down until it latches. • Remove the connector.
3	Remove the mounting bolts/screws according to the aircraft manufacturer's specifications. Remove the ECU.

INSPECTION

ECU - INSPECTION

ATTENTION

The functional test of the ECU can only be carried out with the corresponding software (B.U. D.S. Aircraft), as part of an engine test run (see relevant Maintenance Manual Line 12-20-00) or on an approved test bench.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A SeriesChapter 05-00-00 and 12-20-00.

Step	Procedure
1	Check the component surfaces of the ECU for damage.

NOTE

Deformation and deep scratches are not permissible.

Step	Procedure
2	Check flat and contact surfaces for Allen/ hex. screws and nuts.
3	Check the screws and nuts for damage and wear.

NOTE

Replace damaged screws and nuts. Check the corresponding internal thread too when changing the screws.

Step	Procedure
4	Check the plug connection for damage and wear.
5	Check the rubber mounting grommets for damage.
6	Check the label on the ECU for readability.

INSTALLATION

Preparation

ATTENTION

The wire connectors of the ECU must not be opened and closed more than 20 times! This must be shown on the device by a clearly visible label with a printed numerical sequence (1-20) and by documentation conforming to self-monitoring guidelines.

NOTE

The ECU can only be replaced as a complete spare part.

ECU - INSTALLATION

ATTENTION

Installation must be carried out according to the aircraft manufacturer's and to the specifications of the Installation Manual.

Step	Procedure
1	Install the control unit according to the aircraft manufacturer's instructions.
2	Plug the wiring harness (main strand) into the ECU and turn lever. • Plug in connector LANE A1 • Plug in connector LANE A2 • Plug in connector LANE B

NOTE

Ensure that the correct connection is made to the corresponding LANE by using the white line marking.

Step	Procedure
3	Install the battery grounding cable according to the aircraft manufacturer's instructions.

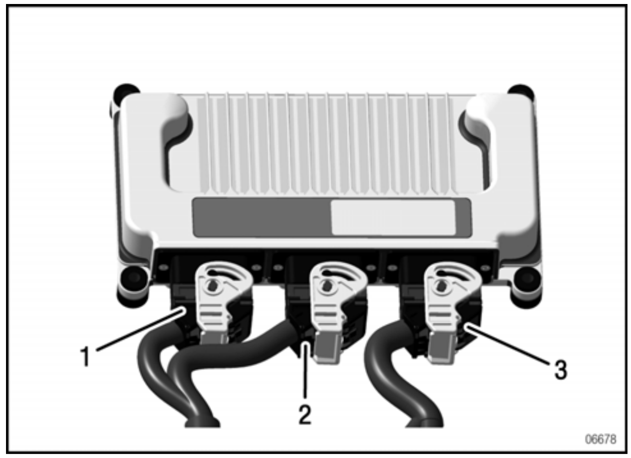

Figure 15.7

1 Connector (LANE A1) *2 Connector (LANE A2)*

3 Connector (LANE B)

NOTE

Put the lever completely horizontal, place on the connector, then close the lever 90°. The lock must latch.

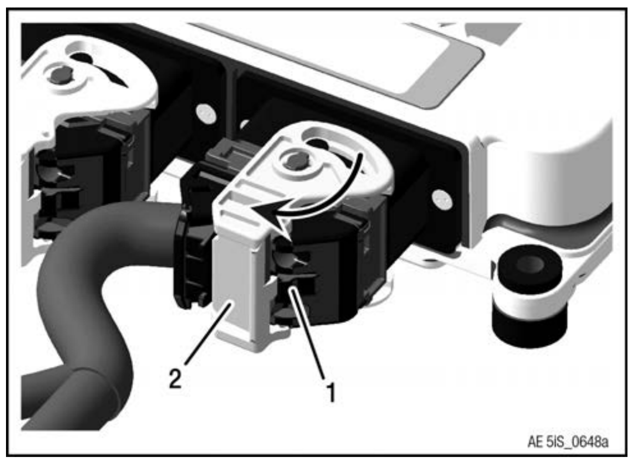

Figure 15.8

1 Lock *2 Lever*

ECU - READ OUT AND FLASHING

Introduction

The intention of this procedural instruction is to guide users through the process of identifying the software- and hardware version of an ECU. Although ECU software changes must be documented within the engine logbook and on the ECU (update label), it is mandatory to identify the current ECU software- and hardware version by using B.U.D.S. Aircraft software.

Generally this process can be performed in two different ways:

- **Situation 1:** ECU has been removed from an Aircraft. That means the ECU has been disconnected from the wiring harness and removed from the aircraft
- **Situation 2:** ECU is installed in an Aircraft. The ECU is connected to the wiring harness and installed in the Aircraft.

Because the situations are essentially different, those two situations will be described independently in this chapter.

NOTE

Before extracting logs or loading ECU software make sure you have installed the latest version of B.U.D.S. Aircraft in accordance to SI-915iA-002. See also Service Bulletin SB-915iA-002iS.

ECU ON WORKBENCH

ATTENTION

Do not open and close the ECU connectors more than 20 times, otherwise it is required to change the ECU and the wiring harness. If it is possible it is recommended to perform the software loading process as described in Situation 2 to save connection cycles. For a flawless software loading procedure ensure that the selected power supply is able to provide constant voltage.

CONNECTION

Step	Procedure
1	Connect B.U.D.S. Aircraft Set with the USB-Port of your computer. If the device is connected and installed the RED indicator light should light up.
2	Connect the B.U.D.S. Aircraft Set Sub-D DE9 connector with the Sub-D DE9 socket of the Y-cable.
3	Connect the Service Wiring Harness with the LANE A1 and LANE B connectors of the ECU.

ATTENTION

Please note labeling of the ECU and the Service Wiring Harness.

Step	Procedure
4	Connect power adapter of Service Wiring Harness with power supply (100-230 V~50/60 Hz, 500 mA).
5	Now the setup should be as shown in following figure.

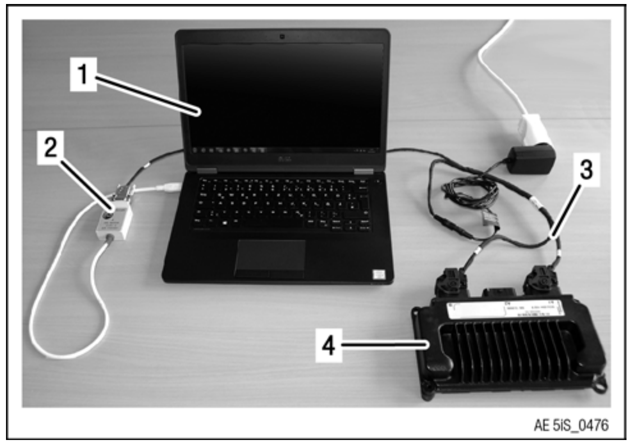

Figure 15.9: Computer with ECU

1	*Computer*	2	*B.U.D.S. Aircraft Set*
3	*Service Wiring Harness*	4	*ECU*

IDENTIFY CURRENT ECU CONFIGURATION

Step	Procedure
1	Launch B.U.D.S. Aircraft by double clicking the desktop icon. Alternatively B.U.D.S. Aircraft can also be started through the start menu entry (e.g. Start - Programs - BUDS - run BUDS).

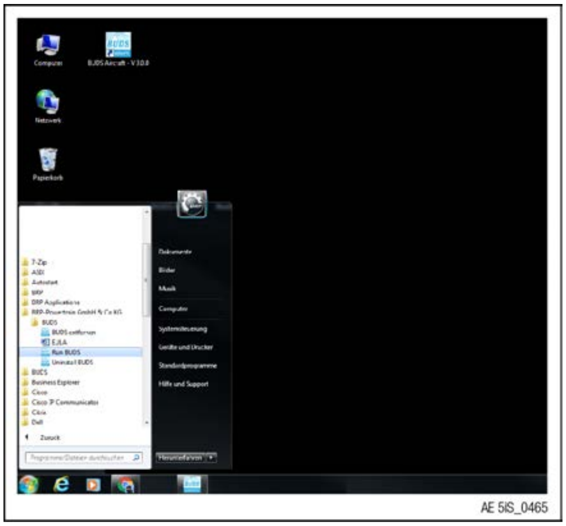

Figure 15.10: B.U.D.S. Aircraft Start

Step	Procedure
2	Wait until the program has been started completely.
3	Check if both Lane Health Indicators (top-left corner) turn green. If they are gray check connections and power supply and/or restart B.U.D.S. Aircraft.
4	Change to “ECU configuration” tab.

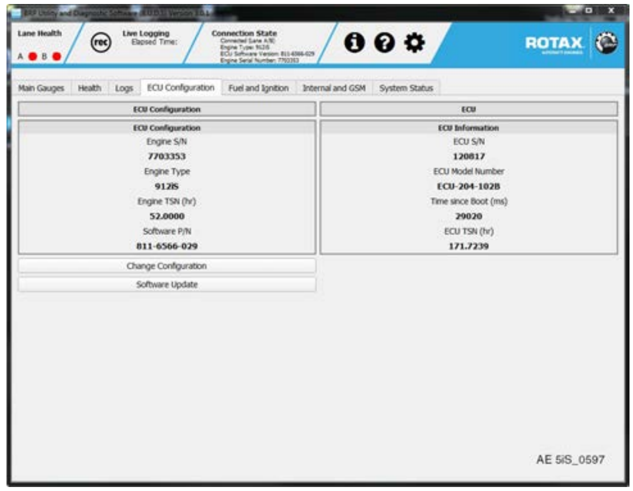

Figure 15.11: ECU configuration tab

Step	Procedure
5	Read and note the values of following fields: • Software P/N: This value indicates the current software installed on the ECU. **NOTE** *Knowing the current “Software Config. Part Number” and “ECU part number” is crucial, when loading ECU software or verifying if ECU has the latest software installed.*
6	Disconnect the wiring attached to connect the ECU with the computer. • Disconnect power supply of the Service Wiring Harness. • Disconnect B.U.D.S. Aircraft Set • Disconnect Service Wiring Harness connectors

READ OUT LOG FILES

General

To have all information it is recommended to extract Lane A and B and also Fault and Data logs. The extraction process (read out) may take 10 minutes or more depending on the number of logs.

NOTE

Fault logs: Fault, failure and warning entries in the ECU.
Data logs: ECU data recorded in a rolling memory.

Step	Procedure
1	Change to “Logs” tab.
2	Select “Extract logs”.

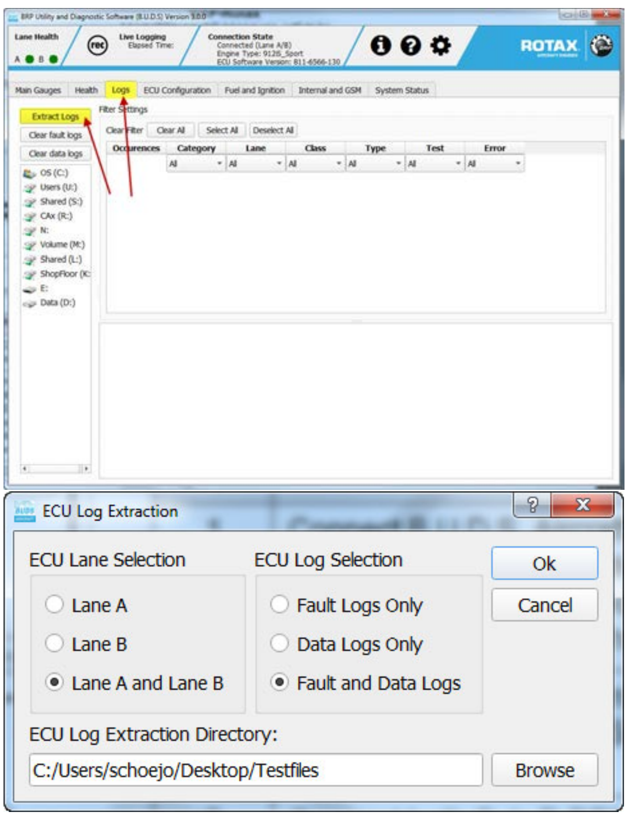

Figure 15.12

Step	Procedure
3	Disconnect and re-connect the power supply if B.U.D.S. Aircraft requests to do so.

Figure 15.13

NOTE

After the extraction process has finished B.U.D.S. Aircraft requests to power cycle the ECU (Disconnect + Re-connect power supply).

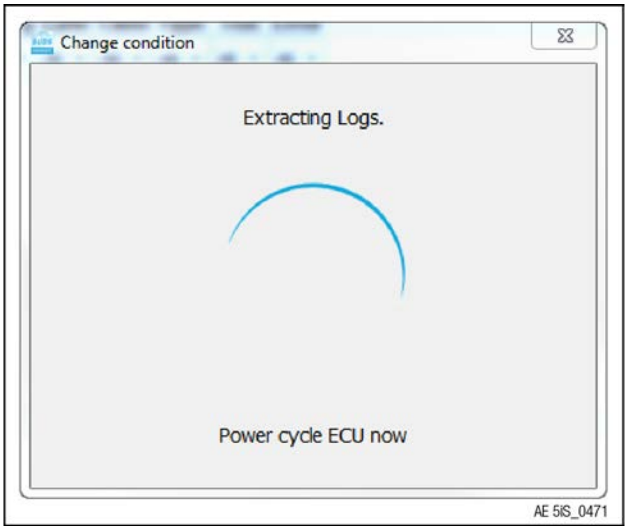

Figure 15.14

Step	Procedure
4	Disconnect the wiring connecting the ECU with the computer. • Disconnect power supply of the Service Wiring Harness. • Disconnect B.U.D.S. Aircraft Set • Disconnect Service Wiring Harness connectors
5	With the Windows Explorer navigate to the created Log-File. This file can now be copied and for example attached to an E-mail or otherwise used.

SOFTWARE UPDATE

ATTENTION

Do not open and close the ECU connectors more than 20 times, otherwise it is required to change the ECU and the wiring harness. For a flawless software flashing procedure ensure that the selected power supply is able to provide constant power.

Preparation
Connect Computer with ECU and identify configuration as described in the previous subsections in this chapter.

Step	Procedure
1	Check the currently installed ECU Software version and the set Engine type. **NOTE** *The last three digits of the “Software P/N“ illustrate the currently installed ECU Software version.*

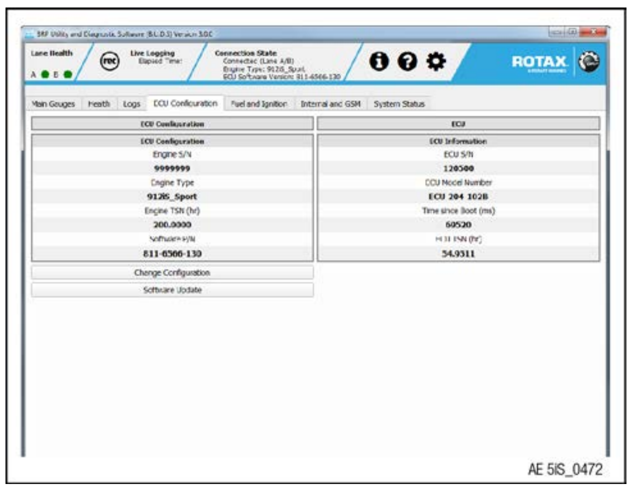

Figure 15.15

> **⚠ WARNING**
>
> **Only Software that is compatible with a specific engine type is allowed to be flashed on an ECU . If the engine type in the ECU deviates from the hardware configuration of the engine, contact a ROTAX® distributor immediately.**

Step	Procedure
2	Select “Software Update”.
3	Disconnect and re-connect the power supply if B.U.D.S. Aircraft requests to do so.
4	Select “Browse” and navigate to the appropriate ECU Software file (.ath) and confirm with “Open“.
5	The path to this file and the Software P/N will be shown.

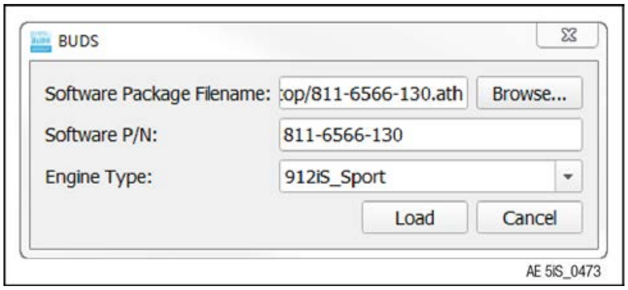

Figure 15.16

Step	Procedure
6	Select “Load”.
7	After the extraction process has finished B.U.D.S. Aircraft requests to power cycle the ECU (Disconnect + Re-connect power supply).
8	Please wait until the Software flashing process is finished. The process itself should take approximately 1 minute (a status display will indicate the progress).
9	After the extraction process has finished B.U.D.S. Aircraft requests to power cycle the ECU.

Check of the Software version

NOTE

If the Software flashing process was interrupted (e.g. the ECU was disconnected from the computer) it is necessary to restart the flashing process with the desired Software. If this flashing process also fails, flash the initial software on the ECU and afterwards retry flashing the desired Software version.

Step	Procedure
1	Check warning lamp indicators. If both warning lamp indicators (section “Lane Health“/top toolbar) start to flash “RED“ after rebooting the ECU, check compatibility between set Engine type and ECU Software version.

Step	Procedure
2	Change to “Health“-Tab and check the Sensor Status and Device Status. If there are Errors/Events the ECU might be damaged and further investigation needs to be done. See following Figure for example of correct health tab (using service harness only).
3	The Software flashing process itself is now complete. Switch “OFF” the ECU.
4	Remove all wiring connections.

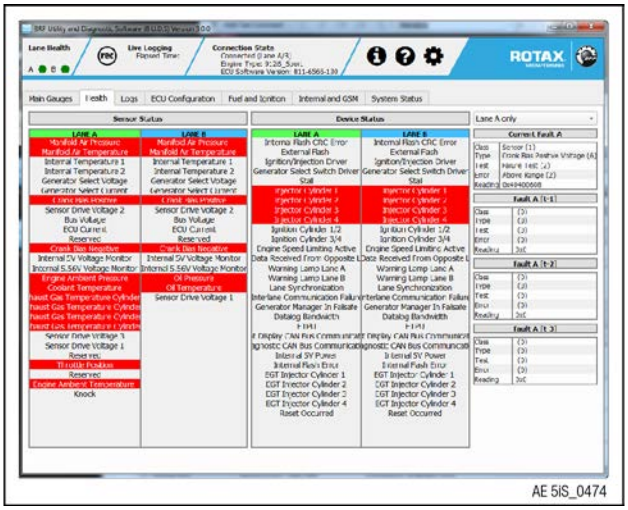

Figure 15.17: Health tab

ECU INSTALLED IN AIRCRAFT

The identification of current ECU configuration, read out of logs and the software updating process is the same as on workbench, see previous section.

CONNECTION

ATTENTION

The battery must provide constant voltage thru the whole extraction process. If this can‘t be ensured, an external power supply must be used.

Connect computer with ECU

NOTE

If 2 Sub-D connectors are installed, proceed as follows. If only 1 Sub-D connector is installed, connect B.U.D.S. Aircraft Set directly.

Step	Procedure
1	Connect B.U.D.S. Aircraft Set with the USB-Port of your computer. If the device is connected and installed the RED indicator light should light up.
2	Connect the B.U.D.S. Aircraft Set Sub- D DE9 connector with the Sub-D DE9 socket of the Y-cable.
3	Connect both Sub-D DE9 sockets of the Maintenance CAN with the Sub-D DE9 connectors of the Y-cable.
4	Now the setup should be as shown in following figure.
5	Activate the EMS by supplying it with aircraft power.

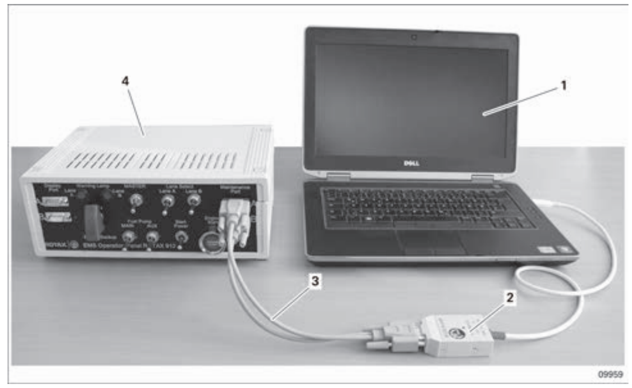

Figure 15.18

1 Computer
2 B.U.D.S. Aircraft Set
3 Y-cable
4 Cockpit (Simulation)

FINISHING WORK

- Attach all the necessary fastenings (e.g. cable ties, holders, clamps etc.) of the wiring harness.
- Transfer the actual data documented when removing the old ECU to the newly installed ECU.
- Delete the error memory of the new ECU.
- Carry out an engine test run.
- Read out the ECU.

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Chapter: 76–20–00
FUSE BOX

TOPICS IN THIS CHAPTER

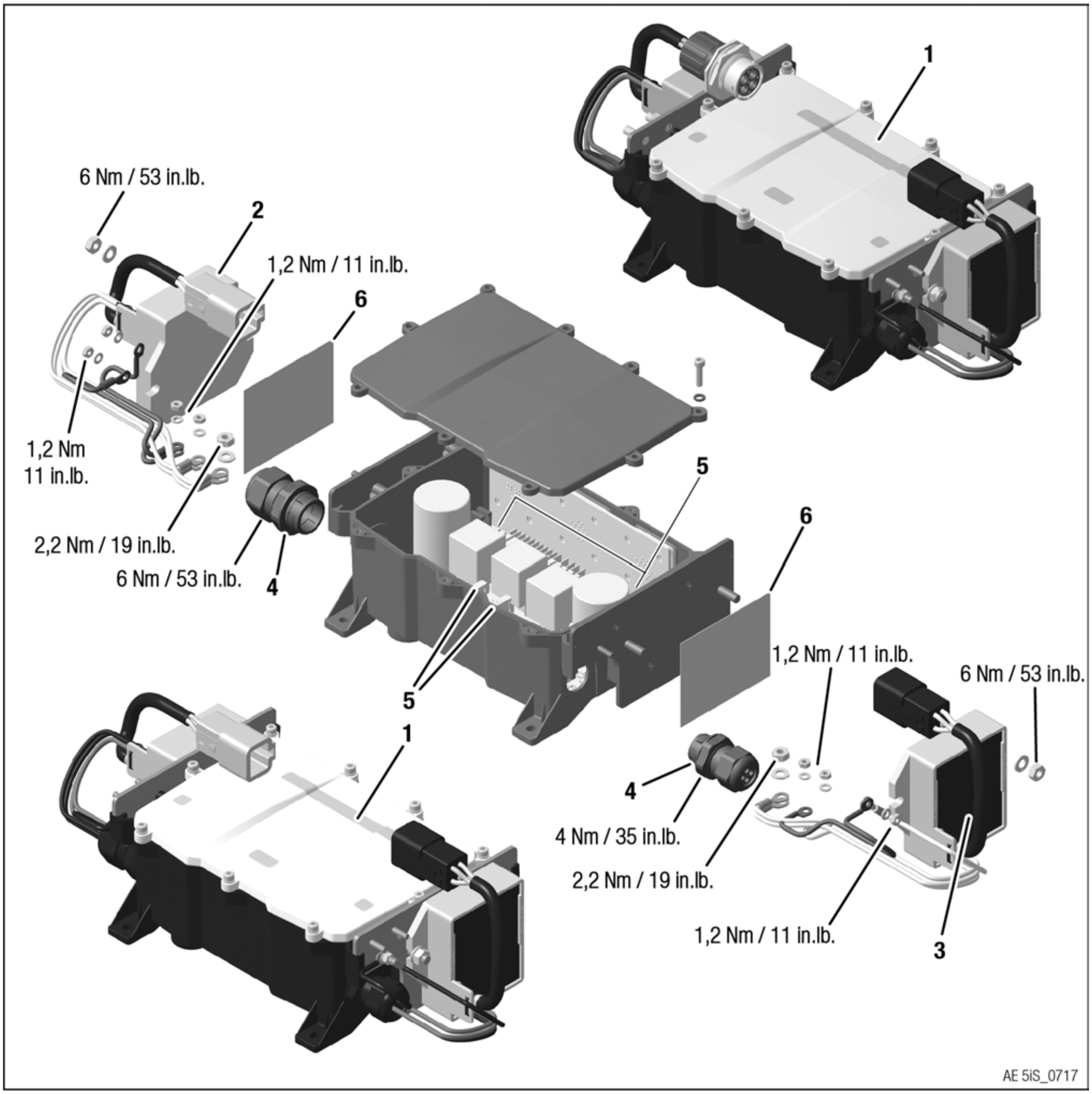

Figure 16.1

1	*Fuse box assy.*	2	*Regulator B*
3	*Regulator A*	4	*Sealing insert*
5	*Fuses*	6	*Heat transfer pad*

SYSTEM DESCRIPTION

GENERAL NOTE

All the components of the voltage supply, e.g. fuses, are included in the power supply unit.

SAFETY INSTRUCTION

⚠ WARNING

Danger of damage to engine!
There is a risk of short circuits and cable fires during work on the engine management system. All engine controls (e.g. switches) must be set in a way that the engine in not supplied with electrical power.

NOTE

The general safety instructions must be followed during all work on the fuse box!

MAINTENANCE

Beside the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

TECHNICAL DATA

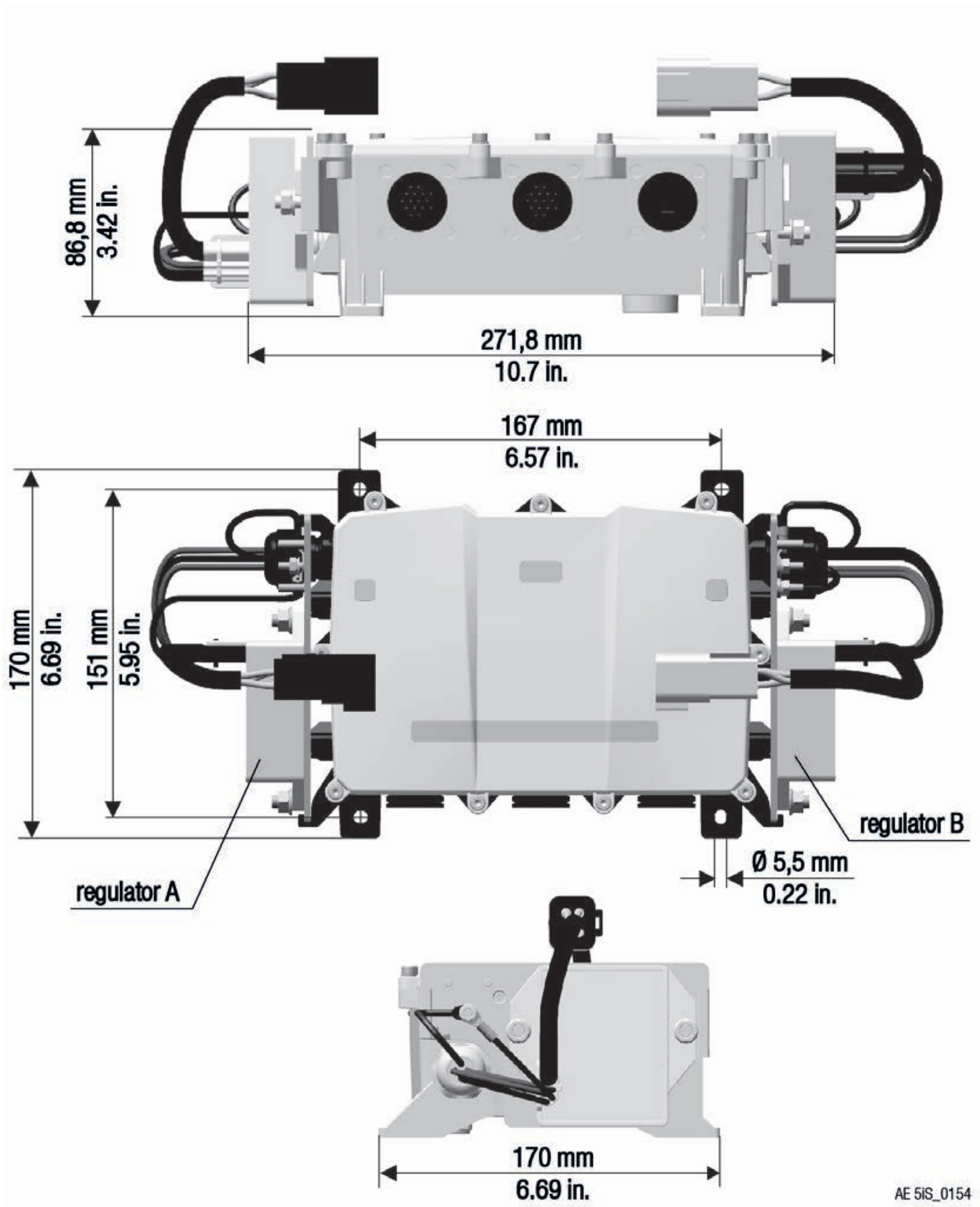

Figure 16.2: Fuse box, TYPICAL

FUSE BOX

Preparation

Before the fuse box is removed, the work and checks described below must be carried out to identify any further malfunctions in the engine and rectify them as part of the repair work.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05–00–00 and 12–00–00.

FUSE BOX — REMOVAL

Step	Procedure
1	Unplug the engine wiring harness and grounding connectors from the fuse box. See Chapter 76-50-00 section Wiring harness.
2	Unplug the aircraft wiring harness.

ATTENTION

Removal must be carried out according to the aircraft manufacturer's instructions.

Step	Procedure
3	Remove the attachment screws of the fuse box according to the aircraft manufacturer's specifications. Remove the fuse box.

REGULATOR B — REMOVAL

Step	Procedure
1	Loosen the gasket screw connection. Wrench size A/F 30.

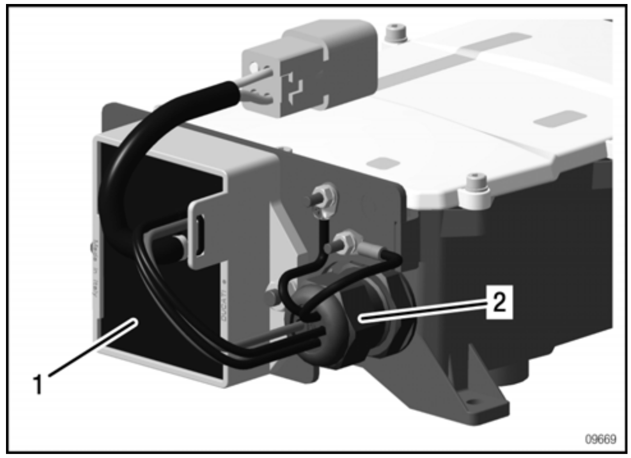

Figure 16.3: TYPICAL

1	*Regulator B*	2	*Cap nut of the gasket screw connection*

Step	Procedure
2	Remove the cover. Loosen 9 M4 Allen screws along with plastic washer. Allen wrench A/F 3 mm.

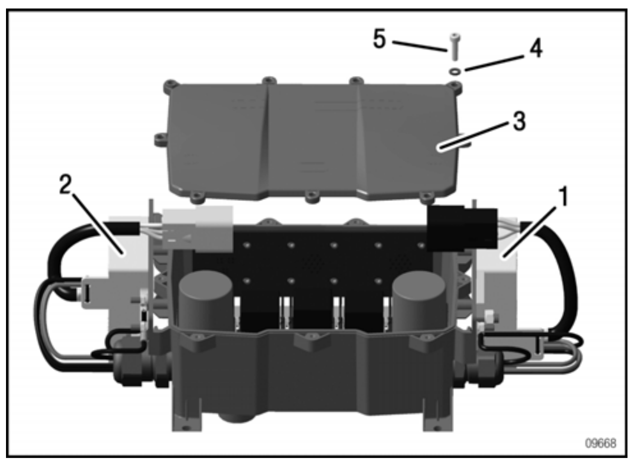

Figure 16.4: TYPICAL

1	*Regulator A*	2	*Regulator B*
3	*Cover*	4	*Plastic washer M4*
5	*M4 Allen screws*		

Step	Procedure
3	Disconnect the 2 RED/WHITE cable from connection bolt B+. Remove the M5 lock nut with washer. Wrench size: A/F 8. Remove the cable from connection bolt.
4	Disconnect the 2 BLACK cable from regulator plate. Remove the 2 M4 lock nut with washer. Wrench size: A/F 7 Remove the cable from connection bolt.
5	Disconnect the 2 BLACK cable from connection bolt B. Remove the M4 lock nut with washer. Wrench size: A/F 7. Remove the cable from connection bolt.
6	Disconnect the 2 BLACK cable from connection bolt B-. Remove the M4 lock nut with washer. Wrench size: A/F 7. Remove the cable from connection bolt.

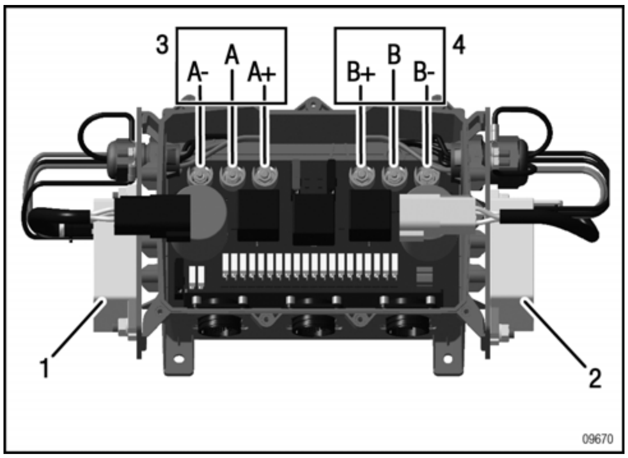

Figure 16.5: TYPICAL

1	*Regulator A*	2	*Regulator B*
3	*Connection bolt regulator A*	4	*Connection bolt regulator B*

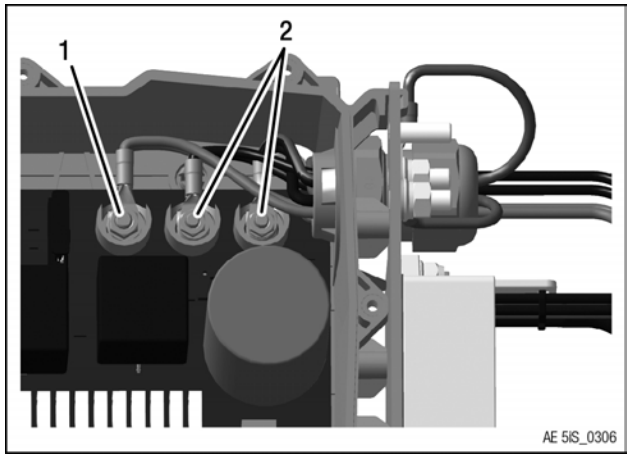

Figure 16.6

1	*Lock nut M5 with washer*	2	*Lock nut M4 with washer*

Step	Procedure
7	Remove the regulator B. Remove the 2 M6 lock nut with washer. Wrench size: A/F 10. **NOTE** *Previous versions of the fuse box may have M4 lock nuts on Regulator B, new versions have M6 lock nuts.*

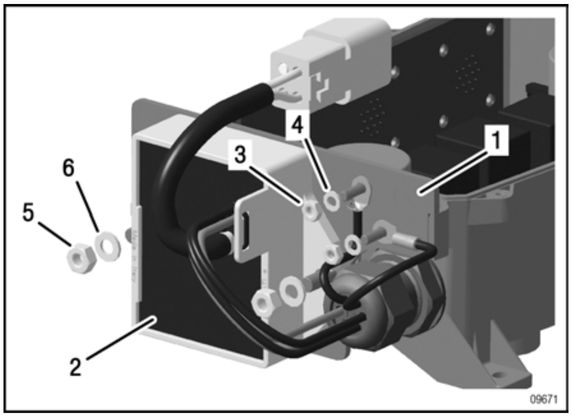

Figure 16.7: TYPICAL

1	*Regulator plate*	2	*Regulator B*
3	*Lock nut M4*	4	*Washer 4.3*
5	*Lock nut M6*	6	*Washer 6.4*

Step	Procedure
8	Pull the 2 RED-WHITE and the 4 BLACK cables with grommet out of the fuse box. To pull out the cables easily, avoid bending the ring terminals.

NOTE

The connecting thread of sealing union must not be dismantled, if you replace the regulator. An exchange of this plastic insert is only necessary if it is damaged.

Step	Procedure
9	Remove the regulator.

NOTE

Be careful when handling the dismantled regulator. On the back side of the regulator and the regulator plate thermal paste can adhere.

REGULATOR A — REMOVAL

- The regulator A is removed analogously to regulator B.

ATTENTION

The pin assignment of the ground cable is different for regulator A and B.

NOTE

Wrench size of the gasket screw connection: A/F 25.

INSTALLATION

- The regulator is installed and removed in the same way. The following should be noted.

NOTE

If the wire is broken or the connector is defective, the damage can be repaired. The wire must be long enough if the connector is cut off. Repair with the tools described here must comply with the aircraft standard of the respective country.

Part no. from the Connector Set	Associated Tool
866420 (black)	DEUTSCH HDT-48 - 00
866422 (gray)	
481510 (Amphenol)	DMC® AF8 / DMC® UH2-5 / DMC® QXRT08 or equivalent

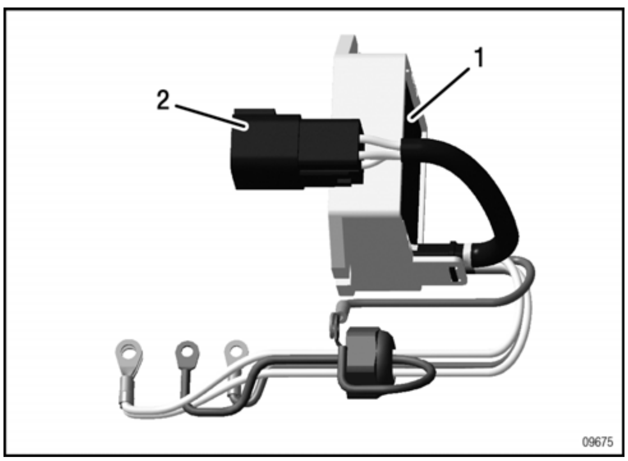

Figure 16.8

1 *Regulator A* 2 *DEUTSCH connector (black)*

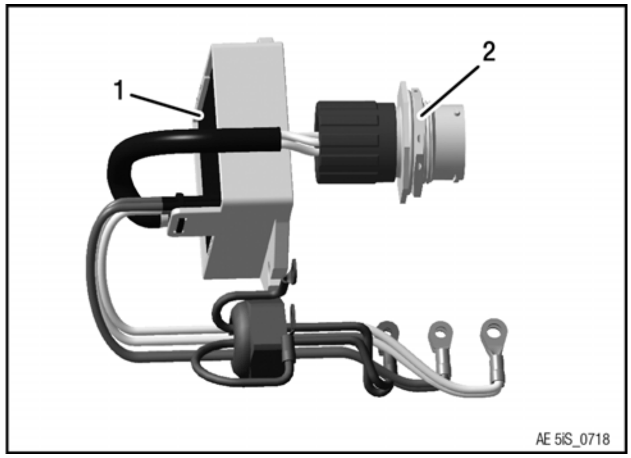

Figure 16.9

1 *Regulator B* 2 *Amphenol connector*

ATTENTION

All hex nuts (self-locking) must be replaced after each removal (e.g. replacement of a regulator).

REGULATOR B — INSTALLATION

ATTENTION

The adhesive surface on the back of the regulator must be cleaned before applying the heat transfer pads. Remove the protective film with caution, because rapid stripping can damage the heat transfer pad.

Step	Procedure
1	Clean the regulator plate: Remove residues of the thermal paste or the heat transfer pads.
2	Bonding the heat transfer pad to the rectifier regulator: Remove the protective film from heat transfer pad and stick the heat transfer pad with the adhesive surface onto the rectifier regulator (avoid any folds or bubbles).

NOTE

When using a heat transfer pad, no additional application of a thermal compound is required.

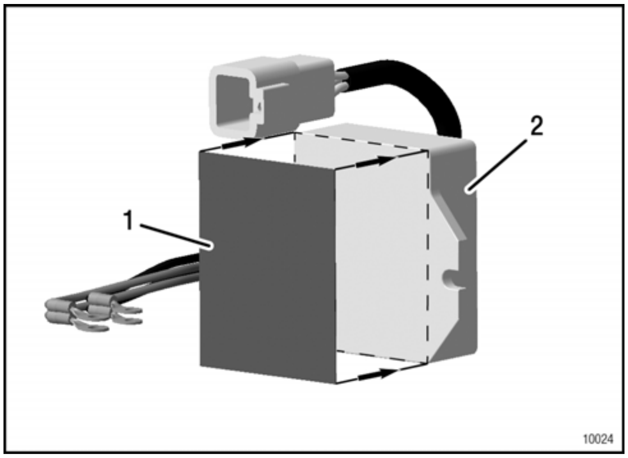

Figure 16.10

1 *Heat transfer pad* 2 *Regulator*

ATTENTION
The regulator must be mounted so that it does not project beyond the regulator plate.

Step	Procedure
3	Fasten regulator to the fuse box with 2 lock nuts M6 and washers. Tightening torque: 6 Nm (53 in.lb). Wrench size: A/F 10.

NOTE

Tighten the two lock nuts M6 alternately to ensure a smooth seat of rectifier regulator on the regulator plate.

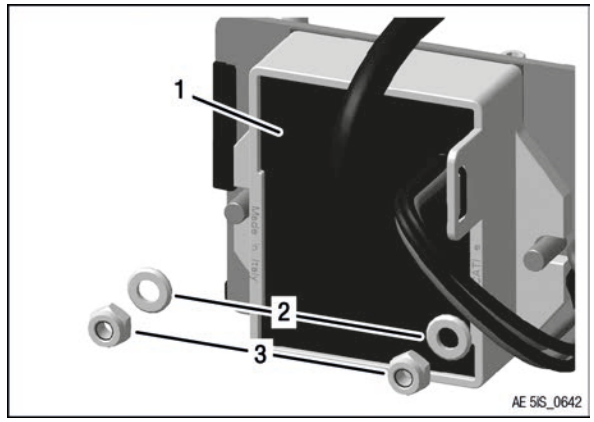

Figure 16.11

1 *Regulator B* 2 *Washer 6.4*

3 *Lock nuts M6*

Step	Procedure
4	Remove the connecting thread of sealing union of the rectifier regulator that should be mounted.

NOTE

The connecting thread of sealing union is included with each rectifier regulator as replacement part. An exchange of this plastic insert is only necessary if it is damaged.

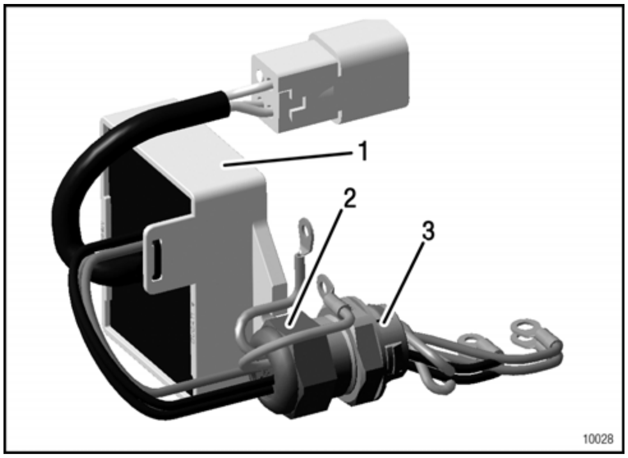

Figure 16.12: TYPICAL

1 *Regulator B*

2 *Cap nut of the gasket screw connection*

3 *Thread of the gasket screw connection*

ATTENTION

When pressing in the gasket screw connection, avoid damaging the connecting thread.

Step	Procedure
5	Pull all the cables 2 RED/WHITE (marking: B+) and 4 BLACK (marking: B and B-) into the fuse box. The plastic insert must be pressed completely into the connecting thread of sealing union.

ATTENTION

Note the wire marking and labeling of the connecting bolts (labeled on the board of the fuse box). All cables must be installed without kinks.

ATTENTION

The ring terminals attached to the connecting ports B-, B and B+ must not touch each other (except those rings which are attached to the same connection bolt).

Step	Procedure
6	BLACK cable (2 pcs, labeled: B-) connect to connection bolt B-. Fasten the cable lug with locking nut M4 and washer on the connection bolt. The crimping of the lower cable lug must be directed towards the board of fuse box. The crimping of the upper cable lug must be directed toward the cover of the fuse box Tightening torque: 1,2 Nm (11 in.lb). Wrench size: A/F 7.
7	BLACK cable (2 pcs, labeled: B) connect to connection bolt B. Fasten the cable lug with locking nut M4 and washer on the connection bolt. The crimping of the lower cable lug must be directed towards the board of fuse box. The crimping of the upper cable lug must be directed toward the cover of the fuse box Tightening torque: 1,2 Nm (11 in.lb). Wrench size: A/F 7.
8	RED-WHITE cable (2 pcs, labeled: B+) connect to connection bolt B+. Fasten the cable lug with locking nut M5 and washer on the connection bolt. The crimping of the lower cable lug must be directed towards the board of fuse box. The crimping of the upper cable lug must be directed toward the cover of the fuse box Tightening torque: 2,2 Nm (19 in.lb). Wrench size: A/F 8.

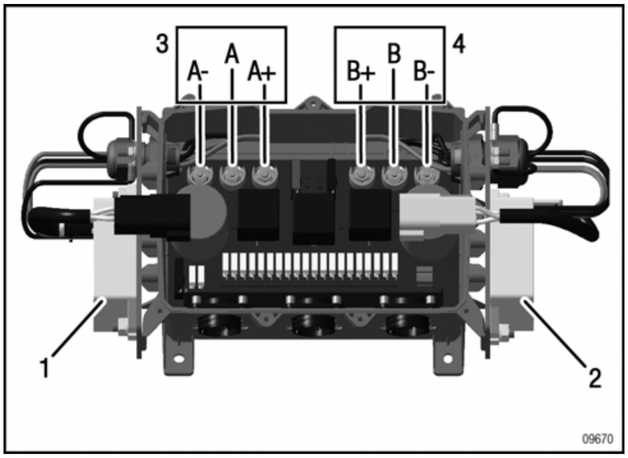

Figure 16.13: Connection

1	*Regulator A*	2	*Regulator B*
3	*Connection bolt regulator A*	4	*Connection bolt regulator B*

ATTENTION

The ring terminals attached to the connecting ports B-, B and B+ must not touch each other (except those rings which are attached to the same connection bolt).

Step	Procedure
9	Connect the unlabeled cable ends coming out of the fuse box and the regulator (2 pcs. BLACK) with the regulator plate. Positioning of the cables must be as shown in Figure Connection Fasten the cable lug with locking nut M4 and washer on the connection bolt. Tightening torque: 1,2 Nm (11 in.lb). Wrench size: A/F 7.
10	Fasten gasket screw connection. Tightening torque: 6 Nm (53 in.lb). Wrench size: A/F 30.
11	Install the Regulator connector into the connector bracket assy.

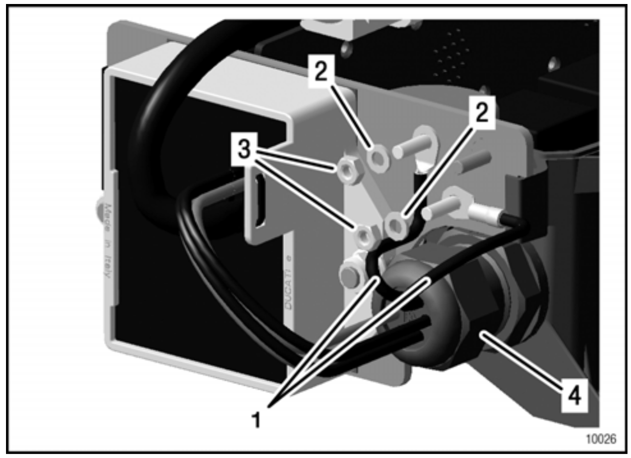

Figure 16.14

1	*Cable BLACK*	2	*Washer 4.3*
3	*Lock nut M4*	4	*Cap nut of the gasket screw connection*

REGULATOR A — INSTALLATION

The regulator A is installed in the same way to regulator B (Step 1 up to Step 3). To be observed.

ATTENTION

Note the wire marking and labeling of the connecting bolts (labeled on the board of the fuse box).

Step	Procedure
1	Remove the connecting thread of sealing union of the rectifier regulator that should be mounted.

NOTE

The connecting thread of sealing union is included with each rectifier regulator as replacement part. An exchange of this plastic insert is only necessary if it is damaged.

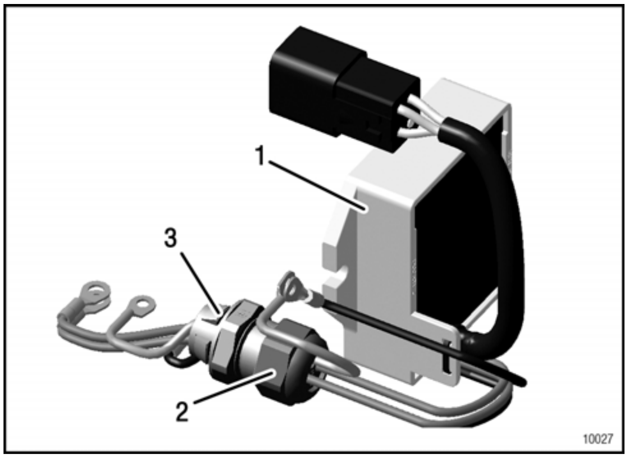

Figure 16.15

1 *Regulator A*
2 *Cup nut of the gasket screw connection*
3 *Thread of the gasket screw connection 4*

ATTENTION

When pressing in the gasket screw connection, avoid damaging the connecting thread.

Step	Procedure
2	Pull all the cables 2 RED/WHITE (marking: A+) and 4 BLACK (marking: A and A-) into the fuse box. The plastic insert must be pressed completely into the connecting thread of sealing union.

ATTENTION

Note the wire marking and labeling of the connecting bolts (labeled on the board of the fuse box). All cables must be installed without kinks.

ATTENTION

The ring terminals attached to the connecting ports A-, A and A+ must not touch each other (except those rings which are attached to the same connection bolt).

Step	Procedure
3	BLACK cable (2 pcs, labeled: A-) connect to connection bolt A-. Fasten the cable lug with locking nut M4 and washer on the connection bolt. The crimping of the lower cable lug must be directed towards the board of fuse box. The crimping of the upper cable lug must be directed toward the cover of the fuse box Tightening torque: 1.2 Nm (11 in.lb). Wrench size: A/F 7.
4	BLACK cable (2 pcs, labeled: A) connect to connection bolt A. Fasten the cable lug with locking nut M4 and washer on the connection bolt. Tightening torque: 1.2 Nm (11 in.lb). Wrench size: A/F 7.
5	RED-WHITE cable (2 pcs, labeled: A+) connect to connection bolt A+. Fasten the cable lug with locking nut M5 and washer on the connection bolt. The crimping of the lower cable lug must be directed towards the board of fuse box. The crimping of the upper cable lug must be directed toward the cover of the fuse box Tightening torque: 2.2 Nm (20 in.lb). Wrench size: A/F 8.

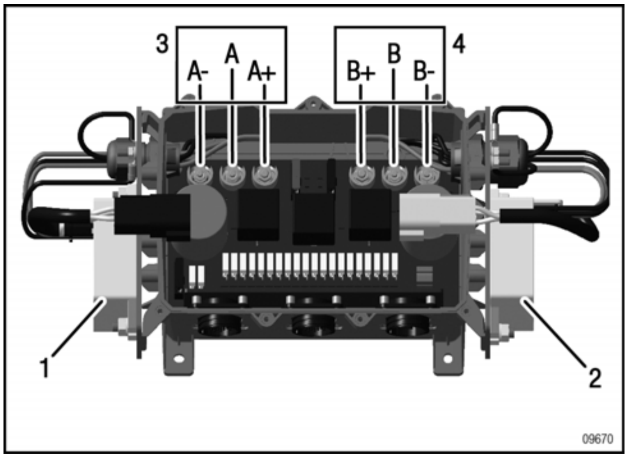

Figure 16.16

1	*Regulator A*	2	*Regulator B*
3	*Connection bolt regulator A*	4	*Connection bolt regulator B*

ATTENTION

The ring terminals attached to the connecting ports A-, A and A+ must not touch each other (except those rings which are attached to the same connection bolt).

Step	Procedure
6	Connect the unlabeled cable ends coming out of the fuse box and the regulator (2 pcs. BLACK) with the regulator plate. Positioning of the cables must be as shown in following figure. Fasten the cable lug with locking nut M4 and washer on the connection bolt. Tightening torque: 1,2 Nm (11 in.lb). Wrench size: A/F 7.
7	Fasten gasket screw connection. Tightening torque: 4 Nm (35 in.lb). Wrench size: A/F 25.

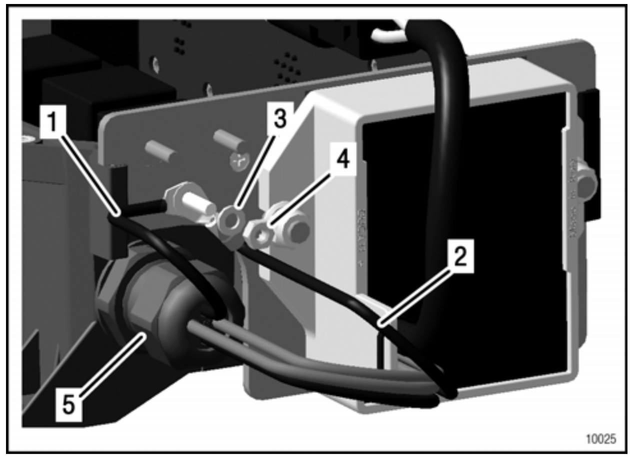

Figure 16.17

1	*Cable BLACK*	2	*Cable BLACK*
3	*Washer 6.4*	4	*Lock nut M6*
5	*Cap nut of the bulkhead fitting*		

FUSES

If a fuse is damaged, it must be replaced by a new one with the same values.

⚠ WARNING

A fuse with a higher amperage must not be used, as this can lead to severe damage.

Arrangement of the fuses	
F2	7.5 A Selector switch B
F3	7.5 A Selector switch A
F4	10 A Fuel pump B
F5	10 A Fuel pump A
F6	10 A Ignition 3t
F7	10 A Ignition 1b
F8	10 A Ignition 3b
F9	10 A Ignition 1t
F10	5 A Injector 4
F11	5 A Injector 3

Arrangement of the fuses	
F12	5 A Injector 2
F13	5 A Injector 1
F14	2 A Caution lamp A
F15	2 A Caution lamp B
F16	5 A Injector 8
F17	5 A Injector 7
F18	5 A Start switch
F19	Not used
F20	20 A Lane A circuit
F21	35 A Lane B circuit
F22	5 A Injector 6
F23	5 A Injector 5

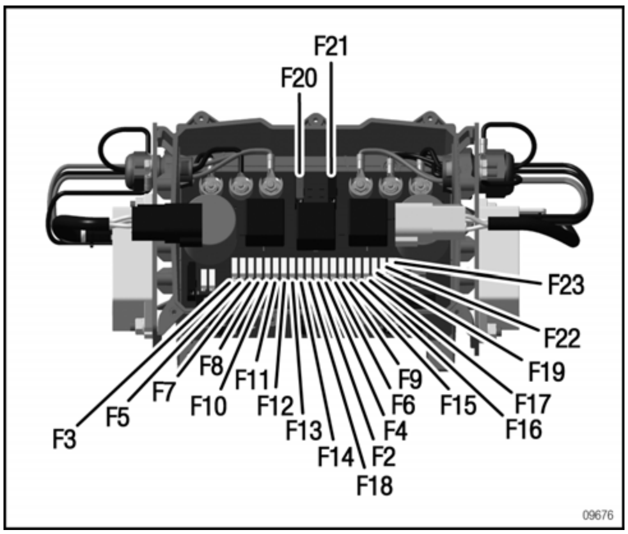

Figure 16.18

1 Reserve fuses

ATTACHMENT OF COVER

ATTENTION

Over tightening the hex screws M4 leads to cracking of the cover.

Step	Procedure
1	Fix cover with 9 hex screws M4 finger-tight. Snug with hex key A/F 3 mm.

NOTE

Before attaching the cover, check the correct position of the gasket.

INSPECTION OF INSTALLATION OF THE REGULATOR

Before installing the fuse box carry out a continuity check using a multimeter between the regulator housing and regulator A and regulator B. A conductive connection (continuity) must not be present.

ATTENTION

If a conductive connection (continuity) is present, the installation of the regulator has to be checked. The fuse box must not be installed in an aircraft until the error is fixed and the installation corrected.

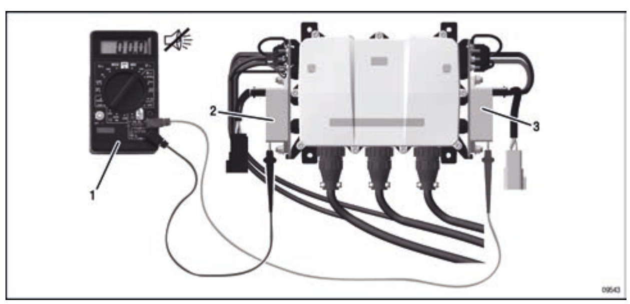

Figure 16.19

1 Multimeter

2 Regulator A (black wire connector)

3 Regulator B (grey wire connector)

FUSE BOX — INSTALLATION

Installation must be carried out according to the aircraft manufacturer's and to the specifications of the Installation Manual for the engine type 915 i A Series.

Step	Procedure
1	Install the fuse box to the aircraft manufacturer's instructions.
2	Connect the fuse box to the wiring harness (main harness).

NOTE

Using the marking of the wiring harness.

INSPECTION OF THE FUSE BOX INSTALLATION

After the installation of the fuse box, use a multimeter to carry out a continuity test between regulator A and regulator B in the static condition. A continuity must not be present.

ATTENTION

If a conductive connection (continuity) is present, check the wiring as specified by the aircraft manufacturer and in accordance with the requirements of the Installation Manual. Until the error is fixed, the engine must only be operated on the ground.

ATTENTION

EMS ground may only be mounted to the regulator plate A (cooling plate of the fuse box) only. Aircraft ground may only be mounted on the regulator plate B (cooling plate of the fuse box) only.

FINISHING WORK

- Attach all the necessary fastenings (e.g. cable ties, holders, clamps etc.) of the wiring harness.
- Carry out an engine test run.

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Chapter: 76–50–00
WIRING HARNESS (MAIN STRAND)

TOPICS IN THIS CHAPTER

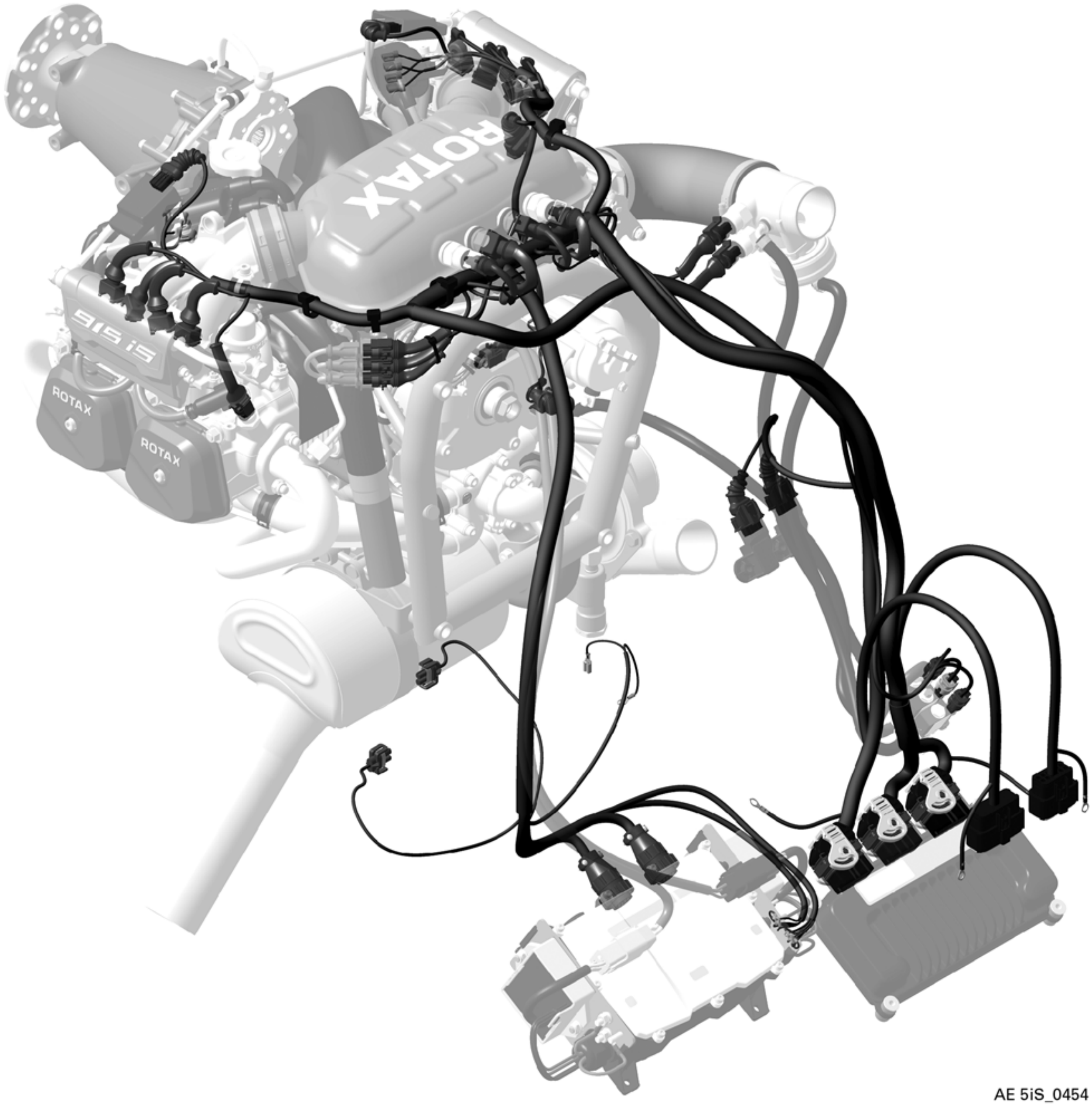


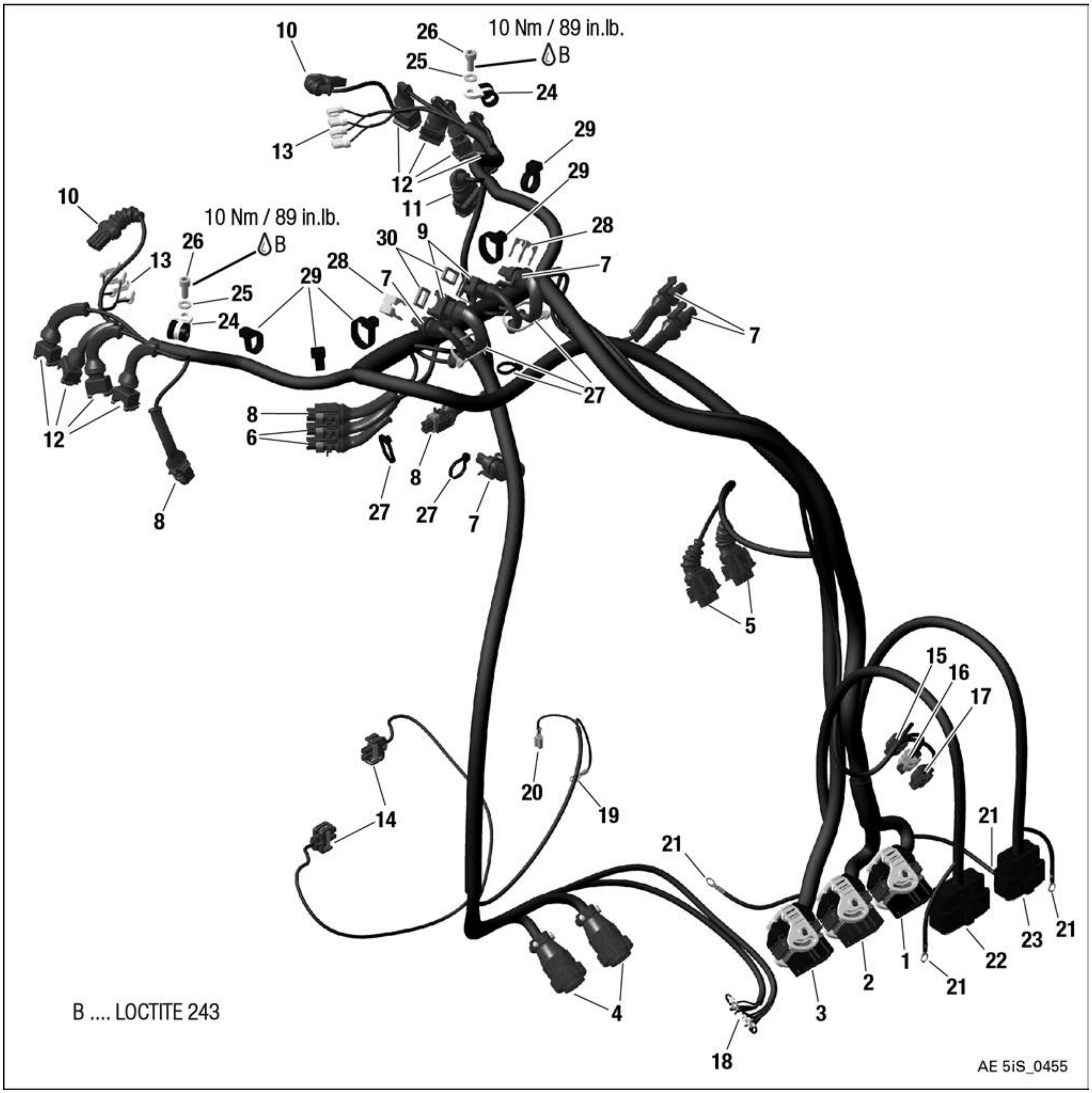
Figure 17.1: Wiring harness (main strand)

SPECIAL TOOLS

Description	Part number	
Maintenance Tool for EMS check		
ECU Adapter	277012	

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
Deoxit contact spray	n.a.


10
26
10 Nm / 89 in.lb.
B
25
24
13
12
29
29
11
10
10 Nm / 89 in.lb.
26
B
13
25
24
29
28
30
9
28
7
7
7
12
8
6
27
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1
2
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4
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18
B .... LOCTITE 243
AE 5iS_0455

Figure 17.2

1	*ECU LANE A1 connector*	2	*ECU LANE A2 connector*
3	*ECU LANE B connector*	4	*FUSE BOX connector*
5	*AAPTS connector (2)*	6	*connector CPS*
7	*Connector OPS, BPS and MAPS*	8	*connector CTS A OTS A KNOCK*
9	*MATS connector*	10	*EGT connector*
11	*TPS connector*	12	*INJ connector*
13	*IGNITION COIL connector*	14	*Fuel pump connector*
15	*PCV A connector*	16	*PCV B connector*
17	*PCV C connector*	18	*Ring terminal M4 EMS ground*
19	*Ring terminal M6 starter relay*	20	*Faston connector starter relay*
21	*Ring terminal harness shield ground*	22	*HIC A connector*
23	*HIC B connector*	24	*Cable clamp 12/M6*
25	*Washer 6.4*	26	*Allen screw M6x14*
27	*TIE WRAP 142x3.2 mm*	28	*Clamp — MAP sensor*
29	*Tie wrap 203x7.6*	30	*MAPS connector gasket*

SYSTEM DESCRIPTION

GENERAL NOTE

The wiring harness consists essentially of two main parts, one for LANE A and one for LANE B. Both are each connected with connectors to the ECU and to the individual connectors to the sensors and actuators.

The wiring harness connects all the engine parts necessary for operation. In this way it provides the electric supply for these parts and the exchange of control and regulation signals.

SAFETY INSTRUCTION

⚠ WARNING

Non-compliance can result in serious injuries or death! The wiring harness and connectors may only be disassembled by the manufacturer, by an authorised distributor or by an aerospace company.

ATTENTION

Danger of damage to the power plant and aircraft! It must be ensured that no electric voltage is connected and that repairs are carried out properly.

NOTE

The general safety instructions must be followed during all work on the wiring harness!

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series 915 i A Series.

REMOVAL

Preparation

Before the wiring harness is removed, the work and checks described below must be carried out to identify any further malfunctions in the cylinder head and rectify them as part of repair work.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A SeriesChapter 05-00-00 and 12-00-00.

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12–20–00.

- Disconnect the wiring harness from the aircraft frame.
- Disconnect all detachable connections (all cable ties, cable holders, clamps etc.).

NOTE

All connectors must be provided with a protective covering after being removed or detached.

STARTER RELAY — DISCONNECTION

Step	Procedure
1	Loosen hex. nut M6 and remove it along with the washer 6.4. Remove starter cables from terminals. Pull off faston connector. Press the lock to pull off the faston connector.
2	Remove the grounding bolt/ screw. Observe the instructions of the aircraft manufacturer.

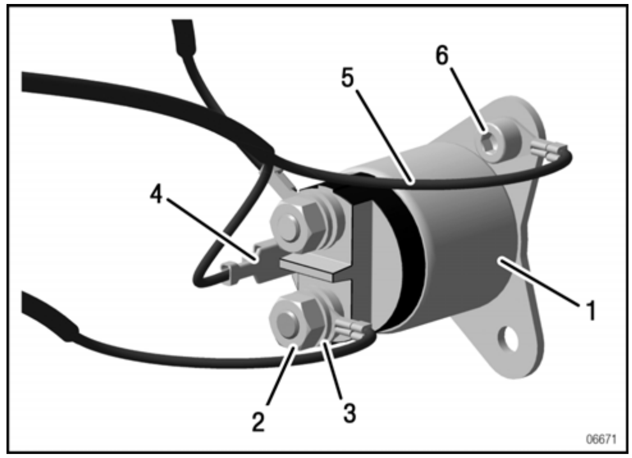


Figure 17.3

1	*Starter relay*	*2*	*Hex. nut M6*
3	*Washer 6.4*	*4*	*Faston connector*
5	*Ground*	*6*	*Bolt/ screw*

AMBIENT AIR PRESSURE AND TEMPERATURE SENSOR — DISCONNECTION

Wiring harness designation:

- AAPTS

Step	Procedure
1	Push in the tab on the top of the connector and at the same time pull the connector out of the connection socket.

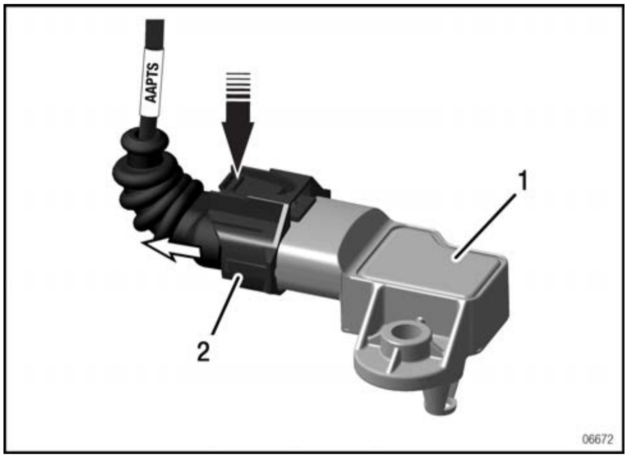


Figure 17.4

1 Tab *2 Connection socket*

GROUND CABLES – DISCONNECTION

For disconnection of the ground cables please observe the instructions of the aircraft manufacturer.

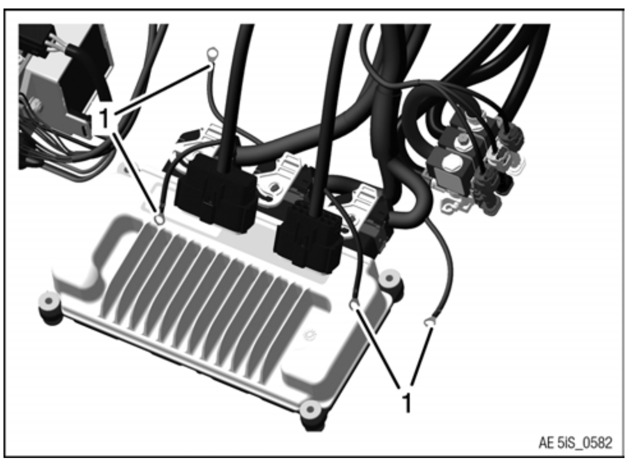


Figure 17.5

1 Ground cables

PRESSURE CONTROL VALVE (PCV) – DISCONNECTION

Wiring harness designation:

- PCV A connector
- PCV B connector
- PCV C connector

Step	Procedure
1	Disconnect PCV A/B/C connector.

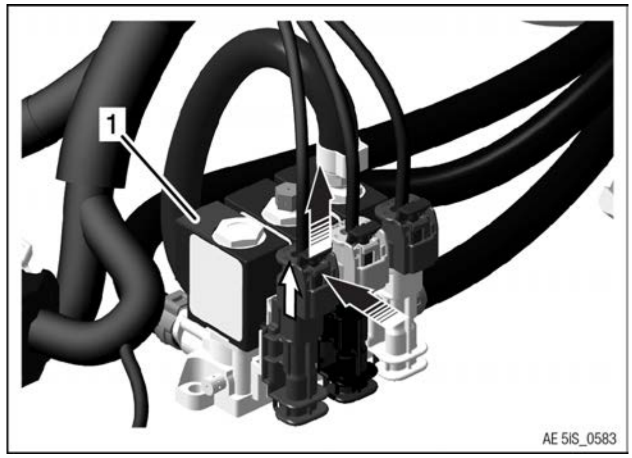


Figure 17.6

1 Pressure control valve

FUSE BOX (FUSE BOX) — DISCONNECTION

See Chapter 76-10-00 section Fuse box.

Step	Procedure
1	Loosen M5 hex. nut from the ground cable on regulator A.

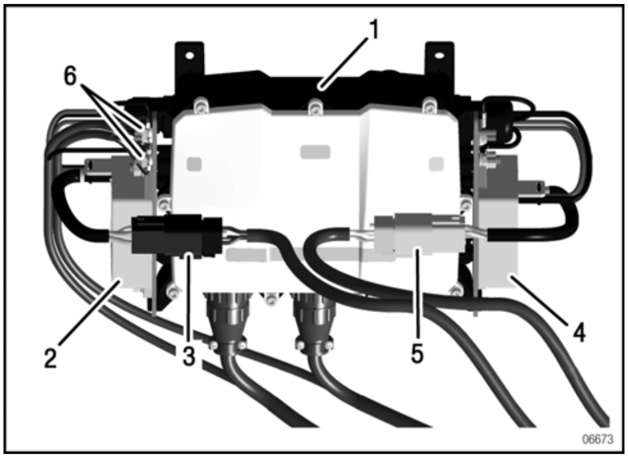


Figure 17.7

1	*Fusebox*	*2*	*Regulator LANE A*
3	*Regulator connector A*	*4*	*Regulator LANE B*
5	*Regulator connector B*	*6*	*EMS harness ground cable*

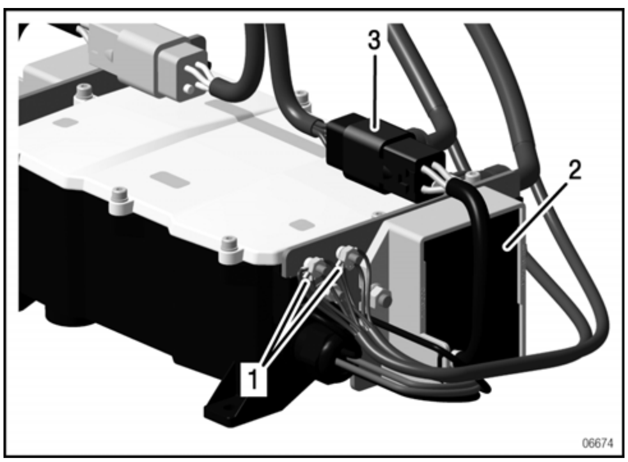


Figure 17.8

1	*Ground cable*	*2*	*Regulator LANE A*
3	*Regulator connector A*		

Step	Procedure
2	Mark the regulator connector before detaching.
3	Push in the tab on the top of the connector and at the same time pull the connector out of the connection socket.

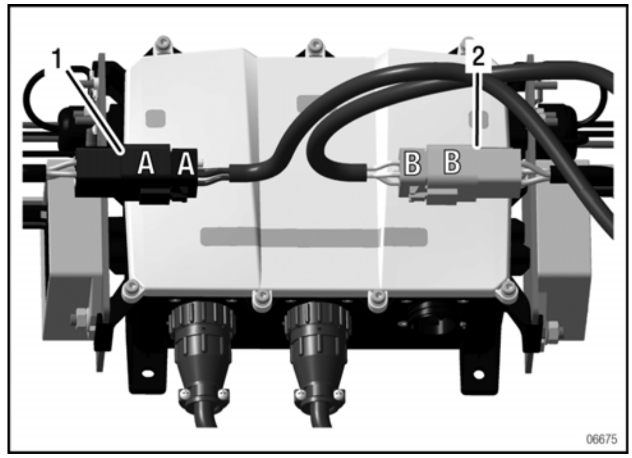


Figure 17.9

1	*Regulator connector A*	*2*	*Regulator connector B*

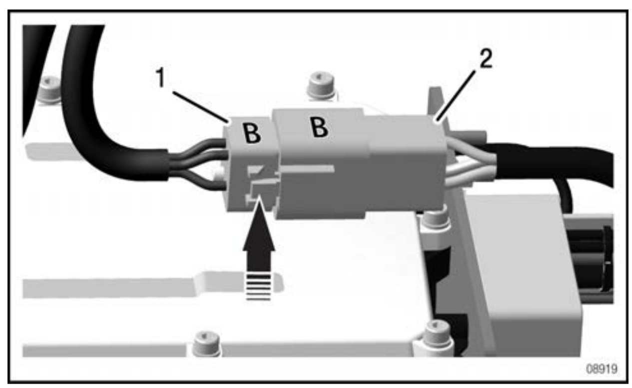


Figure 17.10

1	*Connection socket*	*2*	*Regulator connector*

Step	Procedure
4	Loosen the two round connectors (labelled LANE A, LANE B) from fuse box.

NOTE

Unscrew the connector cap nut counterclockwise.

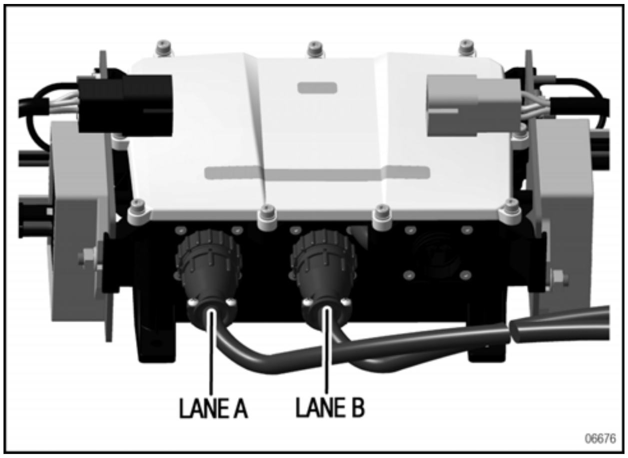


Figure 17.11

NOTE

Round connectors have different index grooves and cannot be mixed up.

Step	Procedure
5	Pull the connectors out of the connector sockets. **NOTE** *Do not lose the grey rubber seals (inside of socket).*

FUEL PUMP — DISCONNECTION

Wiring harness designation:

- FUEL PUMP_1 (MAIN pump)
- FUEL PUMP_2 (AUX pump)

Step	Procedure
1	Loosen the 4 Allen screws M5x12 from cover of the fuel pump assy.

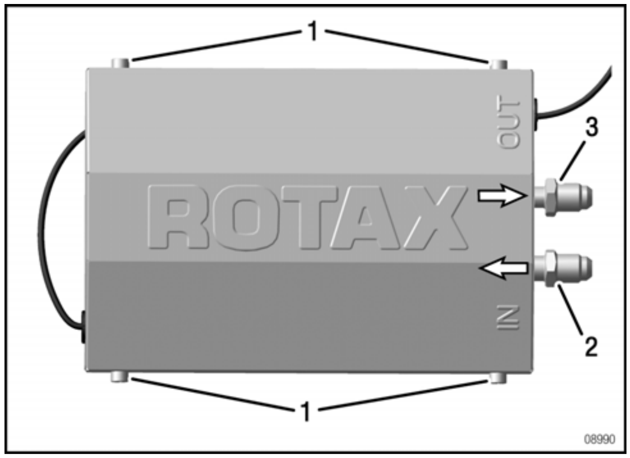


Figure 17.12

1 Allen screws M5x12 *2 Fuel inlet*
3 Fuel outlet

Step	Procedure
2	Unplug the connectors (FUEL PUMP 1, FUEL PUMP 2) from the fuel pumps.

NOTE

First lift one side with a screwdriver, hold the tab and then lift the lower tab with the screwdriver and pull out the connector.

ATTENTION
Do not pull on the cable!

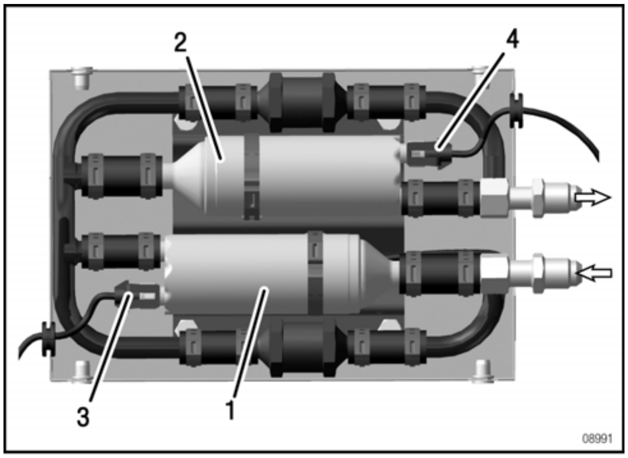


Figure 17.13

1	*Fuel pump (main)*	2	*Fuel pump (auxiliary)*
3	*Connector (fuel pump 1)*	4	*Connector (fuel pump 2)*

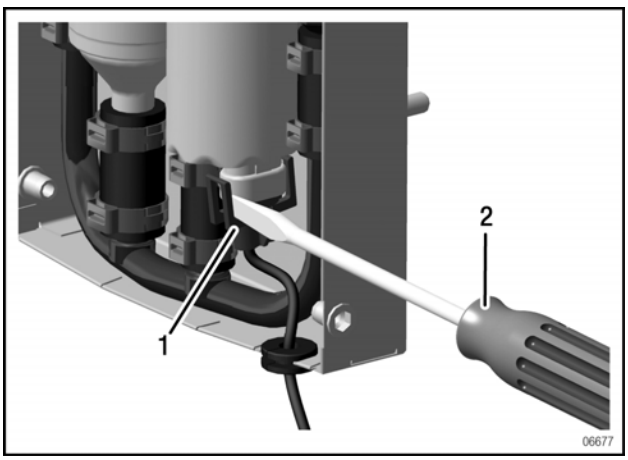


Figure 17.14

1	*Connector (fuel pump 1)*	2	*Screwdriver*

CONTROL UNIT (ECU) — DISCONNECTION

See Chapter 76-10-00 section Control unit.

Wiring harness designation:

- ECU LANE A1
- ECU LANE A2
- ECU LANE B

Step	Procedure
1	Unplug the couplers (ECU LANE A1, ECU LANE A2 and ECU LANE B).

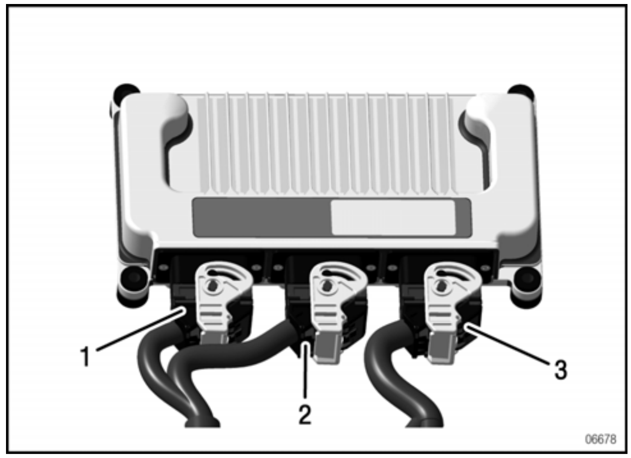


Figure 17.15

1	*Connector (LANE A1)*	2	*Connector (LANE A2)*
3	*Connector (LANE B)*		

Step	Procedure
2	Press in the lock so that the lever can be rotated.
3	Press the lever down until it releases.
4	Remove the connector.

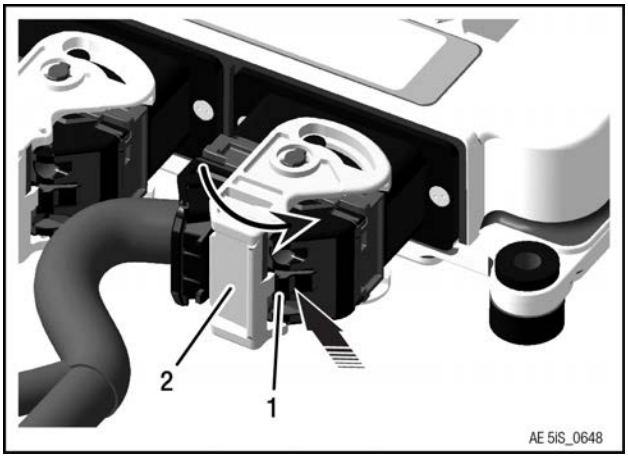


Figure 17.16

1 Lock *2 Lever*

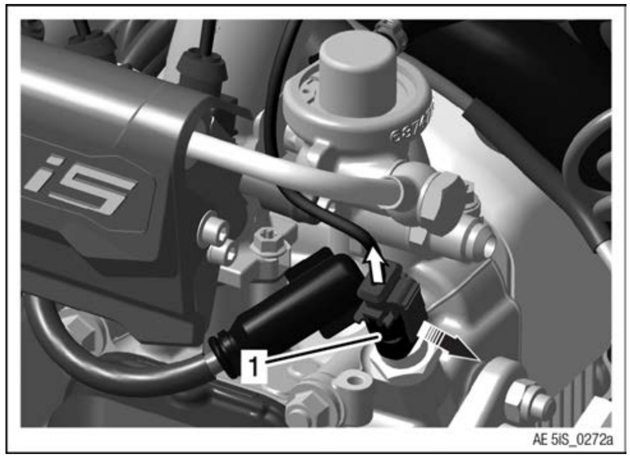


Figure 17.17

1 Temperature sensor

EGT CONNECTOR AND IGNITION COIL — DISCONNECTION

See Chapter 74-20-00 section ignition unit.

Wiring harness designation:

- EGT_1, EGT_2
- EGT_3, EGT_4
- COIL_1
- COIL_2
- COIL_3
- COIL_4

TEMPERATURE SENSOR — DISCONNECTION

Wiring harness designation:

- CTS

Step	Procedure
1	Disconnect the plug connection to the temperature sensor.

INJECTOR — DISCONNECTION

Wiring harness designation:

- INJ_1 to INJ_8

Preparation

- Injector – disconnection, to do this, see Chapter 73-10-00.

THROTTLE POTENTIOMETER (TPS) — DISCONNECTION

Wiring harness designation:

- Throttle potentiometer (TPS)

ATTENTION

Do not damage the wiring harness. Always cut cable ties on the side of the support plate facing away from the wiring harness.

Step	Procedure
1	Cut 2 cable ties on the airbox.
2	Unplug the throttle potentiometer. • Lift the latches • Unplug the connector

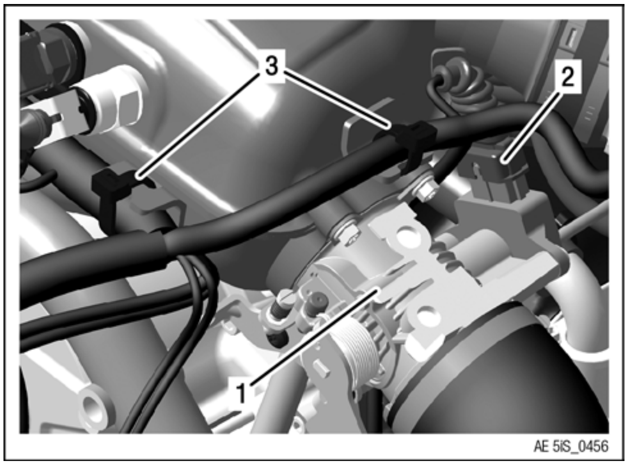


Figure 17.18

1 Throttle valve *2 Throttle potentiometer*

3 Cable ties

PRESSURE SENSOR (BPS) – DISCONNECTION

Wiring harness designation:

- Pressure sensor BPS

Step	Procedure
1	Lift the latch and pull off.

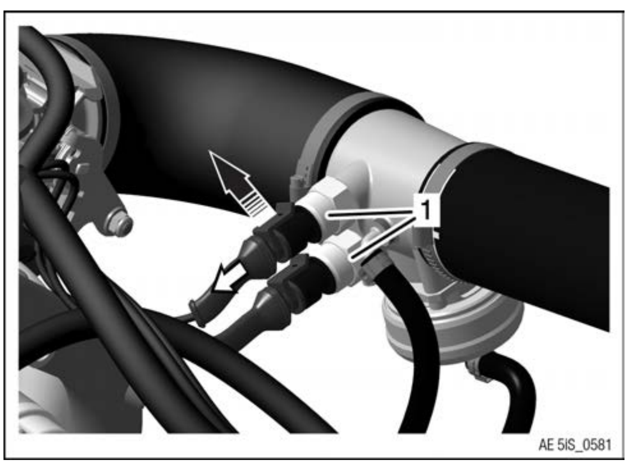


Figure 17.19

1 Pressure sensor

OIL TEMPERATURE SENSOR AND OIL PRESSURE SENSOR — DISCONNECTION

Wiring harness designation:

- Oil temperature sensor OTS
- Oil pressure sensor OPS

Step	Procedure
1	Remove cable tie.
2	Unplug OTS and OPS.

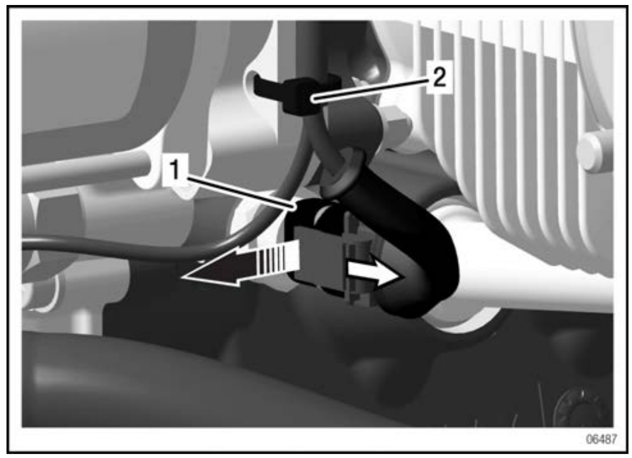


Figure 17.20

1 Temperature sensor *2 Cable tie*

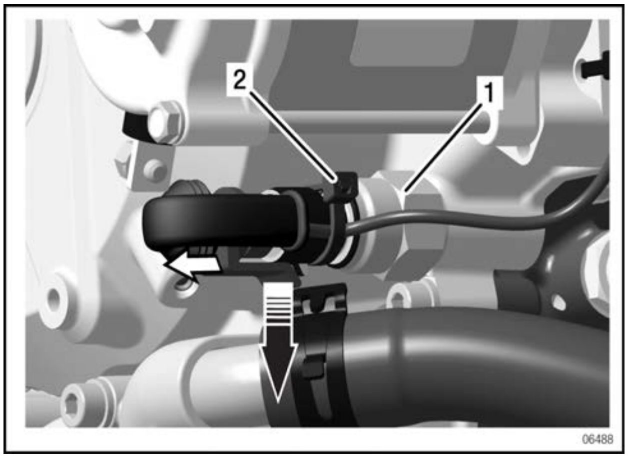


Figure 17.21

1 Pressure sensor *2 Cable ties*

CRANKSHAFT POSITION SENSOR — DISCONNECTION

Wiring harness designation:

- CPS_1 for LANE A (yellow mark)
- CPS_2 for LANE B

Step	Procedure
1	Remove cable ties.
2	Unplug CPS 1 and CPS 2.

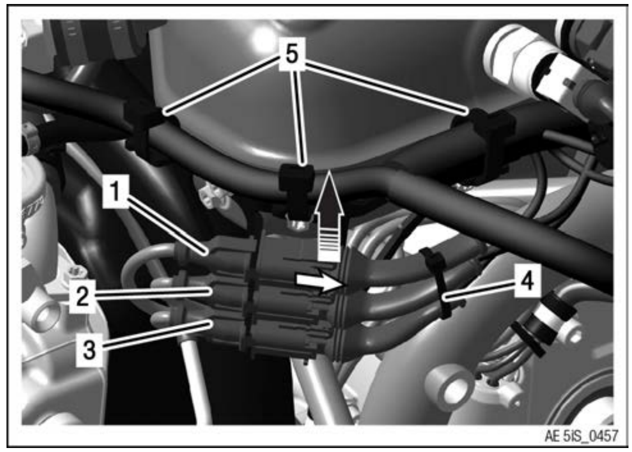


Figure 17.22

1 KNOCK knock sensor *2 CPS_1 LANE A*
3 CPS_2 LANE B *4 Cable tie*
5 Cable tie 203x7.6

KNOCK SENSOR — DISCONNECTION

Wiring harness designation:

- KNOCK

Step	Procedure
1	Lift the latch and pull apart.

AIRBOX PRESSURE SENSOR AND TEMPERATURE SENSOR — DISCONNECTION

Wiring harness designation:

- MAPS_1 and MATS_1 for LANE A
- MAPS_2 and MATS_2 for LANE B

Step	Procedure
1	Remove the 2 cable ties and 2 clamps.
2	Unplug the connectors of the 2 pressure sensors.
3	Lift the latch and pull off.

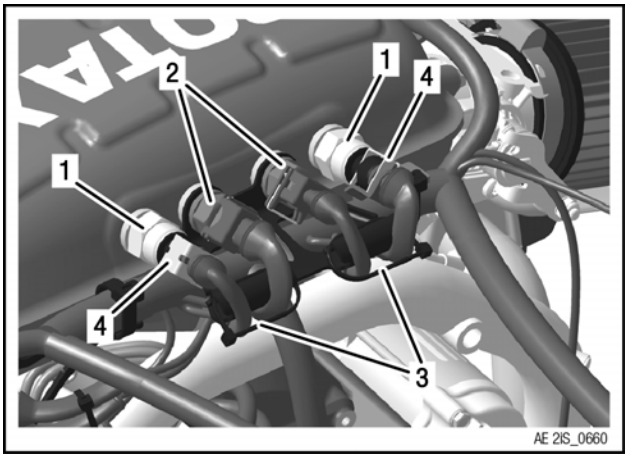


Figure 17.23

1	*Pressure sensors*	2	*Temperature sensor*
3	*Cable ties*	4	*Clamps*

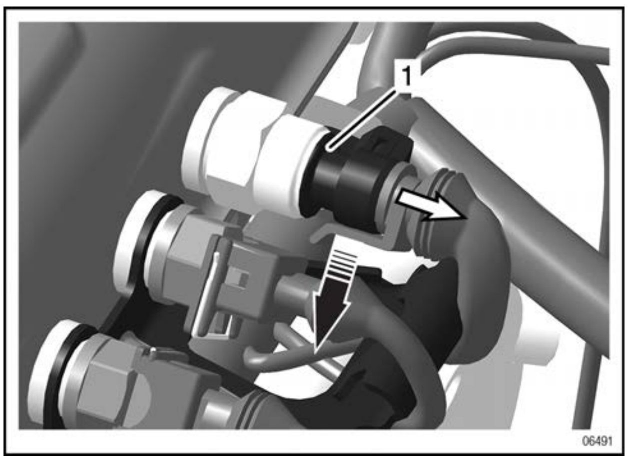


Figure 17.24

1 *Pressure sensor*

Step	Procedure
4	Unplug the connectors of the 2 tempera-ture sensors.
5	Press the metal spring and separate the connectors.

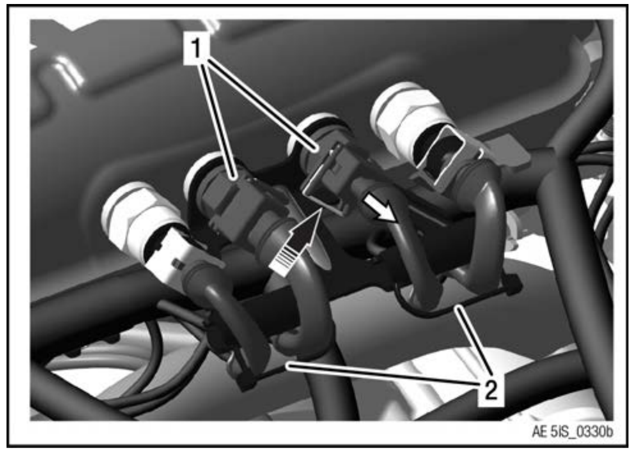


Figure 17.25

1	*Temperature sensor*	2	*Cable tie*

Step	Procedure
6	Remove the cable ties and cable clamps from the airbox.

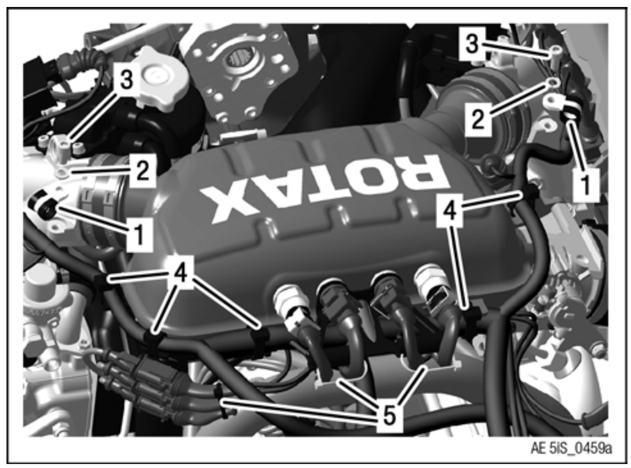


Figure 17.26

1	*Cable clamps*	2	*Washers*
3	*Allen screw M6x14*	4	*Cable tie 203x7.6 mm*
5	*Cable tie 142x3.2 mm*		

WIRING HARNESS REMOVAL

- The wiring harness can be removed.

INSPECTION

ATTENTION

When work is carried out on the components of the engine management system, there is a risk that these might get damaged. Never put measuring probes in plug connectors or use other "aids" to carry out tests in the plug connectors.

ATTENTION

All electronic components must be in the original state. Any modification e.g. to the wiring harness can lead to incorrect inputs or operating faults.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-00-00 and 12–20–00.

NOTE

It must be ensured that all plug-in connections are properly crimped with the cables. (There must be no bent, deformed or loose pins in the plug connections!)

Electric test

The electric test of the wiring harness takes place in the installed state.

Step	Procedure
1	Unplug the wiring harness at the ECU and connect adapter part no. 277012.
2	Wire harness can be tested using an Ohmmeter.

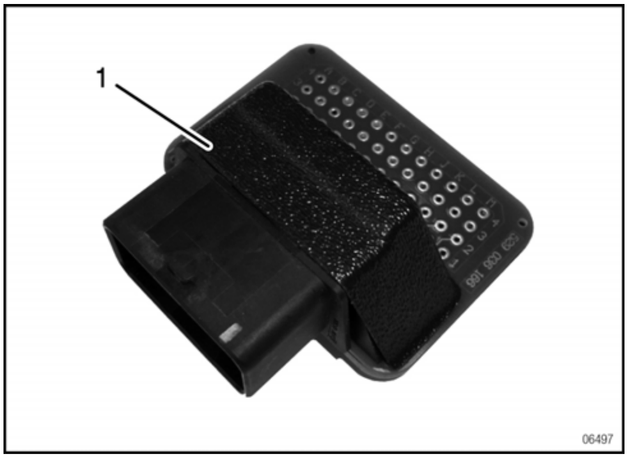


Figure 17.27

1 *Adapter*

INSTALLATION

Preparation

- Check all the wiring harness sections provided.

⚠ WARNING
Non-compliance can result in serious injuries or death! The wiring harness must not be routed through areas or fastened to components in which the maximum permissible temperature of 120 °C (248 °F) can be exceeded during engine operation.

ATTENTION
The wire connectors of the ECU must not be opened and closed more than 20 times! This must be shown on the device by a clearly visible label with a printed numerical sequence (1-20) and by documentation conforming to self-monitoring guidelines.

ATTENTION
Danger due to damage to the wiring harness! For correct operation of the engine, it is necessary for the wiring harness to be in full working order and protected from scuffing, wear, tearing, extreme bending radii and other types of stress. Do not route the wiring harness in the vicinity of belt drives or rollers without the use of appropriate protective measures.

NOTE

Before connecting a connector, remove the protective covering which may be attached both to the connector and to the connection socket.

NOTE

If necessary, clean the pins of the connector and coat them as follows: AMP/ECU connector with a thin layer of Deoxit contact spray.
All the other connectors with a dielectric silicone-based lubricant or an equivalent lubricant.

Step	Procedure
1	Lay the wiring harness correctly according to the routing plan.

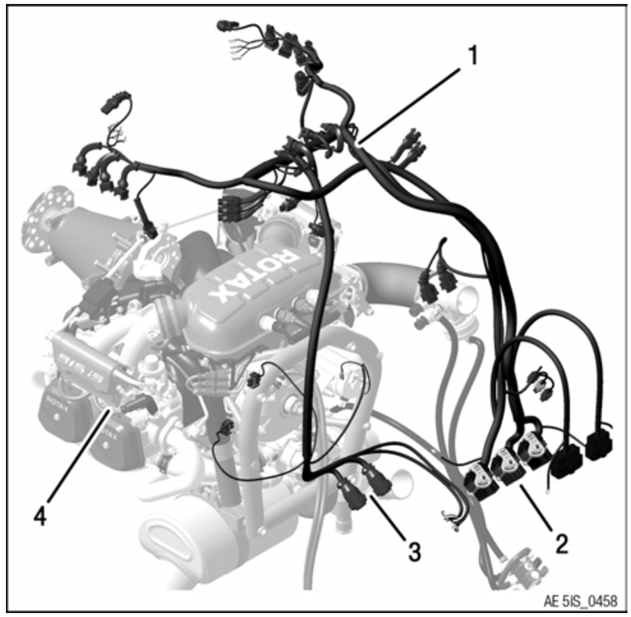


Figure 17.28

1	*Wiring harness*	*2*	*ECU connectors*
3	*FUSE BOX round connectors*	*4*	*Engine*

WIRING HARNESS — INSTALLATION

Wiring harness

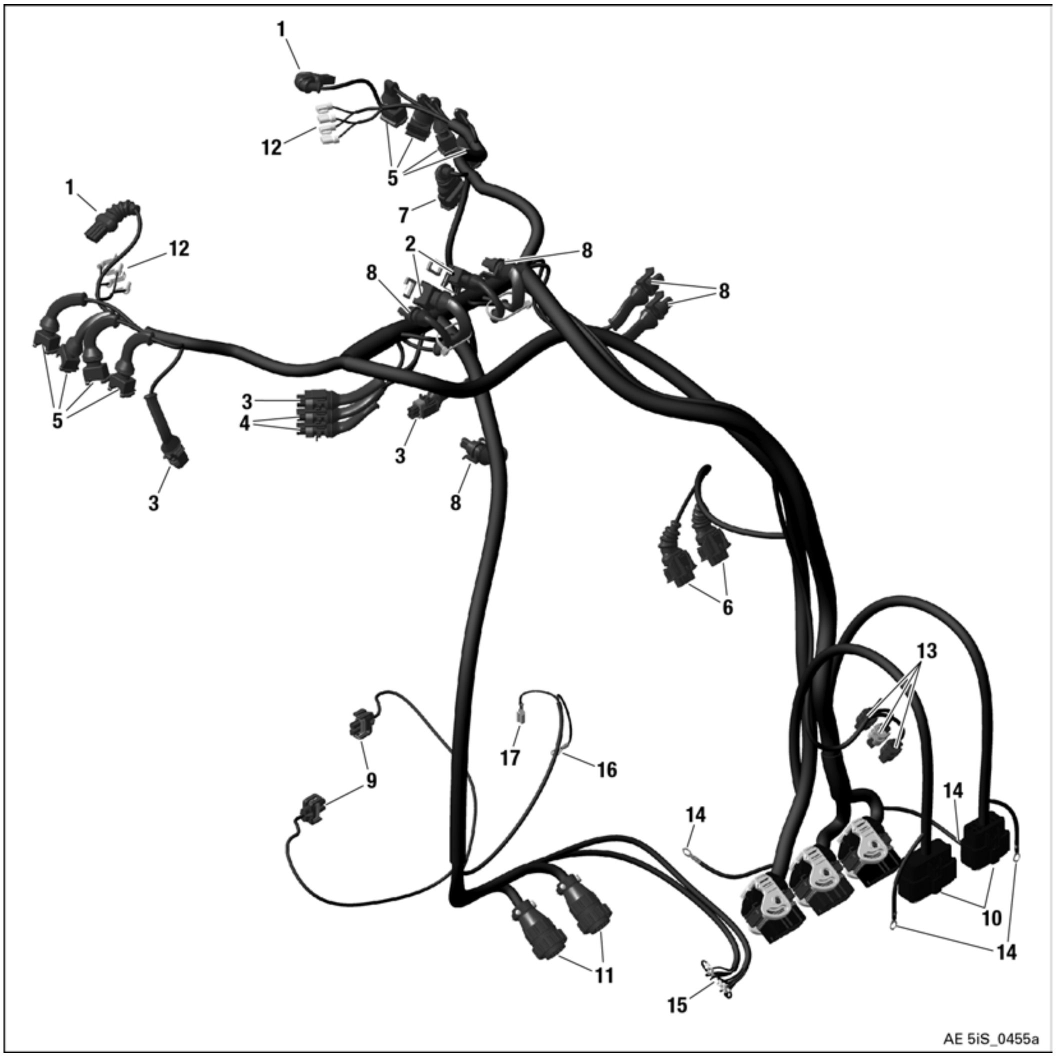


Figure 17.29

NOTE

If the wire is broken or the connector is defective, the damage can be repaired. The cable must be long enough if the connector is cut off.
A repair with the tools described here must comply with the aircraft standard of the respective country.

Pos	Part no. of connector set	Corresponding too
1	481455	Crimping pliers TYCO 539 635-1 Jaws TYCO 539 737-2 Disassembly tool TYCO 1-1579007-6
2	881292	
3	881296	
4	881298	
5	881300	
6	881306	Crimping pliers TYCO 539 635-1 Jaws TYCO 539 737-2 7 881308 Disassembly tool DELPHI 12094429
7	881308	
8	881302	Crimping pliers DELPHI 12155975 Disassembly tool DELPHI 12094429
9	881304	
10	881294	Crimping pliers MOLEX 0638114400 Disassembly tool MOLEX 63813-1500
11	881312	Crimping pliers TYCO 58495-1‘ Disassembly tool TYCO 305 183
12	881310	Crimping pliers TYCO 180319
13	481452, 481453, 481454	Connector set PCV A, Connector set PCV B, Connector set PCV C
14	966057	-
15	965700	-
16	964059	-
17	864011	-

AIRBOX PRESSURE SENSOR AND TEMPERATURE SENSOR — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

NOTE

Note the position of the 2 clamps.

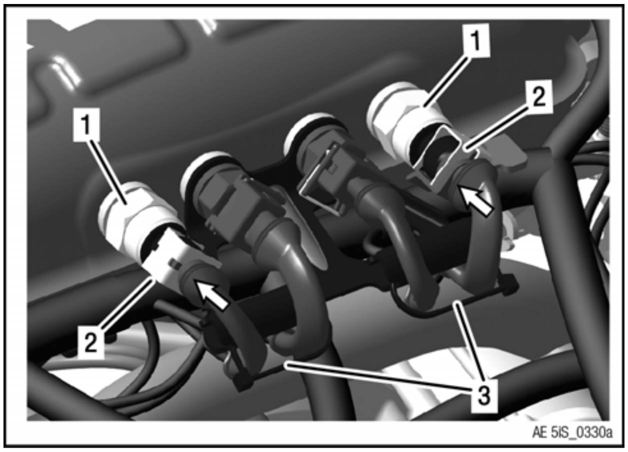


Figure 17.30

1	*Pressure sensors*	2	*Clamps*
3	*Cable ties*		

KNOCK SENSOR — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

CRANKSHAFT POSITION SENSOR — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

NOTE

- *CPS_1 for LANE A (upper crankshaft position sensor)*
- *CPS_2 for LANE B (lower crankshaft position sensor)*

NOTE

The sensors are identical, they are not labelled.

TEMPERATURE AND PRESSURE SENSOR (OIL) — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

THROTTLE POTENTIOMETER — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

PRESSURE SENSOR (BPS) – CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 Pressure sensor (BPS) - disconnection.

TEMPERATURE SENSOR CTS AND INJECTOR — CONNECTION

ATTENTION

Do not clamp the cables for INJ_4 and CTS (Coolant Temperature Sensor) together.

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

EGT CONNECTOR AND IGNITION COIL — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 74-20-00 section Ignition unit. To be observed:

ATTENTION

The ignition coils are arranged like the cylinders (COIL_1, COIL_2, COIL_3, COIL_4). Ignition coils 1 and 2 are the other way round from ignition coils 2 and 4.

NOTE

The red cable is positive (+), the red cable with the black dash is negative (-). Double ignition coils are labelled + and -!

STRAIN RELIEF — CONNECTION

Step	Procedure
1	Attach strain reliefs to the wiring harness with cable ties.
2	Fix clamps with Allen screws and washers. Apply LOCTITE 243 to screws. Tightening torque 10 Nm (89 in. lb.)

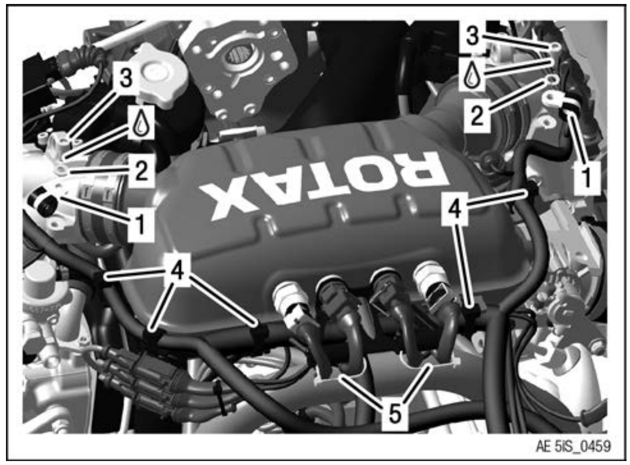


Figure 17.31

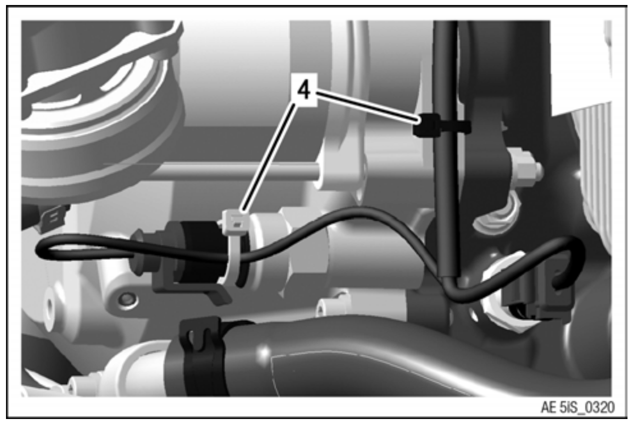


Figure 17.32

1 Cable clamp
2 Washer 6.4
3 Allen screw M6x16
4 Cable tie 203x7.6 mm
5 Cable tie 142x3.2 mm

CONTROL UNIT (ECU) — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

FUEL PUMP — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

FUSE BOX (FUSE BOX) — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

AMBIENT PRESSURE SENSOR — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

STARTER RELAY — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

Tightening torque 10 Nm (89 in. lb).

Please observe the instructions of the aircraft manufacturer.

PRESSURE CONTROL VALVE (PCV) – CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Pressure control valve (PCV) - disconnection.

GROUND CABLES – CONNECTION

For connection of the ground cables please observe the instructions of the aircraft manufacturer.

FINISHING WORK

- Check that all plug connections are secure, contacted and free from corrosion and dirt
- Check the grounding for good contact and cleanliness

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00.

Chapter: 76–70–00
SENSORS AND ACTUATORS

TOPICS IN THIS CHAPTER

SPECIAL TOOLS

Description	Part number	
Multimeter	n.a.	Non certified part
21 mm socket for MAPS and OPS	876075	Non certified part
19 mm socket for CTS and OTS	876130	Non certified part

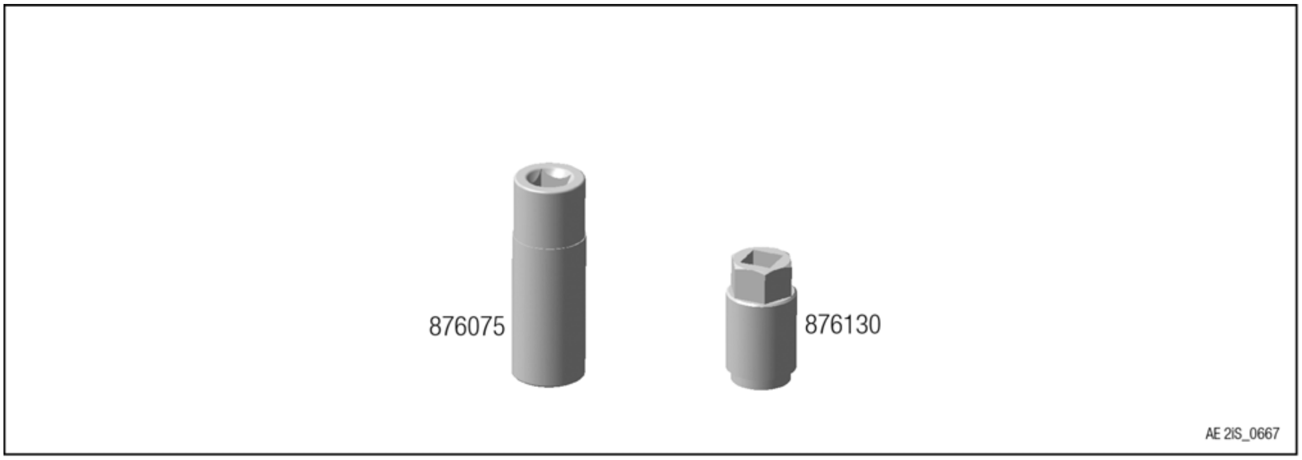


Figure 18.1

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE ANTI SEIZE 8151	297434

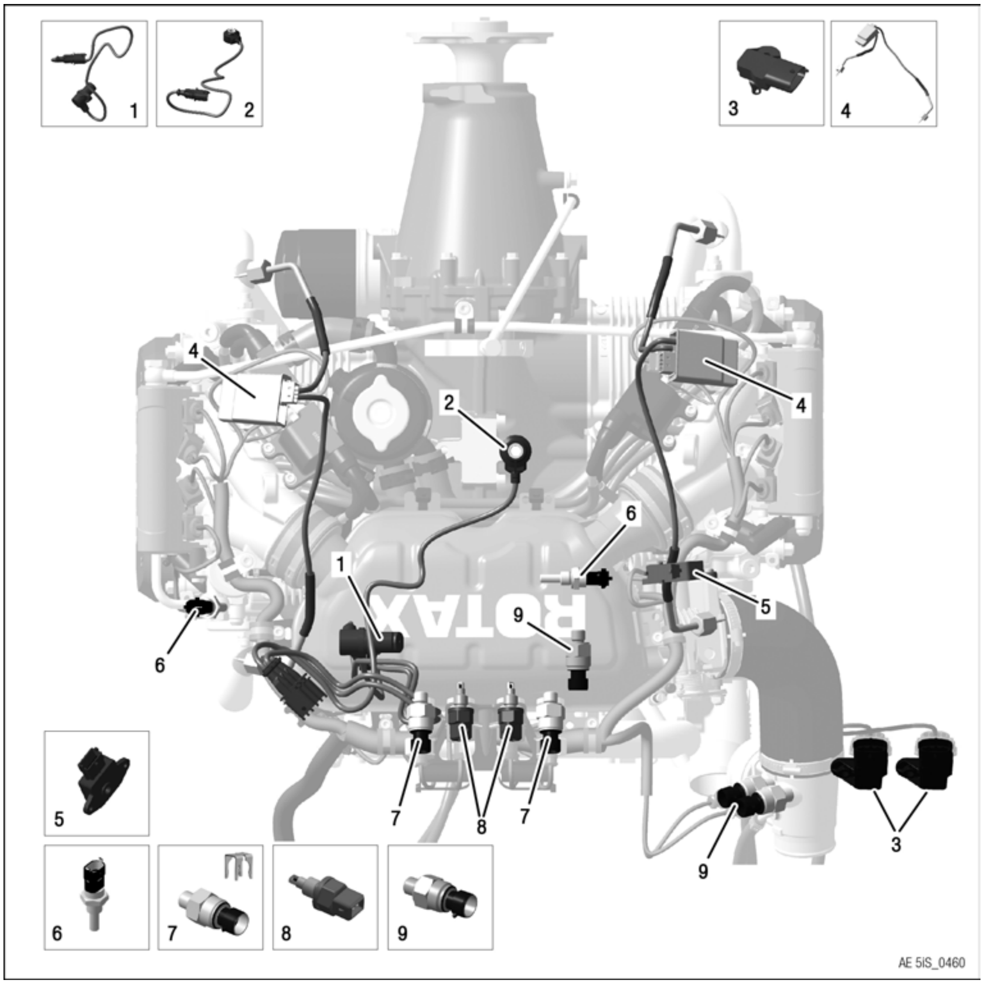


Figure 18.2: Sensors

1 *Crankshaft position sensor (CPS 1 + 2)*

2 *Knock sensor (KNOCK)*

3 *Ambient pressure sensor (AAPTS)*

4 *Temperature sensor (EGT)*

5 *Throttle potentiometer (TPS)*

6 *Temperature sensor (CTS and OTS)*

7 *Pressure sensor (MAPS 1 + 2)*

8 *Temperature sensor (MAPS 1 + 2)*

9 *Pressure sensor (OPS) and BPS*

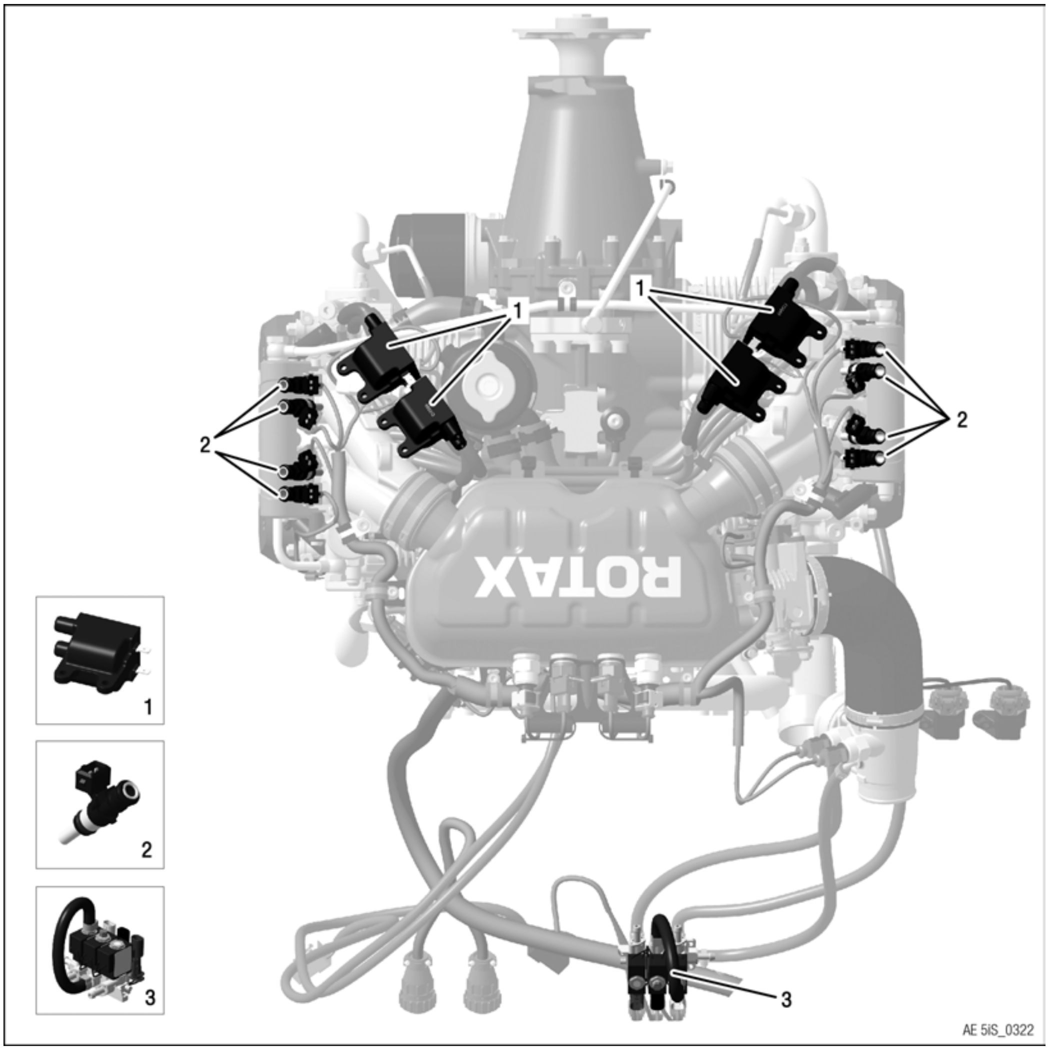


Figure 18.3: Actuators

1 *Ignition coils*
2 *Fuel injectors*
3 *Solenoid valve – PCV*

SYSTEM DESCRIPTION

GENERAL NOTE

In order to ensure that the engine is in the desired operating state and in full working order, a number of sensors are placed on it and used for the Engine Management System (EMS). The information captured by the sensors is transmitted to the ECU where it is processed, and the corresponding signals are sent on to the actuators.

SENSORS

1 Pressure/temperature sensor – ambient pressure
Wiring harness designation: AAPTS
Ambient air pressure and ambient temperature are measured with a combined pressure/temperature sensor. These measurement values are used to compensate for the different altitude and external temperatures.

1 Pressure sensor – oil pressure
Wiring harness designation: OPS
The pressure sensor measures the oil pressure of the engine.

2 Pressure sensors – airbox
Wiring harness designation: MAPS_1/MAPS_2
The pressure sensors measure the pressure of the intake air in the airbox.

2 Temperature sensors – airbox
Wiring harness designation: MATS_1/MATS_2
The temperature sensors measure the temperature of the intake air in the airbox.

4 Temperature sensors – exhaust
Wiring harness designation: EGT_1/EGT_2/ EGT_3/ EGT_4
The temperature sensors measure the temperature of the exhaust gas and are used to regulate the injection quantity.

1 Temperature sensor – cooling system
Wiring harness designation: CTS
The temperature sensor measures the coolant temperature directly in the cylinder head of cylinder 4.

1 Temperature sensor – oil temperature
Wiring harness designation: OTS
The temperature sensor measures the oil temperature.

1 Knock sensor
Wiring harness designation: KNOCK
"Knocking" means uncontrolled combustion in petrol engines, which is caused by auto-ignition of the mixture in the combustion chamber. This undesirable combustion results in increased mechanical loads in the engine.
Operation in this condition over a long period can damage or even destroy the piston. Characteristic frequencies are generated during knocking. These frequencies are detected by the knock sensor and sent to the control unit (ECU).

1 Potentiometer – throttle valve
Wiring harness designation: TPS
The potentiometer measures the position of the throttle valve in the throttle body.

4 Double ignition coils
Wiring harness designation: COIL_1/COIL_2/ COIL_3/COIL_4
Each double ignition coil supplies 2 spark plugs with high voltage.

2 Crankshaft position sensors
Wiring harness designation: CPS_1/CPS_2
The control unit (ECU) requires the current position of the crankshaft for exact control of the ignition and injection points. The crankshaft position sensors measure the revolutions of the crankshaft and give the ECU information about the position of the pistons and the position of the crankshaft.

ACTUATORS AND INDICATORS

Injectors (INJ_1 to INJ_8):
In the engine, eight injection valves (INJ) are used, two for each cylinder.

Ignition coil (IGN): (Ignition Coil)
Four double ignition coils (with one primary coil and one secondary coil each) are attached to the engine. Each end of the secondary coil is connected to a spark plug of different cylinders by ignition cables.

Pressure control valve (PCV)
Electromechanical control device, used to control the gas flow in the area of turbocharger, pop-off valve and wastegate.

SAFETY INSTRUCTION

⚠ WARNING

Danger of injury when removing hose connections, sensors and actuators! Risk of fire due to flammable substances (e.g. fuel). Open flames and smoking in the installation area is not permitted!

ATTENTION

Danger of damage to the fuel distribution system and ignition unit!
Do not touch or pull out ignition cables when the engine is running or at starting speed.

NOTE

The general safety instructions must be followed during all work on the sensors and actuators!

MAINTENANCE

For maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series.

REMOVAL

Preparation
Before the sensors and actuators are removed, the procedures and checks described below must be carried out to identify any further faults in the cylinder head and rectify them as part of repair work.

NOTE

This work can only be carried out on the whole unit.

- General visual inspection. See relevant Maintenance Manual Line for the 915 i A Series engine type.
- Use the BUDS diagnostic unit for troubleshooting and to read out the error memory.

Plausibility test
BUDS (check the plausibility of the values of the sensors with the aid of the Maintenance Tool):

Step	Procedure
1	Engine standstill (cold engine).
2	Activate ECU.
3	Check the plausibility of the pressure, temperature values.
4	Start the engine.
5	Check the plausibility of the sensors.

Elimination process for pressure sensors (MAPS), temperature sensors (MATS) and injection valves (INJ)
In order to identify a component clearly as defective, you should follow the process of elimination, e.g. swap the wiring harness connectors on the sensor.

- If the error on the LANE remains the same, this means the wiring harness is not in working order.

If the error appears on the other LANE after the changeover, this means the sensor is not in working order.

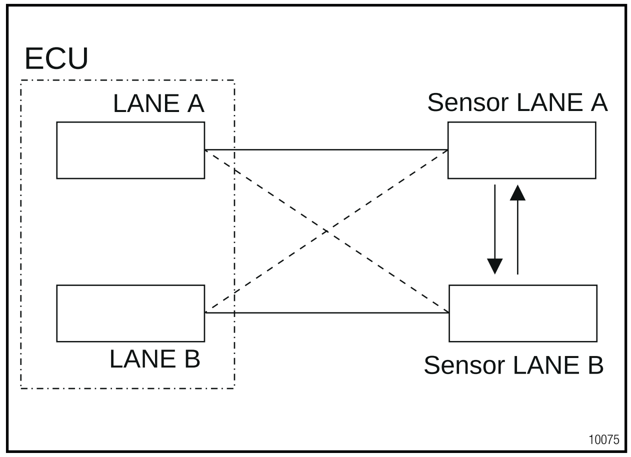


Figure 18.4: Wiring diagram – elimination process

MANIFOLD PRESSURE SENSOR (MAPS_1/MAPS_2) — REMOVAL

Installation position: Airbox

Step	Procedure
1	Cut open the cable ties.
2	Remove 2 clamps.

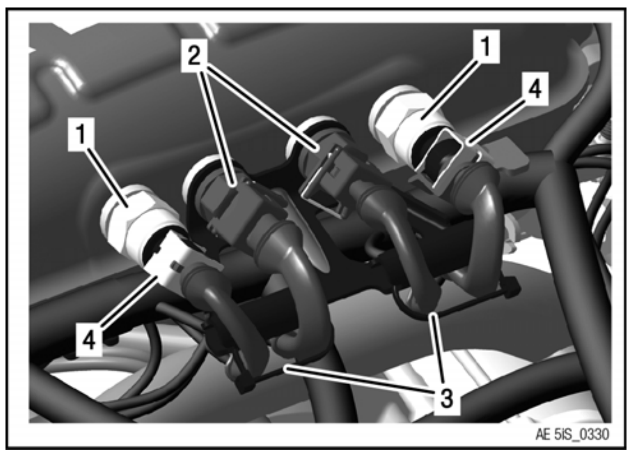


Figure 18.5

1 Pressure sensors | *2 Temperature sensors*
3 Cable ties | *4 Clamps*

Step	Procedure
3	Pull the respective connector of the wiring harness out of the corresponding pressure sensor (MAPS_1/MAPS_2). See Chapter 76-50-00 section Wiring harness (main strand).
4	Lift the latch and pull off.
5	Loosen the pressure sensor with an SW 21 open-ended spanner (or a similar tool) and remove it.
6	Close the opening with the appropriate protective plug.

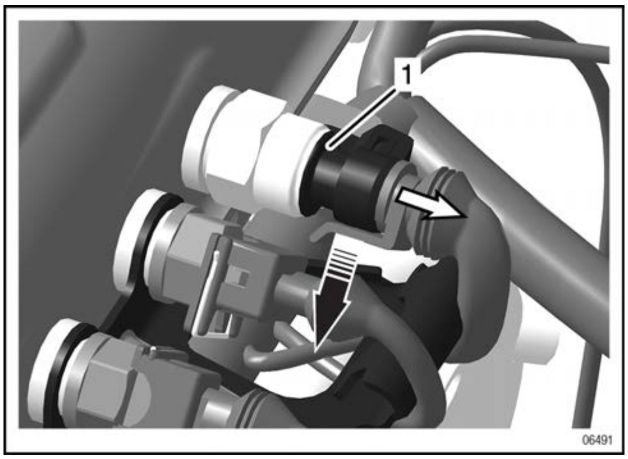


Figure 18.6

1 Pressure sensor

OIL PRESSURE SENSOR (OPS) — REMOVAL

Installation position: Ignition housing

Step	Procedure
1	Cut open the cable ties on the oil pressure sensor.
2	Pull the respective connector of the wiring harness out of the corresponding pressure sensor (OPS). See Chapter 76- 50-00 section Wiring harness (main strand).
3	Lift the latch and pull out the connector.

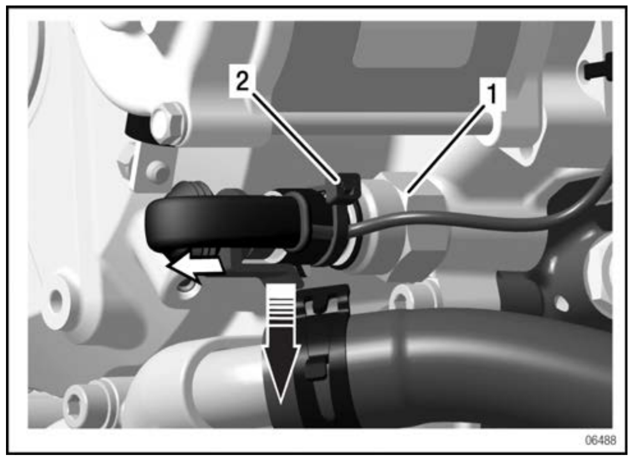


Figure 18.7

1 Oil pressure sensor *2 Cable ties*

Step	Procedure
4	Loosen the oil pressure sensor with an SW 19 open-ended spanner part no. 876130 (or a similar tool) and remove it.
5	Close the threaded bore with the appropriate protective covering.

AMBIENT AIR PRESSURE/ TEMPERATURE SENSOR (AAPTS) — REMOVAL

Installation position: Aircraft frame

Step	Procedure
1	Push in the tab on the top of the connector and at the same time pull the connector out of the connection socket.
2	Follow the aircraft manufacturer's instructions for disassembly.

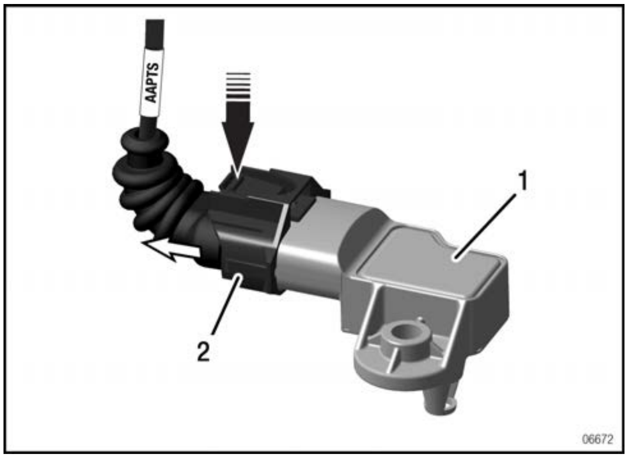


Figure 18.8

1 *Pressure/temperature sensor* *2* *Connection socket*

PRESSURE CONTROL VALVE (PCV) – REMOVAL

Installation position: Aircraft frame

Step	Procedure
1	Lift the latch, press and pull out the connector.
2	Follow the aircraft manufacturer's instructions for disassembly.
3	For removal of the hoses, see Chapter 73-10-00 section Pressure control valve hoses - removal.

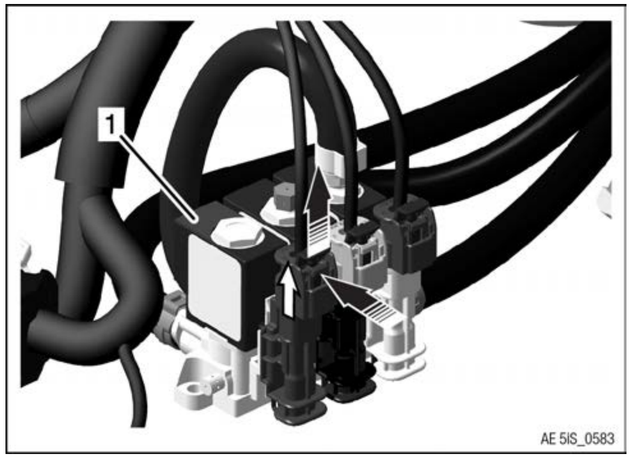


Figure 18.9

1 *Pressure control valve (PCV)*

MANIFOLD TEMPERATURE SENSOR (MATS_1+MATS_2) — REMOVAL

Installation position: Airbox.

Step	Procedure
1	Cut open the cable ties.
2	Unplug the relevant connector of the wiring harness from the corresponding manifold temperature sensor (MATS). See Chapter 76-50-00 section Wiring harness (main strand).

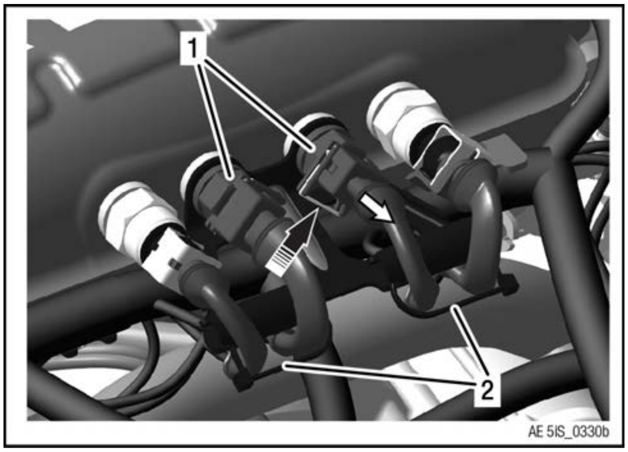


Figure 18.10

1	*Manifold temperature sensor*	2	*Cable ties*

Step	Procedure
3	Unscrew the temperature sensor with an SW 19 open-ended spanner part no. 876130 (or similar tool) and remove it together with the sealing ring and the connector bracket.
4	Close the threaded bore with the appropriate protective covering.

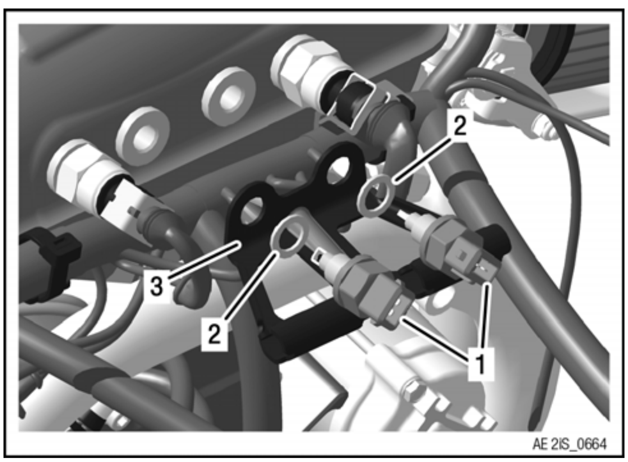


Figure 18.11

1	*Temperature sensor*	2	*Sealing ring*
3	*Connector bracket*		

EXHAUST GAS TEMPERATURE SENSOR (EGT1/EGT2/EGT3/EGT4) — REMOVAL

Installation position: Double ignition coils, exhaust pipes

Step	Procedure
1	Remove the respective wiring harness plug from the corresponding exhaust gas temperature sensor (EGT1/EGT2/EGT3/EGT4). See Chapter 76-50-00 section Wiring harness (main strand).

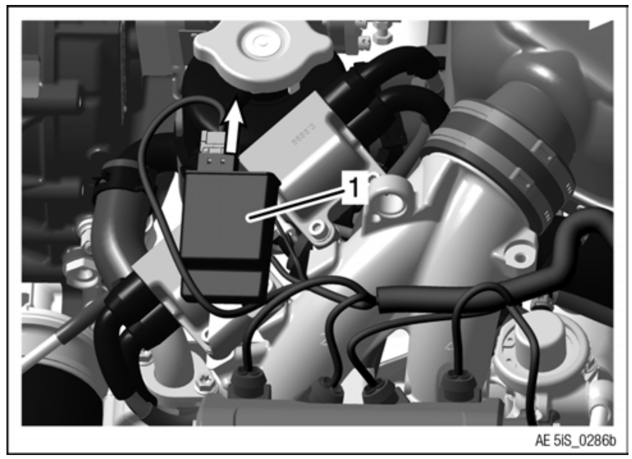


Figure 18.12

1	*EGT wiring harness plug*

Step	Procedure
2	Press the metal bracket and separate the connectors.
3	Carefully pull exhaust gas temperature sensor (EGT) out of the locking plate.

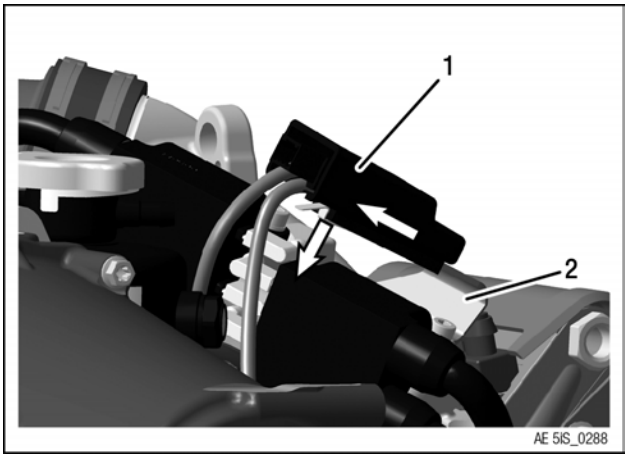


Figure 18.13

1	*Exhaust gas temperature sensor (EGT)*	*2*	*Locking plate*

Step	Procedure
4	Use a size 17 open-ended spanner (or similar tool) to detach the temperature sensor from the exhaust pipe.

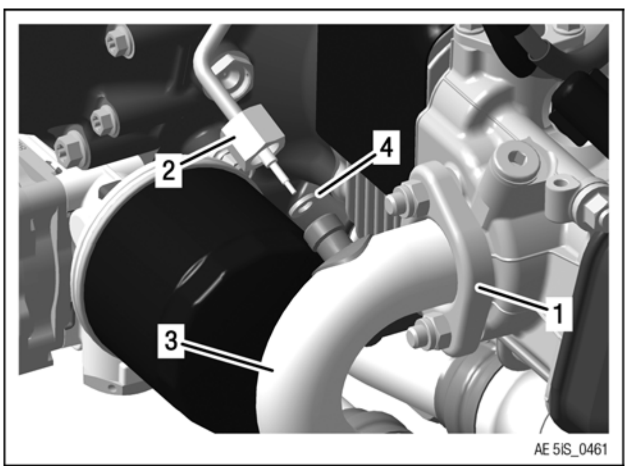


Figure 18.14: TYPICAL

1	*Exhaust flange*	*2*	*Exhaust gas temperature sensor*
3	*Exhaust pipe*	*4*	*Sealing ring*

OIL TEMPERATURE SENSOR (OTS) — REMOVAL

Installation position: Crankcase

Step	Procedure
1	Cut open the cable ties.
2	Unplug the respective connector of the wiring harness (main strand) from the corresponding temperature sensor. See Chapter 76-50-00 section Wiring harness (main strand).
3	Lift the latch and pull out the connector.

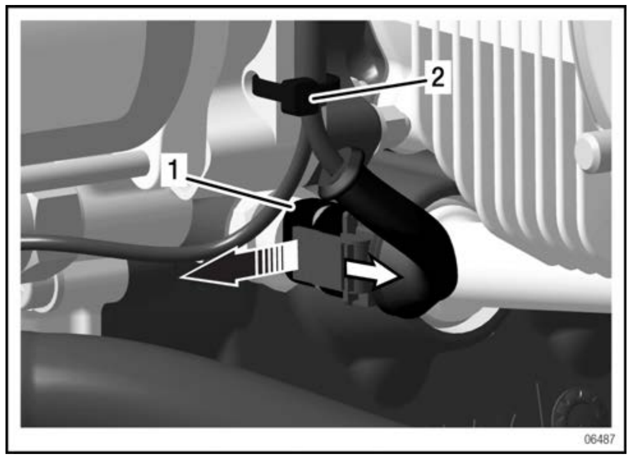


Figure 18.15

1	*Oil temperature sensor*	*2*	*Cable ties*

Step	Procedure
4	Use an SW19 open-ended spanner part no. 876130 (or a similar tool) to remove the temperature sensor from the crankcase.
5	Close the opening with the appropriate protective plug.

CYLINDER HEAD TEMPERATURE SENSOR (CTS) — REMOVAL

Installation position: Cylinder head (cylinder 4)

Step	Procedure
1	Unplug the respective connector of the wiring harness from the corresponding temperature sensor. See Chapter 76- 50-00 section Wiring harness (main strand).
2	Use an 19 mm socket wrench part no. 876130 (or a similar tool) to remove the temperature sensor from the cylinder head.

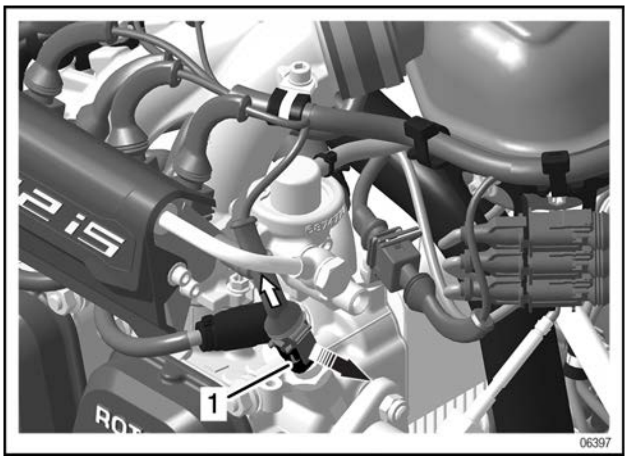


Figure 18.16

1 *Temperature sensor*

KNOCK SENSOR — REMOVAL

Preparation
(Only necessary with cooling baffle installed)

- Remove the fuel line assy. See Chapter 73-10-00 section Fuel system.
- Unplug EGT 1/3. See Chapter 76-50-00 section Wiring harness.
- Open the 1-ear clamp on the intake manifold 1/3.
- Remove the intake manifold 1/3 assy. with the fuel rail and put it to one side. See Chapter 73-10-00 section Fuel system.
- Remove coolant hoses, expansion tank and cooling air baffle. See Chapter 75-00-00 section Removal.

NOTE

The assemblies and lines are only to be removed if necessary and only as far as is necessary!

Installation position: Crankcase

Step	Procedure
1	Unplug the connector of the wiring harness from the knock sensor. See Chapter 76-50-00 section Wiring harness (main strand).
2	Remove the cable tie. Lift the latch and pull apart.
3	Pull the connector out of the support plate.

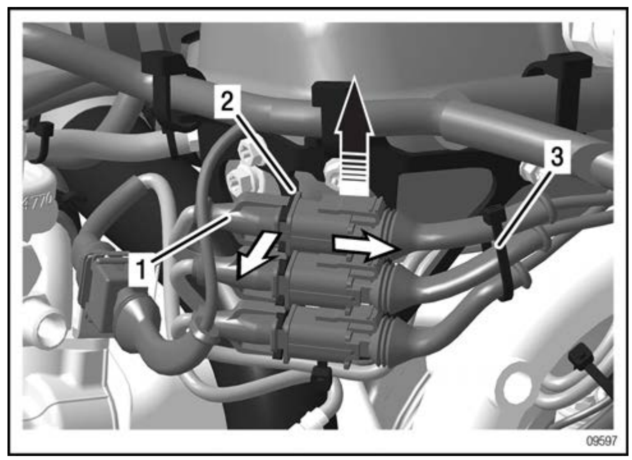


Figure 18.17

1 *Connector* 2 *Support plate*

3 *Cable tie*

ATTENTION

Mark the position of the sensor!

Step	Procedure
4	Loosen the hex. screw M8x30.
5	Remove the knock sensor.

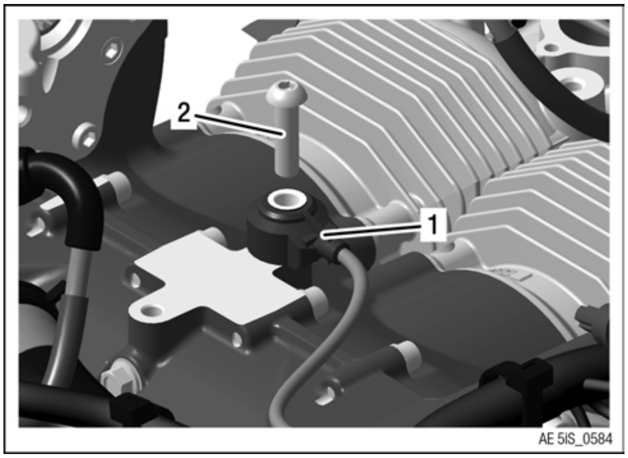


Figure 18.18

1 Knock sensor *2 Screw*

CRANKSHAFT POSITION SENSOR ASSY. (CPS_1, CPS_2) — REMOVAL

Installation position: Ignition housing

Step	Procedure
1	Unplug the respective connector of the wiring harness (main strand) from the corresponding crankshaft position sensor assy. See Chapter 76-50-00 section Wiring harness (main strand).
2	Remove cable ties. Lift the latch and pull apart.
3	Pull the connector out of the support plate.

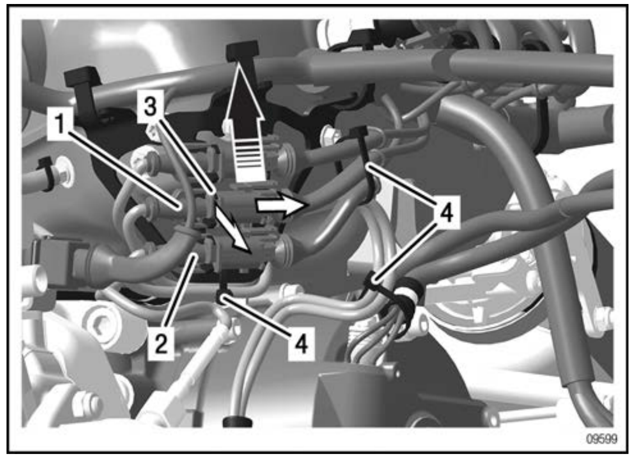


Figure 18.19

1 Connector CPS_1 *2 Connector CPS_2*

3 Support plate *4 Cable ties*

Step	Procedure
4	Remove the Allen screw M6x50 and washer with an Allen key 5 (or similar tool) and remove the cable clamp. **NOTE** *This screw is sealed with LOCTITE 243.*
5	Loosen the Allen screw M6x20 and washer and remove the crankshaft position sensor assy.
6	Close the opening with the appropriate protective plug.

ATTENTION

Ensure that the O-ring is positioned on the crankshaft position sensor assy.

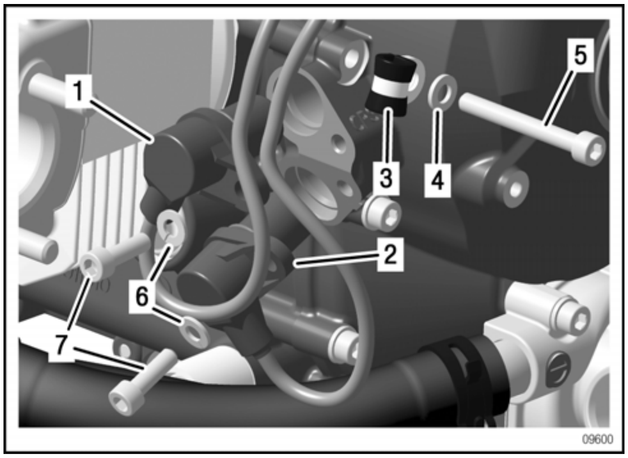


Figure 18.20

1	*Crankshaft position sensor CPS_1, upper position*	2	*Crankshaft position sensor CPS_2, lower position*
3	*Cable clamp*	4	*Washer*
5	*Allen screw M6x50*	6	*Lock washer A6*
7	*Allen screw M6x20*		

THROTTLE POTENTIOMETER (TPS) — REMOVAL

Installation position: Throttle body

NOTE

The throttle potentiometer is not available as a spare part.

Step	Procedure
1	Unplug the respective connector of the wiring harness from the throttle potentiometer. See Chapter 76-50-00 section Wiring harness (main strand).
2	Remove the throttle body assy. To do this, see Chapter 73-10-00 section Fuel pump and distribution.

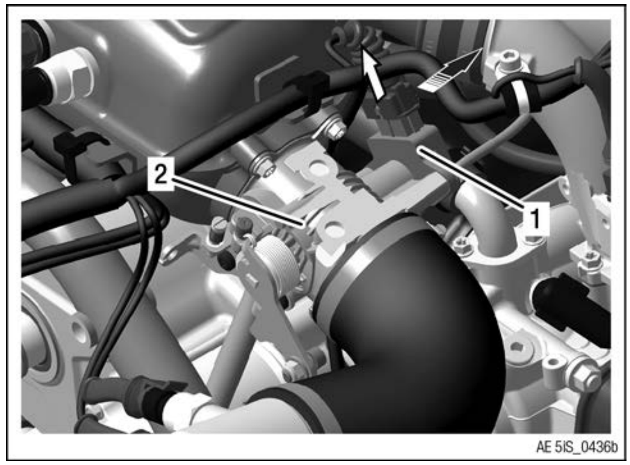


Figure 18.21

1	*Throttle valve potentiometer*	2	*Throttle body assy.*

PRESSURE SENSOR (BPS) — REMOVAL

Installation position: Overboost valve

Step	Procedure
1	Pull the respective connector of the wiring harness out of the corresponding pressure sensor (BPS).
2	Lift the latch and pull off.
3	Loosen the pressure sensor with an SW 21 open-ended spanner (or a similar tool) and remove it.
4	Close the opening with the appropriate protective plug.

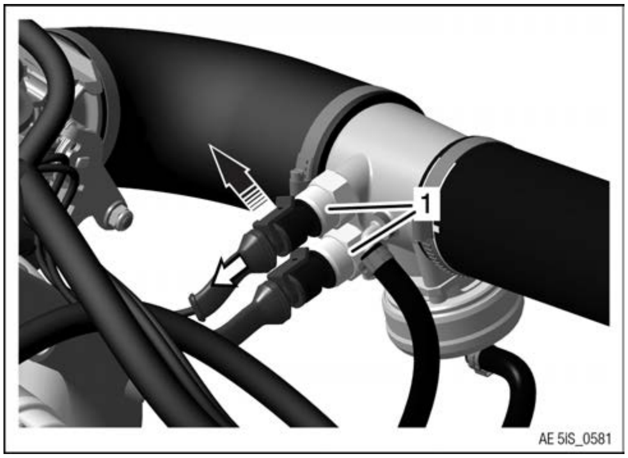


Figure 18.22

1	*Pressure sensor (BPS)*

INJECTION VALVE (INJ) — REMOVAL

To do this, see Chapter 73-10-00 section Fuel pump and distribution.

GOVERNOR — REMOVAL

See Chapter 61-20-00 section Governor.

DOUBLE IGNITION COIL — REMOVAL

See Chapter 74-20-00 section Distribution.

FUEL PUMP — REMOVAL

To do this, see Chapter 73-10-00 section Fuel pump and distribution.

INSPECTION

SENSORS AND ACTUATORS INSPECTION/MEASUREMENT

Preparation

NOTE

Before starting to inspect the sensors and actuators, ensure that the whole aircraft system is fully functional!

Aircraft components to be checked:

- Battery
- Fuses
- Grounding connections
- Cable connections

GENERAL TEST PROCEDURE

ATTENTION

During work on the components of the engine management system, there is a risk of damage. Never put measuring probes in plug connectors or use paper clips to carry out tests in the plug connectors.

NOTE

The MAINTENANCE TOOL BUDS software must be used for diagnostics!

- After a problem has been solved, any error entries in the ECU must be documented with the MAINTENANCE TOOL and then deleted.

Functional test

The function of the sensors and actuators must be checked with the ECU activated.

GENERAL RESISTANCE MEASUREMENT

Before checking the resistance, ensure that there is no voltage present at the component to which the ohmmeter is connected. Always pull out the connectors beforehand. Switch off the ignition. Disconnect the battery. Otherwise the measurement unit can be damaged.

The ohmmeter is connected to the 2 connections of a consumer or to the 2 ends of an electric line. It doesn't matter which cable (+/-) of the measurement unit is clamped to which contact. Exceptions are resistance measurements on components which contain diodes.

The resistance measurement on the engine usually covers 2 areas:

- Resistance or component check
- Continuity check of an electric cable, a switch etc. This checks whether an electric cable is disconnected so that the connected electric device cannot function. The ohmmeter is connected to the two ends of the electric cable in question for the measurement. If the resistance is close to 0 (zero) then there is continuity. This means the electric cable is in working order. If the cable is broken, the measurement unit displays infinity.

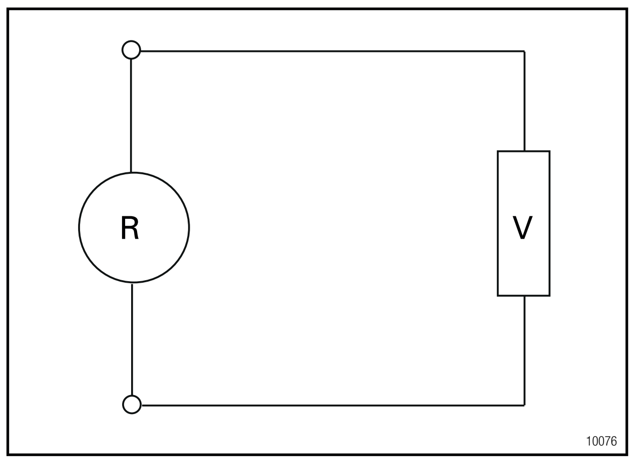


Figure 18.23

R Ohmmeter *V Consumer*

RESISTANCE MEASUREMENT (TEMPERATURE SENSOR)

General note

If resistance values are measured with an ohmmeter, all values are given at a temperature of approx. 20 ° C. A resistance value changes with temperature.

The temperature sensors which are mostly used in the engine are NTC (Negative Temperature Coefficient) and operate in the opposite manner i.e. the resistance value essentially falls when the temperature rises. This must be taken into account when measuring at temperatures which differ from the specified values. The relationship between the resistance and the temperature can be found in the respective diagram of the relevant sensor.
The resistance value of a temperature sensor can appear to be in working order at ambient temperature but defective at other temperatures. If in doubt, replace the sensor.

NOTE

It should be remembered that the static measurement is only meaningful for the determined temperature ranges. Exact information can be obtained if the sensor has been tested over a wider temperature range.

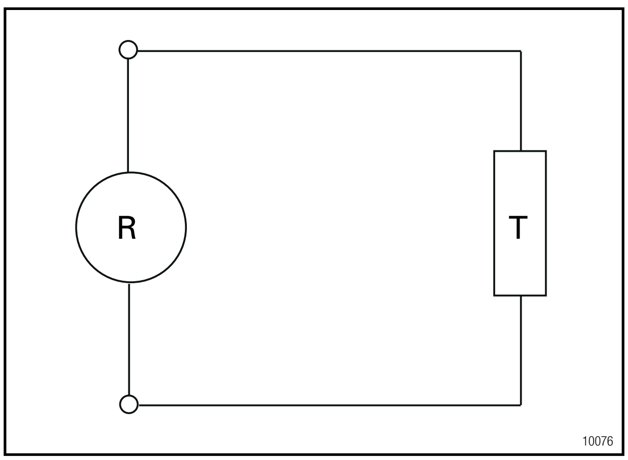


Figure 18.24

R Ohmmeter *T Temperature sensor*

VOLTAGE MEASUREMENT

General note

ATTENTION
Voltage supply: The secondary side of the ignition unit is an exception to the following instructions! The ignition voltage can be up to 30 000 volts! This high voltage must only be measured with a special measurement unit or an oscilloscope with a special test probe.

Voltage can be detected with a simple test lamp or a voltage tester. However, this only indicates whether there any voltage is connected at all. To check the level of the voltage present, a voltmeter (= multimeter) must be connected.

Step	Procedure
1	The voltmeter must first be adjusted to the measurement range in which the voltage to be measured probably is. Voltages on the engine are generally no higher than approx. 28 volts.
2	Connect the cables of the measurement unit parallel to the consumer.

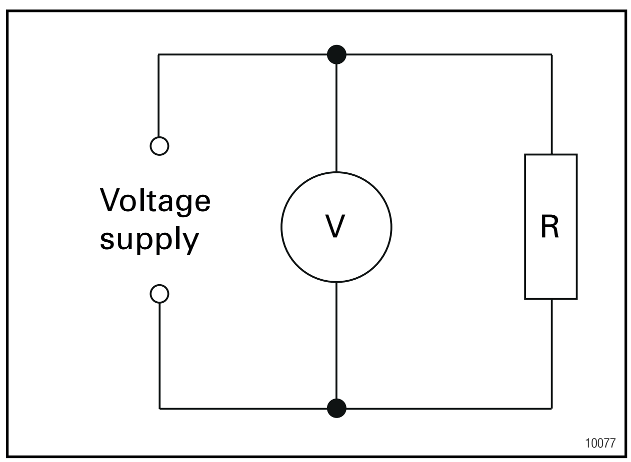


Figure 18.25

V Parallel-connected voltmeter *R Consumer*

ATTENTION
Piercing wire sheath with a test probe is forbidden.

CURRENT MEASUREMENT

General note

It is not often necessary to measure the amperage on the engine. This requires an ammeter, which is usually integrated in a multimeter.

ATTENTION
Amperage: Never measure the amperage in the cable to the starter with a normal ammeter! The measurement unit can be destroyed by the high currents which occur here. A current clamp can be used for measuring such high amperages.

Step	Procedure
1	Before the current measurement, the measurement unit is adjusted to the measurement range in which the amperage you are measuring is likely to be found. If this is not known, set the highest measurement range, and if there is no display, switch down to the next measurement range, and so on.
2	If not using a clamp-on ammeter, the circuit must be disconnected in order to measure the amperage. The measurement unit (ammeter) is connected in between.

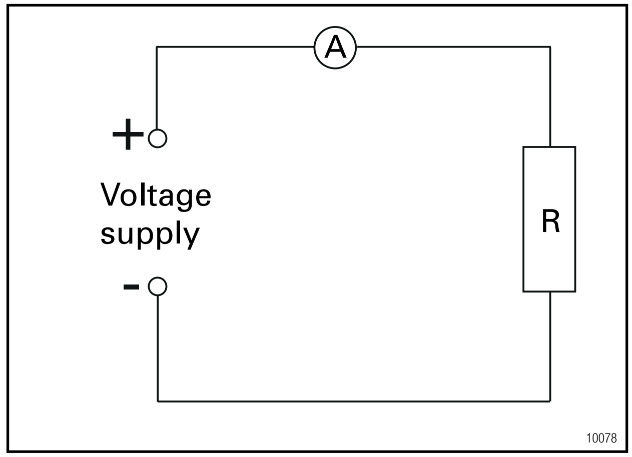


Figure 18.26

A *Series-connected ammeter*

R *Consumer*

MANIFOLD PRESSURE SENSOR (MAPS_1, MAPS_2) — INSPECTION

Manifold pressure sensor (MAPS_1, MAPS_2)			
Signal	**PIN**	**Voltage [in V]**	**Remarks**
Supply voltage	B	5 V ± 0.5	
OUT	C	0.5 .... 4.5 V	corresponds to 0 to 2 bar
GROUND	A	0 V	

Manifold pressure sensor (MAPS_1, MAPS_2)			
Signal	**PIN**	**Voltage [in V]**	**Remarks**
Measurement			
Pressure (bar/psi)	**Current [in V]**		
2 bar / 29 psi	4.5 V		
0	0 V		

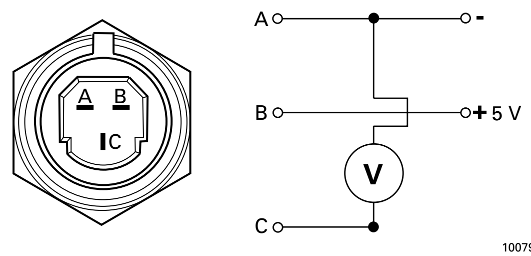


Figure 18.27

BOOST PRESSURE SENSOR (BPS) — INSPECTION

Boost pressure sensor (BPS_1, BPS_2)			
Signal	**PIN**	**Voltage [in V]**	**Remarks**
Supply voltage	B	5 V ± 0.5	
OUT	C	0.5 .... 4.5 V	corresponds to 0 to 2 bar
GROUND	A	0 V	
Measurement			
Pressure (bar/psi)	**Current [in V]**		
2 bar / 29 psi	4.5 V		
0 bar	0.5 V		

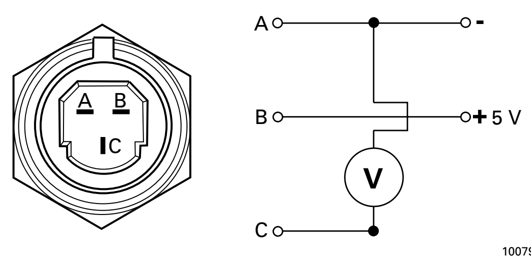


Figure 18.28

OIL PRESSURE SENSOR (OPS) — INSPECTION

Oil pressure sensor (OPS)			
Signal	**PIN**	**Voltage [in V]**	**Remarks**
Supply voltage	B	5 V ± 0.5	
OUT	C	0.5 .... 4.5 V	corresponds to 0 to 10 bar
GROUND	A	0 V	

Oil pressure sensor (OPS)			
Signal	**PIN**	**Voltage [in V]**	**Remarks**
Measurement			
Pressure (bar/psi)	**Current [in V]**		
10 bar / 145 psi	4.5 V		
0	0V		

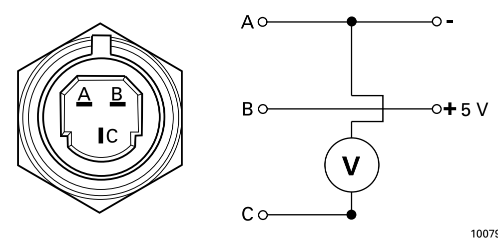


Figure 18.29

MANIFOLD TEMPERATURE SENSOR (MATS_1/MATS_2) — INSPECTION

Manifold temperature sensor (MATS_1, MATS_2)	
Measurement	
Temperature [°C/°F]	**Resistance [Ω]**
-10 °C/14 °F	9217 +/- 9 %
0/32 °F	5808 +/- 7%
20 °C/38 °F	2500 +/- 5 %
80 °C/176 °F	331 +/- 10 %

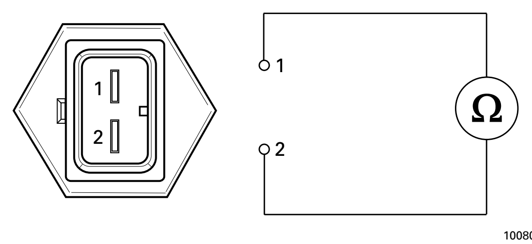


Figure 18.30

OIL TEMPERATURE SENSOR (OTS) — INSPECTION

Oil temperature sensor (OTS)	
Measurement	
Temperature [°C/°F]	**Resistance [Ω]**
-10 °C/14 °F	9395 +/- 7 %
0/32 °F	5895 +/- 7 %
20 °C/38 °F	2499 +/-6 %
80 °C/176 °F	323 +/-3 %
100 °C/212 °F	187 +/- 2 %

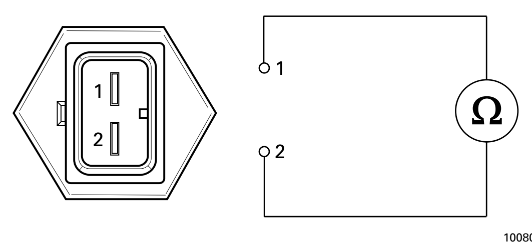


Figure 18.31

CYLINDER HEAD TEMPERATURE SENSOR (CTS) — INSPECTION

Cylinder head temperature sensor (CTS)		
Measurement		
Temperature [°C/°F]	**Resistance [Ω]**	
-10 °C/14 °F	9395 +/- 7 %	
0/32 °F	5895 +/- 7 %	
20 °C/38 °F	2499 +/-6 %	
80 °C/176 °F	323 +/-3 %	
100 °C/212 °F	187 +/- 2 %	

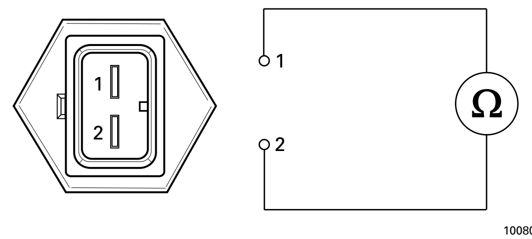


Figure 18.32

EXHAUST GAS TEMPERATURE SENSOR (EGT 1, EGT 2, EGT 3, EGT 4) - INSPECTION

Exhaust gas temperature sensor (EGT 1, EGT 2, EGT 3, EGT 4)		
Measurement		
Temperature [°C/°F]	**Resistance [Ω]**	
-40 °C/-40 °F	169.7	
0/32 °F	200.5	
50 °C/122 °F	238.5	
100 °C/212 °F	275.9	
200 °C/392 °F	349	
300 °C/572 °F	419.7	
500 °C/932 °F	534.1	

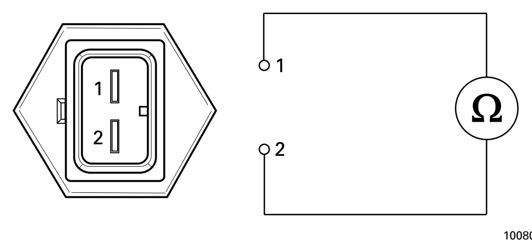


Figure 18.33

KNOCK SENSOR (KNOCK) — INSPECTION

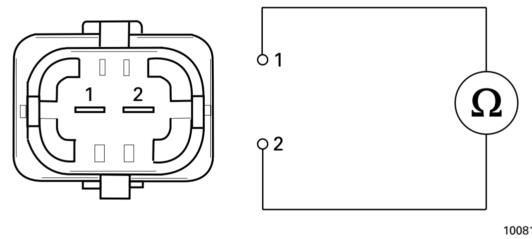
Preparation

Carry out a general visual inspection: Check that the sensor is securely fitted.

- Corrosion or damage to the wiring, connector contacts or connections

Voltage and resistance test

- cannot be tested

Knock sensor		
Measurement		 Figure 18.34
Measuring points	**Resistance [Ω]**	
Between PIN 1 and PIN 2	4 to 10 MΩ	
Between PIN and housing	≥ 1 MΩ	

CRANKSHAFT POSITION SENSOR (CPS_1/CPS_2) — INSPECTION

Preparation

Carry out a general visual inspection:

- Check that the sensors are fitted securely.
- Corrosion or damage to the wiring, connector contacts or connections
- Check the O-ring on the crankshaft position sensor
- Check the thread
- Check the crankshaft position sensor surface
- Check the crankshaft position sensor bore

Voltage and resistance test

- cannot be tested

THROTTLE POTENTIOMETER (TPS) — INSPECTION

Preparation

Carry out a general visual inspection:

- Check the setting of the throttle valve actuation and travel (are both stops reached yes/ no)
- Check that the pilot screw is fitted securely.
- Check that the throttle valve sensor is securely fitted
- Corrosion or damage to the connector and contacts
- Check that the sensor shaft moves freely
- Check the parameters of the throttle valve setting with the Maintenance Tool (especially if the ECU or the throttle valve sensor have been replaced)

Throttle potentiometer (TPS)			
Signal	**PIN**	**Value [in V]**	**Remarks**
Supply voltage	1	+ 5 V	
Ground offset	2	0 V	
Signal	3	0.25 to 4.7 V	

Measurement	
Position	**Voltage [in V]**
Closed	0.25 V
Max. opened	4.7 V

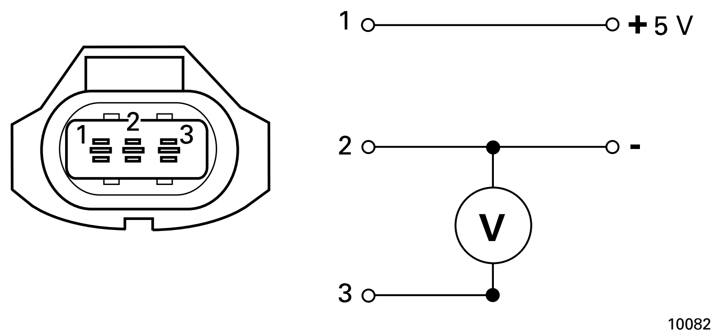


Figure 18.35

AMBIENT AIR PRESSURE/TEMPERATURE SENSOR (AAPTS) — INSPECTION

Ambient air pressure/temperature sensor (OPS)			
Signal	**PIN**	**Value [in V]**	**Remarks**
Supply voltage	3	5 V +/- 0.25 V	
Ground offset	1	0 V	
Signal temperature	2	45 kΩ - 89 Ω	
Pressure	4	0.25 V - 4.75 V	

Measurement	
Pressure (bar/psi)	**Voltage [in V]**
-10	9395 Ω +/- 4 %
0	5895 Ω +/- 3,8 %
20	2499 Ω +/- 3,4 %
30	1706 Ω +/- 3,1 %
50	833,8 Ω +/- 2,8 %
80	322,5 Ω +/- 2,3 %
100	186,6 Ω +/- 2,0 %

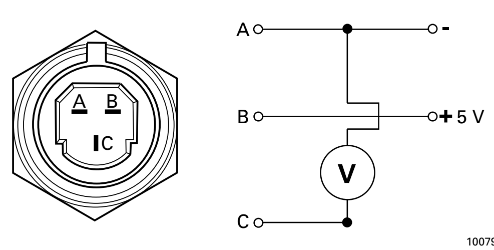


Figure 18.36

INJECTORS — INSPECTION

Preparation

Carry out a general visual inspection:

- Corrosion or damage to the wiring, connector contacts or connections
- Check the labelling of the injectors

Functional test

- Check flow rate
- Leak-proofness
- Check the "spray pattern" using the map

ATTENTION
Risk of damage to engine management system components! There is a risk of a permanent bypass (fuel pressure surge).

Voltage and resistance test

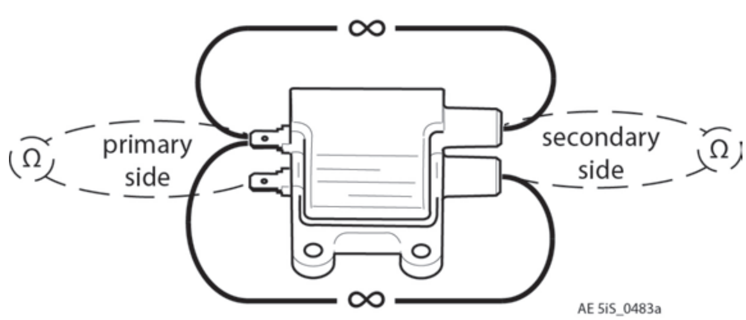
The internal resistance is about 12 Ω.

DOUBLE IGNITION COIL — INSPECTION

Preparation

Carry out a general visual inspection:

- Corrosion or damage to the wiring, connector contacts or connections
- Check the labelling of the connector

Double ignition coil		
Measurement		
Measuring points	**Resistance**	
Primary side	0.6 Ω +/- 0.6 Ω	 Figure 18.37
Secondary side	8.2 kΩ +/- 0.82 kΩ	
Between Primary side and Secondary side	Infinite	

FUEL PUMP — INSPECTION

To do this, see Chapter 73-10-00 section Fuel pump and distribution.

INSTALLATION

Preparation

- Clean all parts carefully
- Remove protective coverings

OIL PRESSURE SENSOR (OPS) — INSTALLATION

Step	Procedure
1	Clean the thread of the oil pressure sensor.
2	Apply LOCTITE 243 to the thread of the pressure sensor and use an 21 mm socket wrench part no. 876075 (or a similar tool) to tighten it. Tightening torque 15 Nm (133 in. lb.).

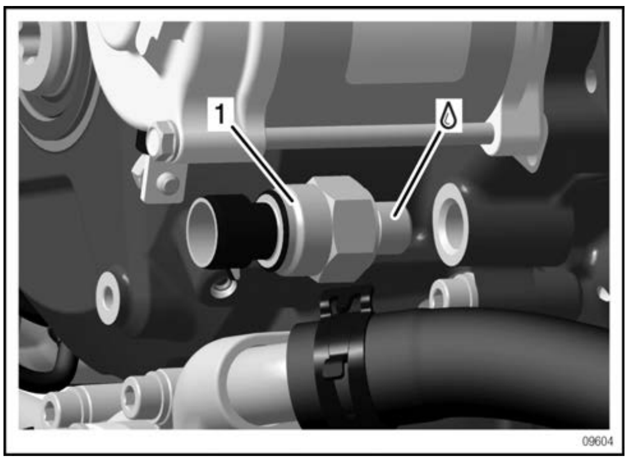


Figure 18.38

1 *Oil pressure sensor (OPS)*

Step	Procedure
3	Plug the respective wiring harness connector into the corresponding pressure sensor. See Chapter 76-50-00 section Wiring harness (main strand).
4	Attach cable ties (strain relief).

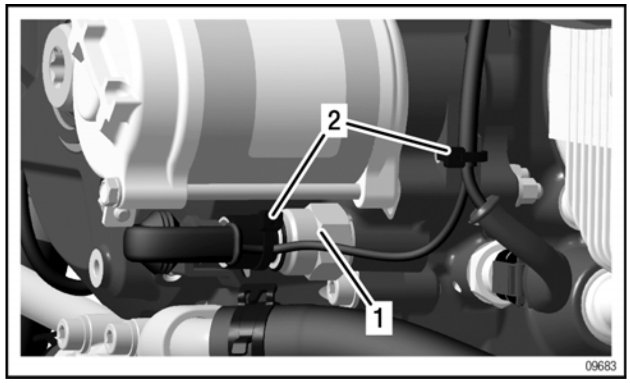


Figure 18.39

1 *Oil pressure sensor (OPS)* 2 *Cable ties*

BOOST PRESSURE SENSOR (BPS) — INSTALLATION

Step	Procedure
1	Clean the thread of the boost pressure sensor.
2	Tighten the pressure sensor with an 21 mm socket wrench part no. 876075 (or similar tool). Tightening torque 10 Nm (89 in. lb.).
3	Plug the respective wiring harness connector into the corresponding pressure sensor. See Chapter 76-50-00 section Wiring harness (main strand).
4	Make sure to put the connector latch to the bottom.

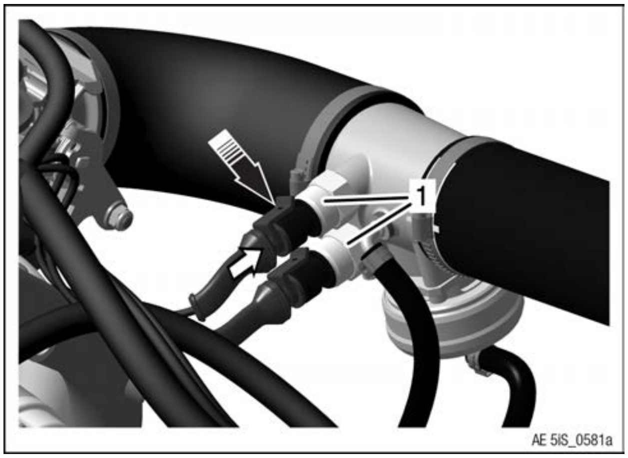


Figure 18.40

1	*Boost pressure sensor (BPS)*

MANIFOLD PRESSURE SENSOR (MAPS_1/MAPS_2) — INSTALLATION

Step	Procedure
1	Clean the thread of the manifold pressure sensor.
2	Tighten MAPS with an 21 mm socket wrench part no. 876075 (or similar tool). Tightening torque 10 Nm (89 in. lb.).
3	Plug the respective wiring harness connector into the corresponding pressure sensor. See Chapter 76-50-00 section Wiring harness (main strand).
4	Make sure to put the connector latch to the bottom.
5	Install the clamp. Check for tight fit and correct position of the clamp on sensor and connector!
6	Attach cable ties (strain relief) .

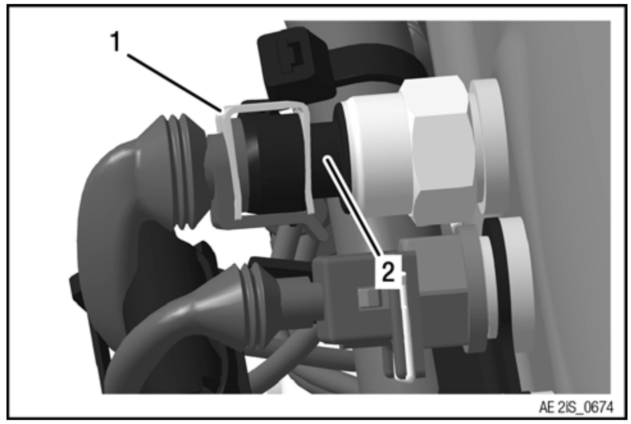


Figure 18.41: Position of the clamp

1	*Clamp*	2	*Manifold pressure sensors (MAPS_1/MAPS_2)*

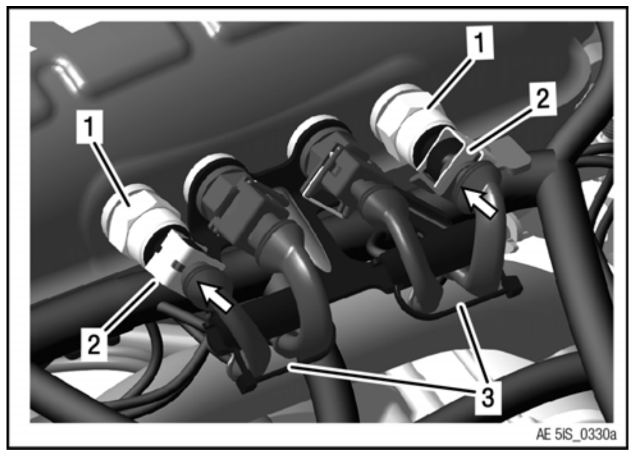


Figure 18.42

1	*Pressure sensors (MAPS_1/MAPS_2)*	2	*Clamp*
3	*Cable ties*		

PRESSURE CONTROL VALVE – INSTALLATION

NOTE

For installation of the hoses, see Chapter 73-10-00 section Pressure control valve hoses - installation.

Step	Procedure
1	Follow the aircraft manufacturer's instructions for assembly.
2	Plug the respective wiring harness connector into the pressure control sensor.
3	Lock connector with tab.

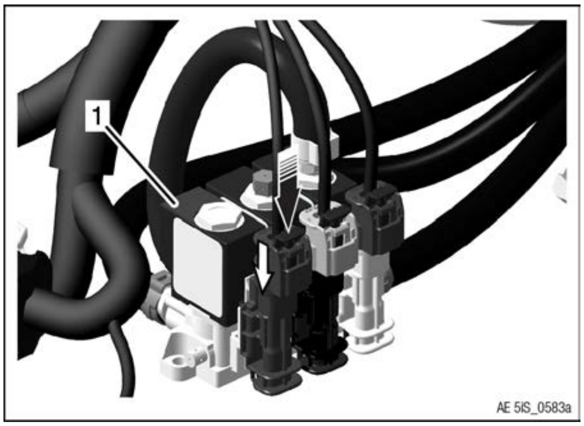


Figure 18.43

1 *Pressure control valve*

AMBIENT AIR PRESSURE/ TEMPERATURE SENSOR (AAPTS) — INSTALLATION

Step	Procedure
1	Follow the aircraft manufacturer's instructions for assembly.
2	Plug the respective wiring harness connector into the corresponding pressure or temperature sensor. See Chapter 76-50-00 section Wiring harness (main strand).

CYLINDER HEAD TEMPERATURE SENSOR (CTS) — INSTALLATION

Step	Procedure
1	Clean the thread of the cylinder head temperature sensor.
2	Apply LOCTITE 243 to the thread of CTS and use an 19 mm socket wrench part no. 876130 (or a similar tool) to tighten it. Tightening torque 15 Nm (133 in. lb.).
3	Plug the respective wiring harness connector into the corresponding temperature sensor. See Chapter 76-50-00 section Wiring harness (main strand).

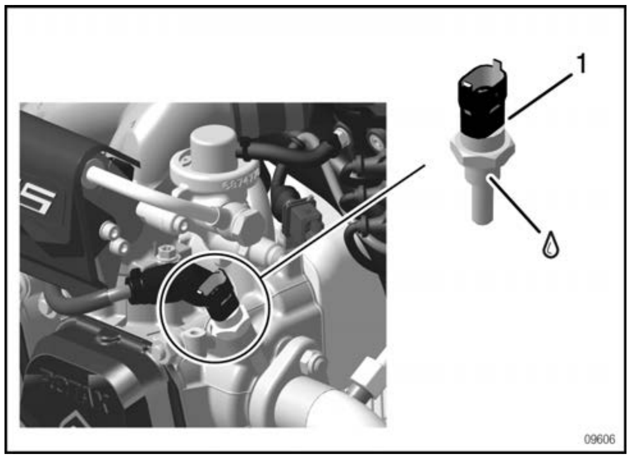


Figure 18.44

1 *Cylinder head temperature sensor (CTS)*

MANIFOLD TEMPERATURE SENSOR (MATS) — INSTALLATION

Step	Procedure
1	Clean the thread of the manifold temperature sensor.
2	Fasten the temperature sensor with the connector bracket and sealing ring using an 19 mm socket wrench part no. 876130 (or similar tool). Tightening torque 15 Nm (133 in. lb.).

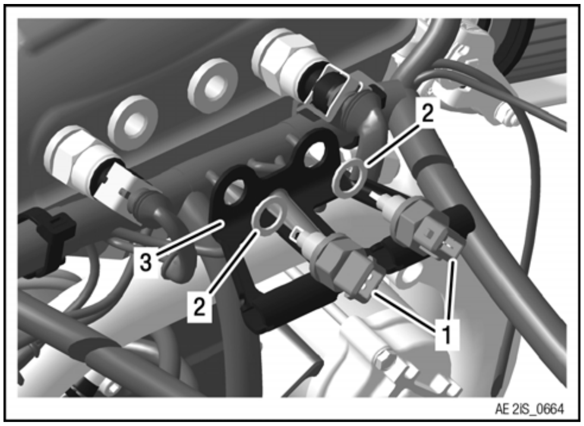


Figure 18.45

1	*Manifold temperature sensor (MATS)*	2	*Sealing ring*
3	*Connector bracket*		

Step	Procedure
3	Plug the respective wiring harness connector into the corresponding temperature sensor. See Chapter 76-50-00 section Wiring harness (main strand).
4	Attach cable ties (strain relief).

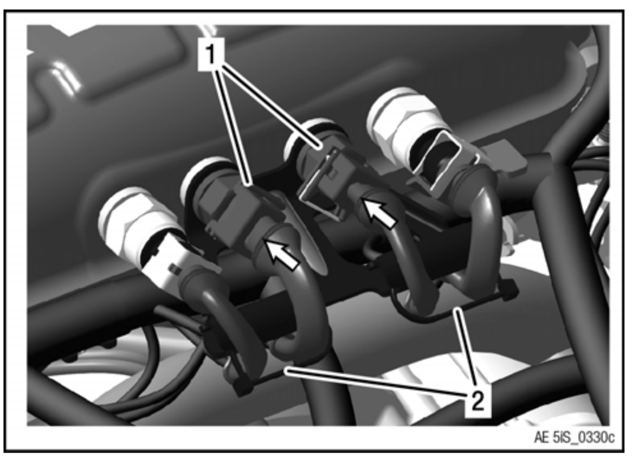


Figure 18.46

1	*Temperature sensor (MATS)*	2	*Cable ties*

OIL TEMPERATURE SENSOR (OTS) — INSTALLATION

Step	Procedure
1	Clean the thread of the oil temperature sensor.
2	Apply LOCTITE 243 to the thread of OTS and use an 19 mm socket wrench part no. 876130 (or a similar tool) to tighten it. Tightening torque 15 Nm (133 in. lb.).
3	Plug the respective wiring harness connector into the corresponding temperature sensor. See Chapter 76-50-00 section Wiring harness (main strand).

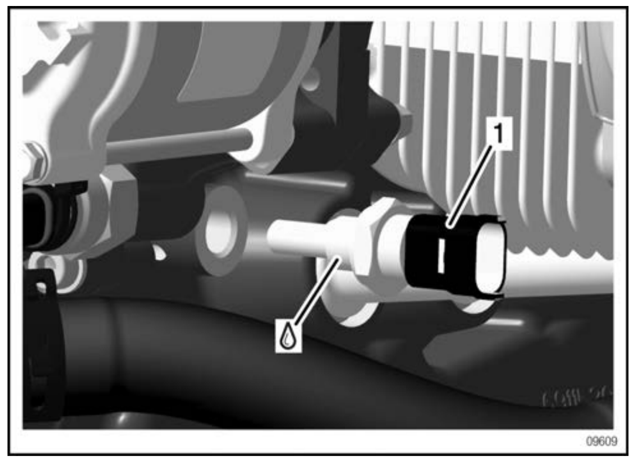


Figure 18.47

1	*Oil temperature sensor (OTS)*

Step	Procedure
4	Attach cable ties.

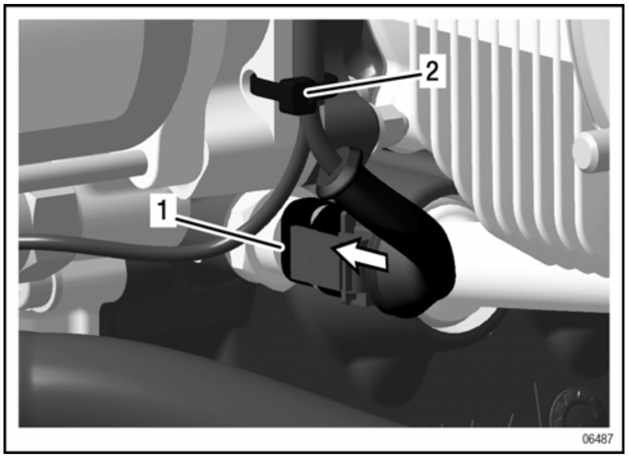


Figure 18.48

1 Temperature sensor (OTS) *2 Cable ties*

EXHAUST GAS TEMPERATURE SENSOR (EGT1/EGT2/EGT3/EGT4) — INSTALLATION

Step	Procedure
1	Carefully push the temperature sensor (EGT) into the locking plate.

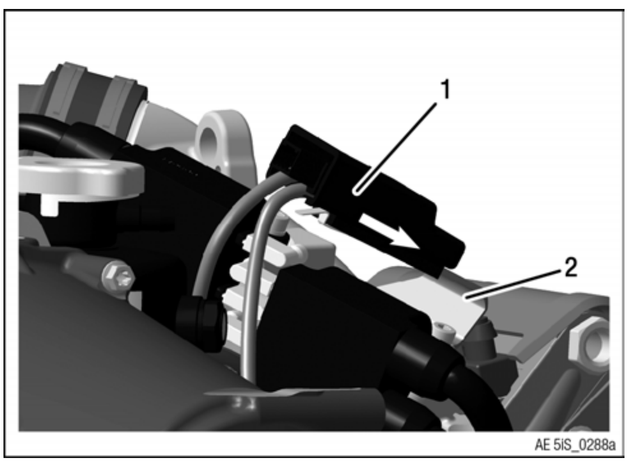


Figure 18.49

1 EGT *2 Locking plate*

Step	Procedure
2	Lay the wires of the EGT sensors.
3	Clean the thread of the temperature sensor.
4	Apply LOCTITE ANTI SEIZE. to temperature sensor.
5	Use an SW 17 torque wrench (or similar tool) and tighten the temperature sensors with sealing plugs on the exhaust pipes. Tightening torque 15 Nm (133 in lb.).

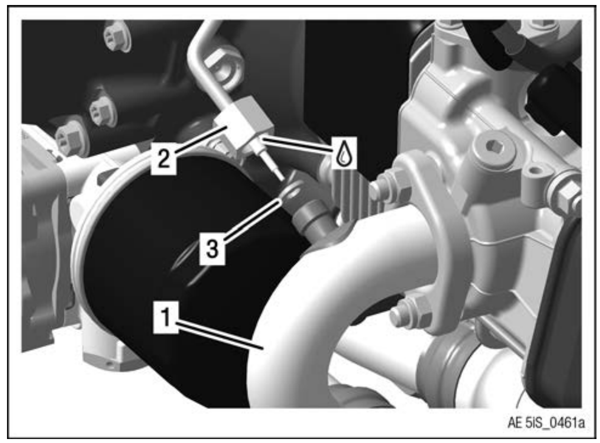


Figure 18.50

1 Exhaust pipe *2 Exhaust gas temperature sensor*
3 Sealing ring

Step	Procedure
6	Plug the respective wiring harness connector into the corresponding pressure or temperature sensor. See Chapter 76-50-00 section Wiring harness (main strand).

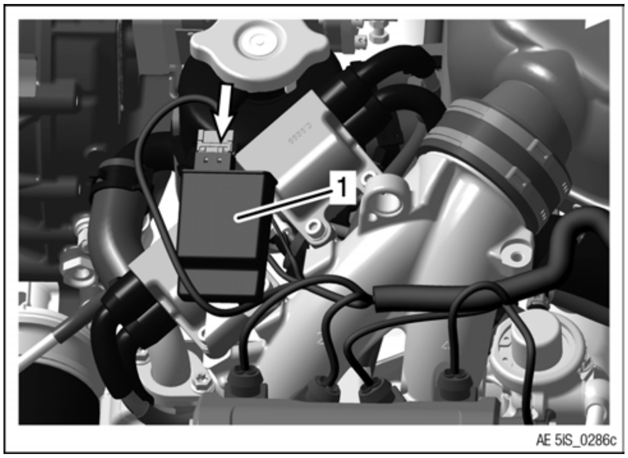


Figure 18.51

1 Connector (EGT)   *2 Locking plate*

KNOCK SENSOR (KNOCK) — INSTALLATION

Step	Procedure
1	Clean the end face of the knock sensor.
2	Tighten the knock sensor. Tightening torque 20 Nm (15 ft .lb.).

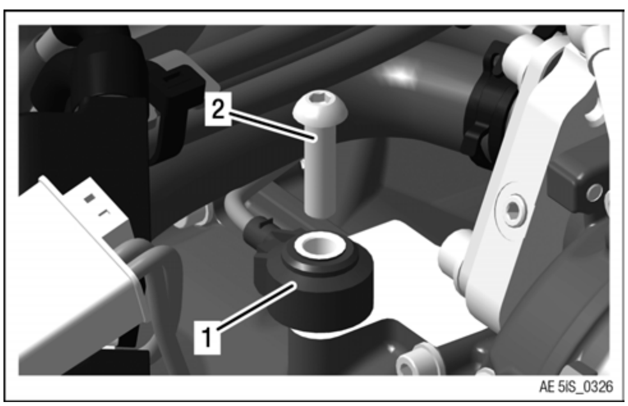


Figure 18.52

1 Connector (KNOCK)   *2 Binding head screw M8x30*

Step	Procedure
3	Plug the respective wiring harness connector into the knock sensor.
4	Carefully push the connector (KNOCK) in to the locking plate.

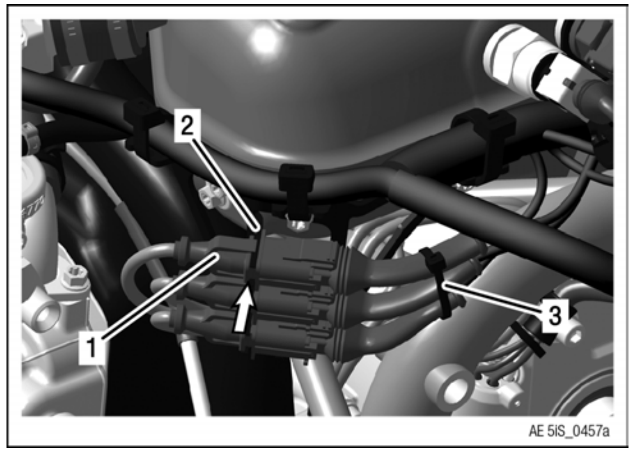


Figure 18.53

1 Connector (KNOCK)   *2 Locking plate*

3 Cable tie

Step	Procedure
5	Attach the cables of the knock sensor with a cable tie .

Finishing work:

Follow the same procedure as removal when doing this work. See Chapter 76-70-00 section Knock sensor removal – preparation

CRANKSHAFT POSITION SENSOR ASSY. (CPS_1/CPS_2) — INSTALLATION

ATTENTION

Ensure that the O-ring rests on the sensor.

NOTE

Oil the O-ring before installation.

Step	Procedure
1	Tighten crankshaft position sensors using hex. screws M6x20 with lock washers and secure with LOCTITE 243. Tightening torque 10 Nm (89 in. lb.)

ATTENTION

Arrange the cable so that it does not rest against the engine suspension frame or other components.

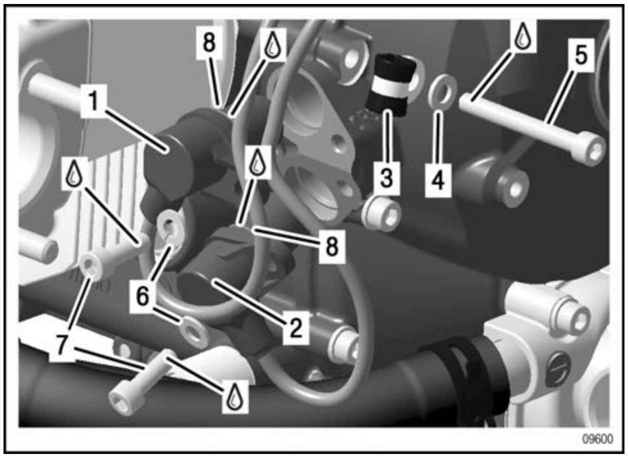


Figure 18.54

1	*Crankshaft position sensor CPS_1*	2	*Crankshaft position sensor CPS_2*
3	*Cable clamp*	4	*Washer*
5	*Hex. screw M6x50*	6	*Lock washer*
7	*Hex. screw M6x20*	8	*O-ring*

Step	Procedure
2	Push the cable clamp onto the cables and tighten with hex. screw M6x50 and washer with LOCTITE 243 to the ignition housing. Tightening torque 10 Nm (89 in. lb.)
3	Plug the respective wiring harness connector into the crankshaft position sensor.
4	Carefully push the connector (CPS) into the locking plate. Secure the connectors with a cable tie.

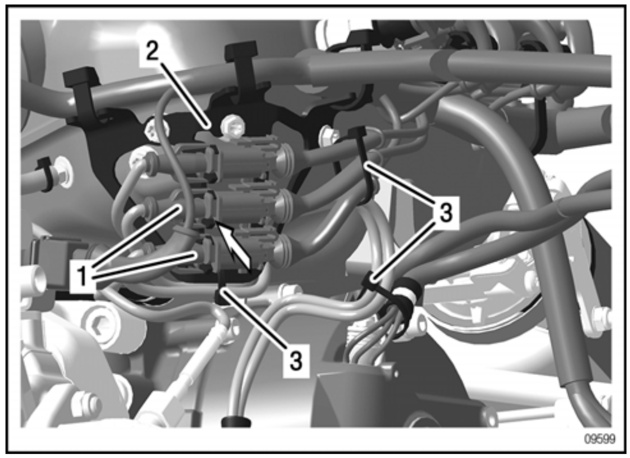


Figure 18.55: TYPICAL

1	*Connector (CPS)*	2	*Locking plate*
3	*Cable tie*		

THROTTLE POTENTIOMETER (TPS) — INSTALLATION

Step	Procedure
1	Install the throttle body assy. To do this, see Chapter 73-10-00 section Fuel pump.
2	Plug the respective wiring harness connector into the throttle potentiometer.

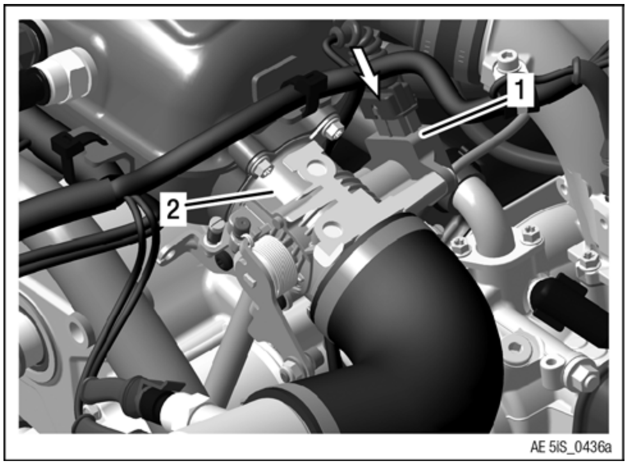


Figure 18.56

1	*Throttle valve potentiometer*	2	*Throttle body assy.*

INJECTION VALVE (INJ) — INSTALLATION

To do this, see Chapter 73-10-00 section Fuel pump and distribution.

GOVERNOR — INSTALLATION

See Chapter 61-20-00 section Governor.

DOUBLE IGNITION COIL — INSTALLATION

To do this, see Chapter 73-10-00 section Fuel pump and distribution.

FUEL PUMP — INSTALLATION

To do this, see Chapter 73-10-00 section Fuel pump and distribution.

FINISHING WORK

- Complete the engine

Fill with operating fluids (coolant, oil or fuel).
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

Carry out an engine test run.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00 section Planned maintenance.

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Chapter: 78–00–00
EXHAUST SYSTEM

TOPICS IN THIS CHAPTER

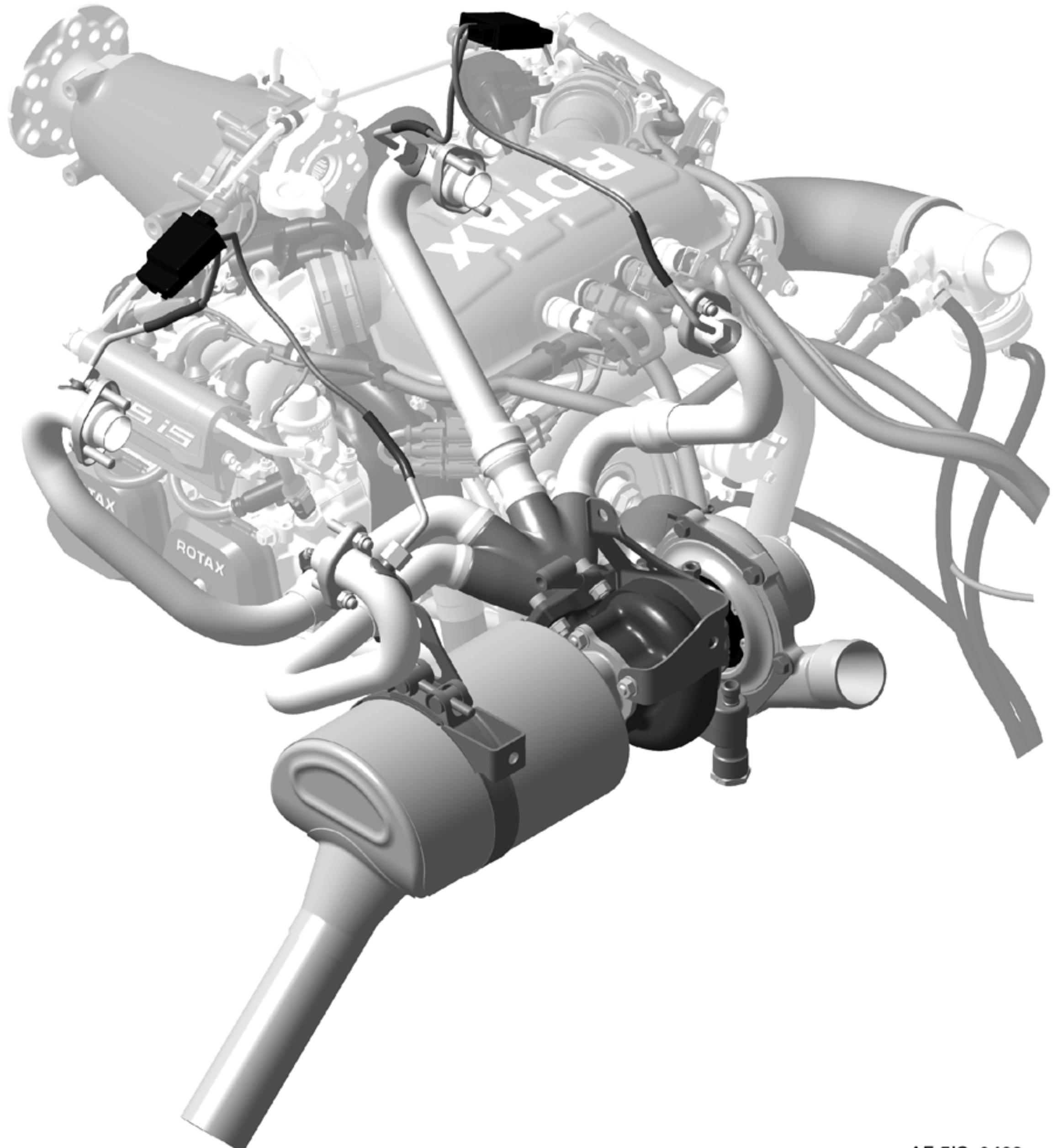


Figure 19.1: Exhaust system

SYSTEM DESCRIPTION

Exhaust flow
The Exhaust gases are pushed out of the cylinders through the exhaust pipes and are brought together in the exhaust manifold. From there the exhaust gases pass the turbine side of the turbocharger (depending on the waste gate position). From there the exhaust gases leave the engine through the muffler.

Exhaust Gas
Temperature Sensors (EGT)
The sensors for reading of the exhaust gas temperature are located the exhaust pipes near the cylinder outlet.

SAFETY INSTRUCTION

⚠ WARNING
Danger of severe burns and scalds! Allow the engine and exhaust system to cool to ambient temperature before starting work.

CONNECTIONS FOR DISPLAY SYSTEMS

EXHAUST GAS TEMPERATURE DISPLAY

For removal, inspection and installation see Chapter 76-70-00.

The engine is equipped with 4 EGT temperature sensors for regulating the optimal fuel/air mixture. These can be installed in various ways depending on the exhaust system. One control box supports two sensors.

ATTENTION
Corrosion damage on sensors! The sensors must be installed vertically from the pipe.

Chapter: 78–10–00
EXHAUST

TOPICS IN THIS CHAPTER

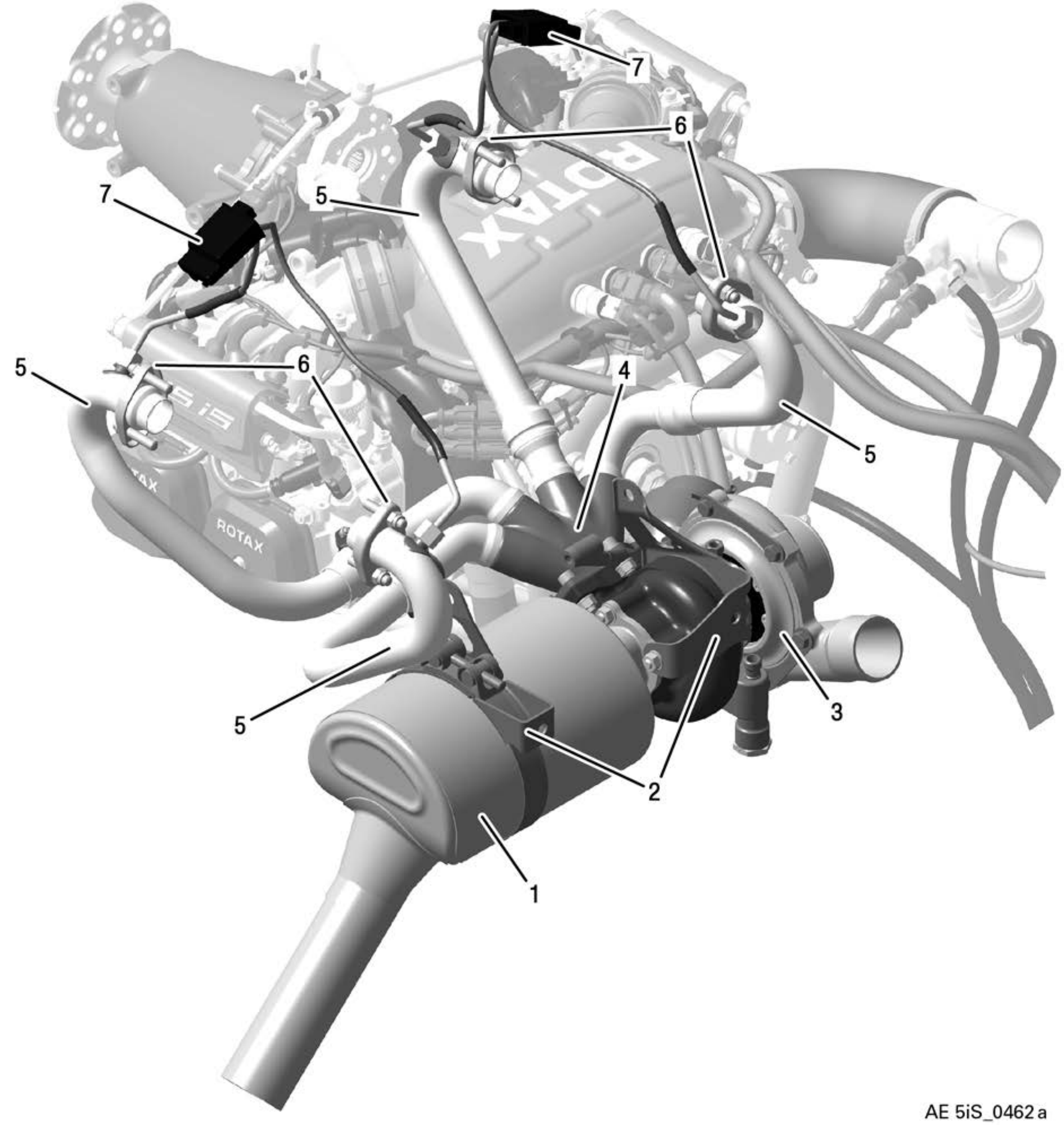


Figure 20.1

1	*Muffler assy.*	2	*Exhaust bracket*
3	*Turbo charger assy.*	4	*Exhaust manifold assy.*
5	*Exhaust pipe*	6	*Exhaust flange*
7	*Temperature sensor (EGT)*		

SERVICE PRODUCTS

Description	Part number
LOCTITE 648	899788
LOCTITE ANTI SEIZE 8151	297434

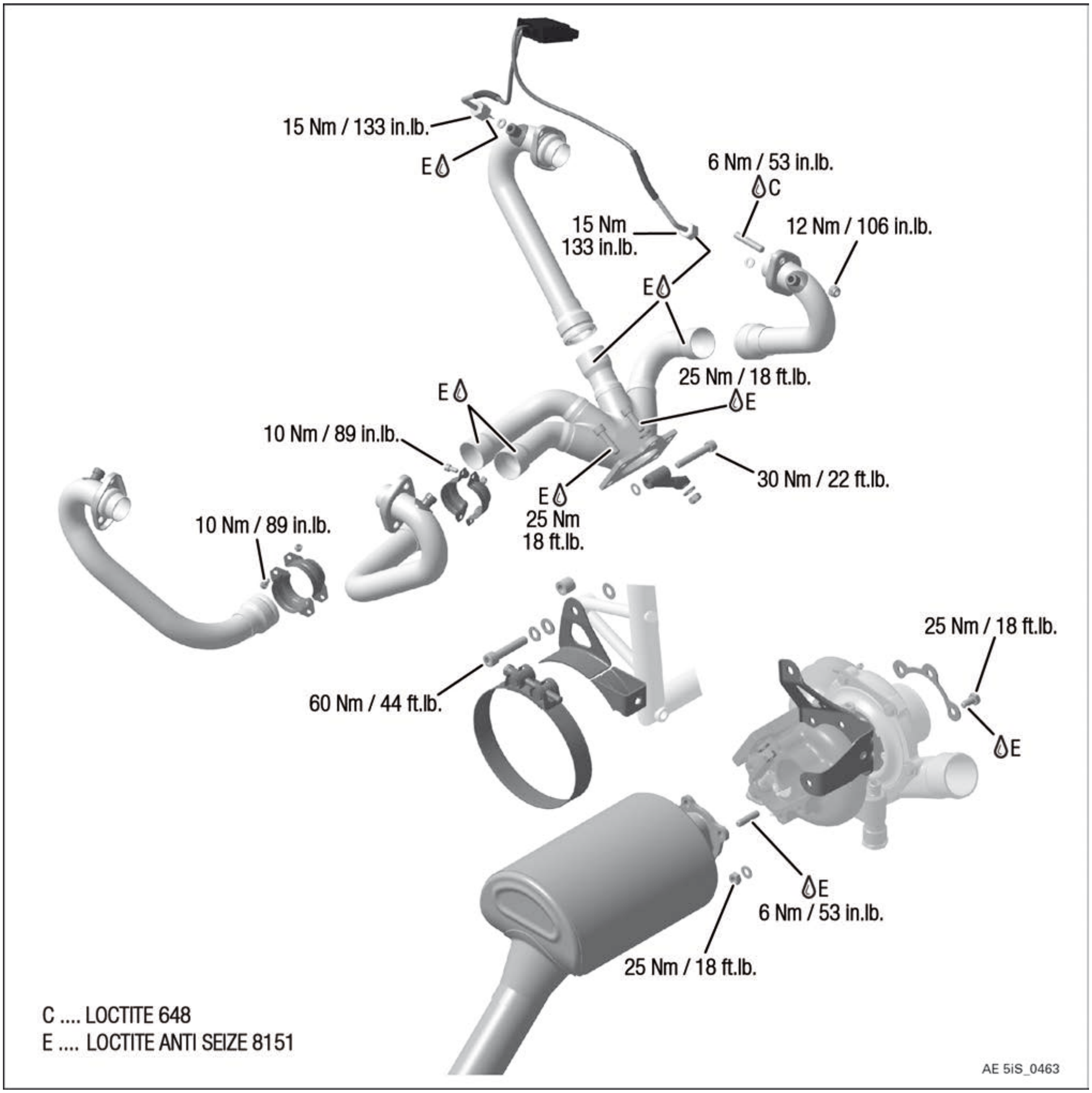


Figure 20.2: Exhaust

SYSTEM DESCRIPTION

The exhaust collects the gases produced in the combustion chamber, leads them via the exhaust manifold to the muffler, which is used to reduce noise. The exhaust gas passes via the outflow pipe through a tail pipe into the open.

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series .

REMOVAL

⚠ WARNING
Danger of severe burns and scalds! Allow the engine and exhaust system to cool to ambient temperature before starting work.

Follow the aircraft manufacturer's instructions for removal.

Preparation
See Chapter 76-70-00 section Exhaust gas temperature sensor (EGT1/EGT2/EGT3/EGT4) — removal.

- Remove the temperature sensor (EGT).

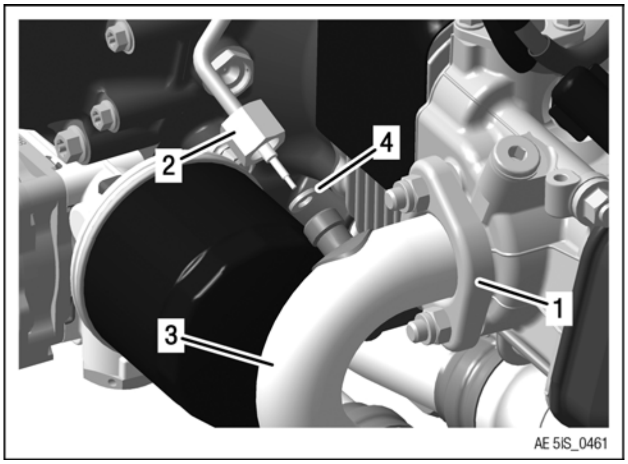


Figure 20.3

1	*Exhaust flange*	2	*Temperature sensor (EGT)*
3	*Exhaust pipe*	4	*Sealing ring*

EXHAUST PIPE — REMOVAL

Step	Procedure
1	Loosen 2 M8 lock nuts

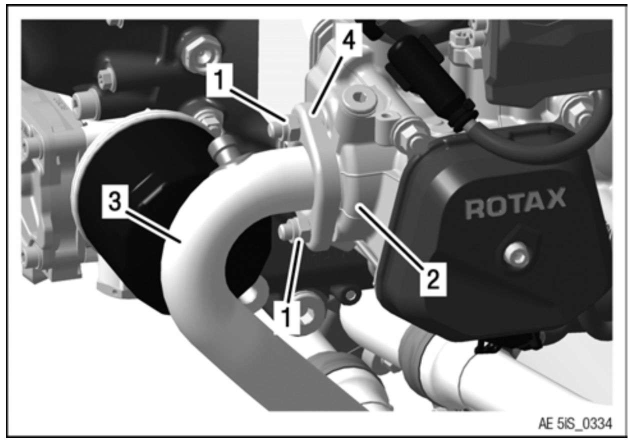


Figure 20.4

1	*Lock nut M8*	2	*Cylinder head*
3	*Exhaust pipe*	4	*Exhaust flange*

Only for cylinder 2 and cylinder 4
Exhaust pipe –removal

Step	Procedure
2	Loosen four Hex. nut M5.
3	Remove the exhaust pipe clamp.

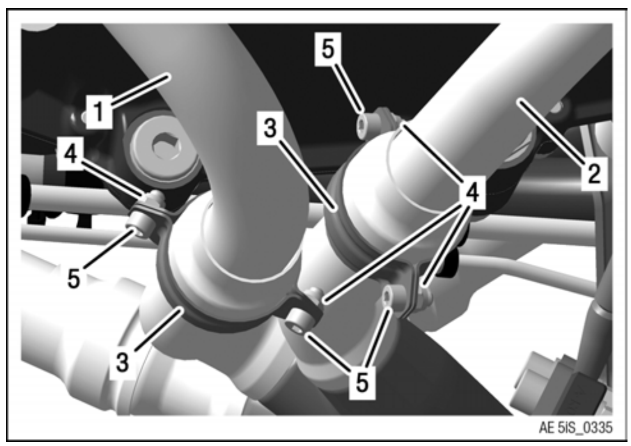


Figure 20.5

1	*Exhaust pipe cyl. 2*	2	*Exhaust pipe cyl. 4*
3	*Exhaust pipe clamp*	4	*Hex. nut M5*
5	*Allen screw M5x10*		

EXHAUST MANIFOLD ASSY. – REMOVAL

Step	Procedure
1	Remove hex. nuts M8 with washers.
2	Remove Allen screws M8x20 and M8x30.

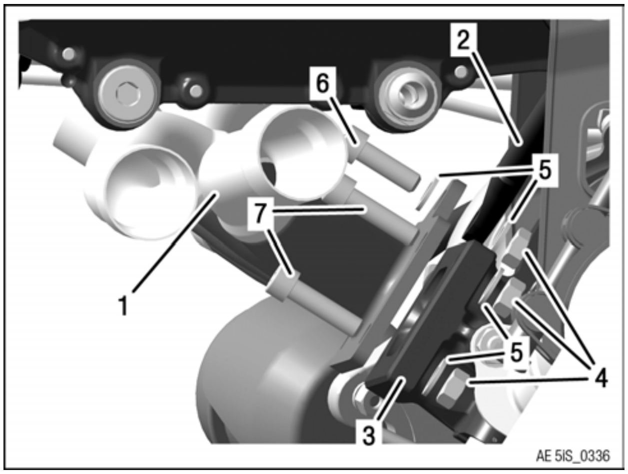


Figure 20.6

1	*Exhaust manifold assy.*	2	*Turbo charger bracket*
3	*Turbo charger*	4	*Hex. nut M8*
5	*Washer 8.4*	6	*Allen screw M8x20*
7	*Allen screw M8x30*		

MUFFLER ASSY. — REMOVAL

Preparation

- Remove turbocharger before muffler assy. removal, see Chapter 78-20-00 Turbocharger – removal.

Step	Procedure
1	Remove 3 hex. screws on the exhaust bracket.

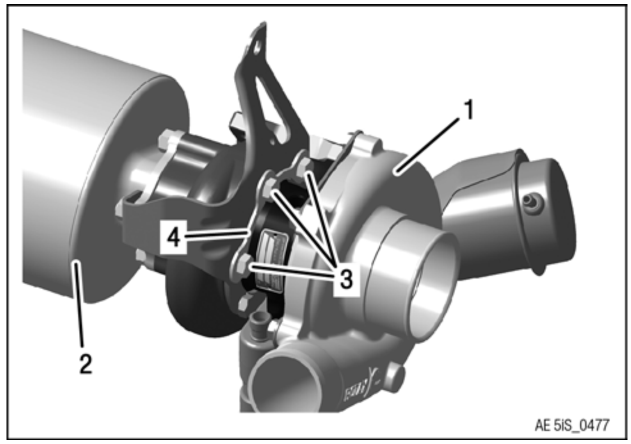


Figure 20.7

1	*Turbocharger*	2	*Muffler assy.*
3	*Hex. screws*	4	*Exhaust bracket*

NOTE

Studs M8 x 19.5/13 are for attaching the muffler assy.. Check for tight fit and any damage.
When replacing a stud, it is fitted so that the longer thread (19.5 mm (.76 in.) is screwed into the turbo. Apply LOCTITE ANTI SEIZE to studs.

Step	Procedure
2	Remove hex. nuts with washers of the muffler assy.
3	Remove turbocharger with turbocharger bracket from the muffler assy.

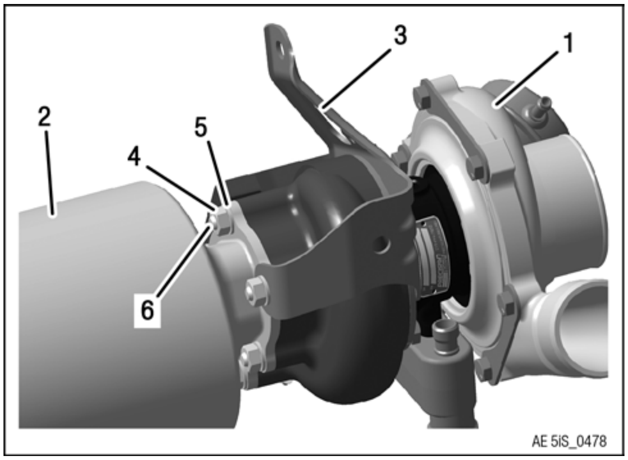


Figure 20.8

1	*Turbocharger*	2	*Muffler assy.*
3	*Turbocharger bracket*	4	*Hex. nut*
5	*Washer*	6	*Stud M8x19.5/13*

INSPECTION

EXHAUST ASSY. — INSPECTION

Follow the aircraft manufacturer's instructions for inspection.

Step	Procedure
1	Check the exhaust for cracks, dents and leaks.

EXHAUST PIPE AND CYLINDER HEAD — INSPECTION

ATTENTION

A deformed exhaust flange must be replaced!

Step	Procedure
1	Check the conical sealing surfaces in the cylinder head and on the exhaust pipe for deformation.

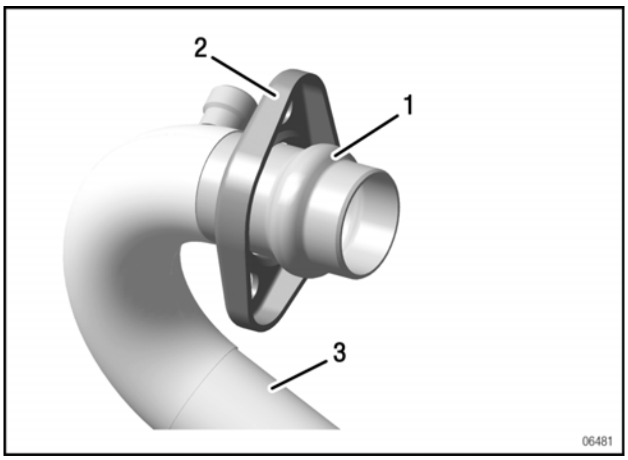


Figure 20.9

1 *Conical seal*
2 *Exhaust flange*
3 *Exhaust pipe*

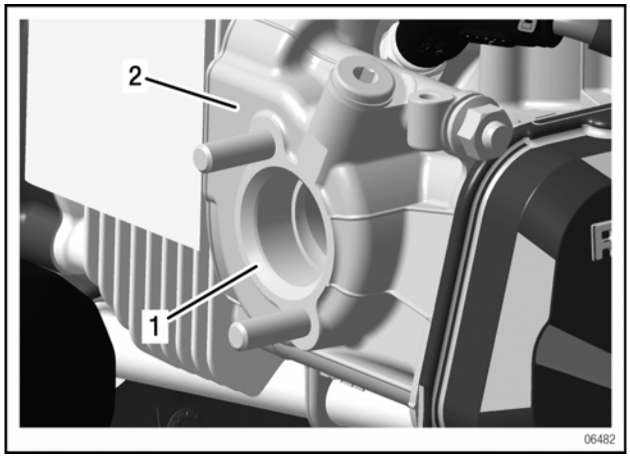


Figure 20.10

1 *Conical seal*
2 *Cylinder head*

EXHAUST MANIFOLD ASSY. – INSPECTION

Step	Procedure
1	Check the exhaust manifold assy. for deformation.

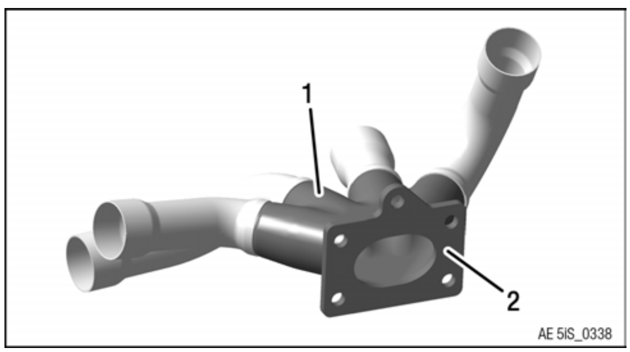


Figure 20.11

1 *Exhaust manifold assy.*
2 *Flange for turbo charger*

MUFFLER ASSY. — INSPECTION

Step	Procedure
1	Check the muffler assy. for damage and wear.

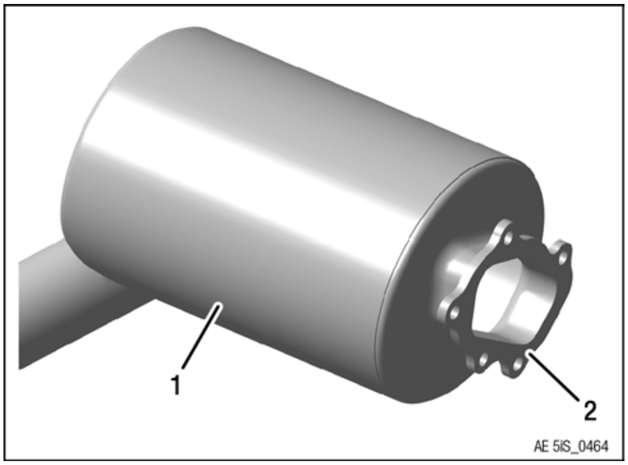


Figure 20.12

1 Muffler assy. *2 Exhaust muffler flange*

INSTALLATION

MUFFLER ASSY. — INSTALLATION

Step	Procedure
1	Apply LOCTITE ANTI SEIZE. to the turbine housing stud M8
2	Mount muffler assy. on studs of turbine housing. **NOTE** *Do not forget to install the turbocharger bracket correctly.*

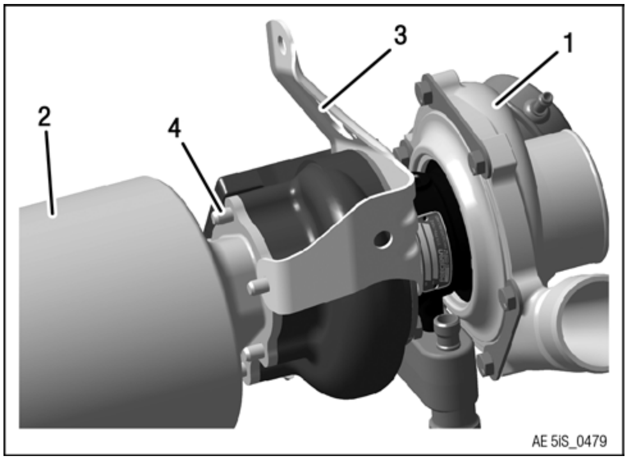


Figure 20.13

1	*Turbocharger*	2	*Muffler assy.*
3	*Turbocharger bracket*	4	*Stud M8x19.5/13*

Step	Procedure
3	Apply LOCTITE ANTI SEIZE to screws. Tighten the turbocharger with turbocharger bracket using a reinforcement plate and hex. screws. Tightening torque 25 Nm (19 ft. lb.).

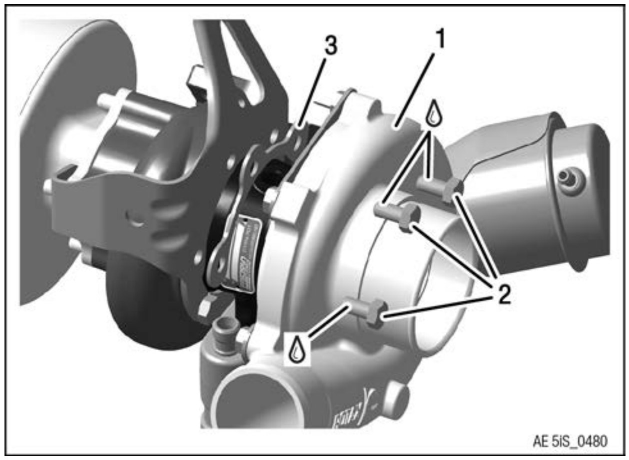


Figure 20.14

1	*Turbocharger*	2	*Hex. screws*
3	*Reinforcement plate*		

Step	Procedure
4	Tighten muffler assy. with washers and nuts M8 on turbine housing. Tightening torque 25 Nm (19 ft. lb.).

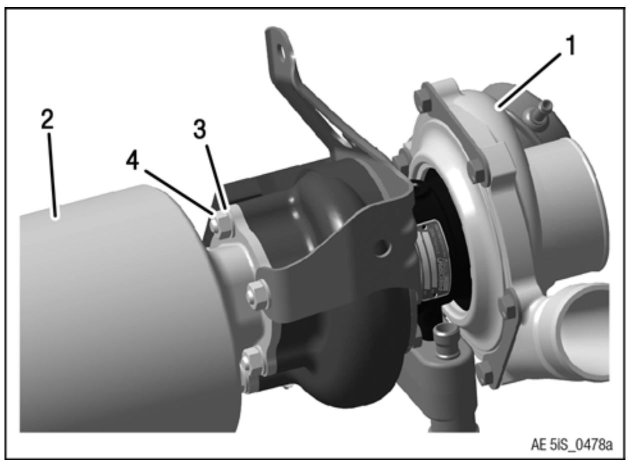


Figure 20.15

1	*Turbocharger*	2	*Muffler assy.*
3	*Washer*	4	*Hex. nut*

EXHAUST MANIFOLD — INSTALLATION

The turbocharger must be installed before exhaust manifold - installation.

Step	Procedure
1	Install exhaust manifold using Allen screws M8x20 and M8x30 with hex. nuts M8 and washers. Apply LOCTITE ANTI SEIZE. to the Allen screws. Tightening torque 25 Nm (18 ft. lb.)

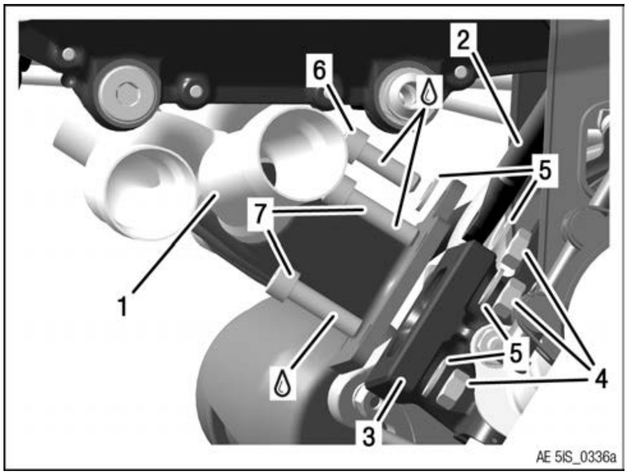


Figure 20.16

1	*Exhaust manifold assy.*	2	*Turbocharger bracket*
3	*Turbocharger*	4	*Hex. nut M8*
5	*Washer 8.4*	6	*Allen screw M8x20*
7	*Allen screw M8x30*		

ATTENTION

The attachment screws for exhaust manifold and turbocharger bracket are not tightened until installation on the engine is complete to prevent locking up of stresses.

EXHAUST PIPE ON CYLINDER HEAD — INSTALLATION

Step	Procedure
1	Check that the studs are firmly in place. Secure them with LOCTITE 648 if necessary and tighten them. Tightening torque 6 Nm (53 in. lb.)
2	Fasten the exhaust flange to the cylinder head with 2 new lock nuts M8. Tightening torque 12 Nm (106 in. lb.).

NOTE

The exhaust flange must be parallel to the screw face on the cylinder head but must not touch against it.

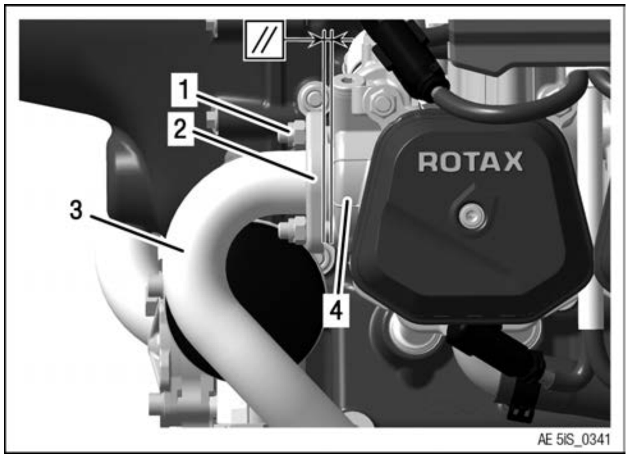


Figure 20.17

1	*Lock nut M8*	2	*Exhaust flange*
3	*Exhaust pipe*	4	*Cylinder head*

Step	Procedure
3	Mount exhaust pipe clamps.
4	Fasten the exhaust pipe clamps using M5 Allen screws and **new** M5 lock nuts. Tightening torque 10 Nm (89 in. lb.).

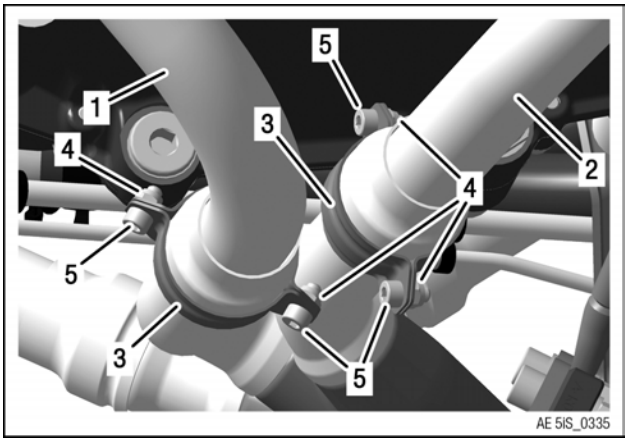


Figure 20.18

1	*Exhaust pipe cyl. 2*	2	*Exhaust pipe cyl. 4*
3	*Exhaust pipe clamp*	4	*Lock nut M5*
5	*Allen screw M5x10*		

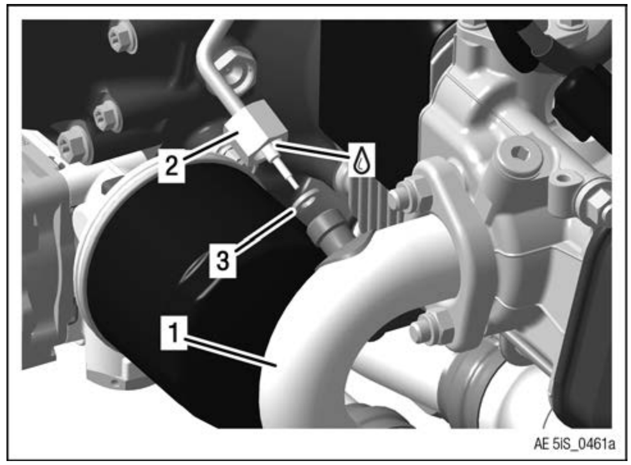


Figure 20.19

1	*Exhaust pipe*	2	*Temperature sensor (EGT)*
3	*Sealing ring*		

FINISHING WORK

ATTENTION

Follow the aircraft manufacturer's instructions for installation.

See Chapter 76-70-00 section Exhaust gas temperature sensor (EGT1/EGT2/EGT3/EGT4) — installation.

Step	Procedure
1	Install the temperature sensor (EGT) into the exhaust pipe, lubricate with LOCTITE ANTI SEIZE. **NOTE** *Do not forget the sealing ring.*
2	Tighten the temperature sensor to 15 Nm (133 in. lb.).

Chapter: 78–20–00
TURBOCHARGER

TOPICS IN THIS CHAPTER

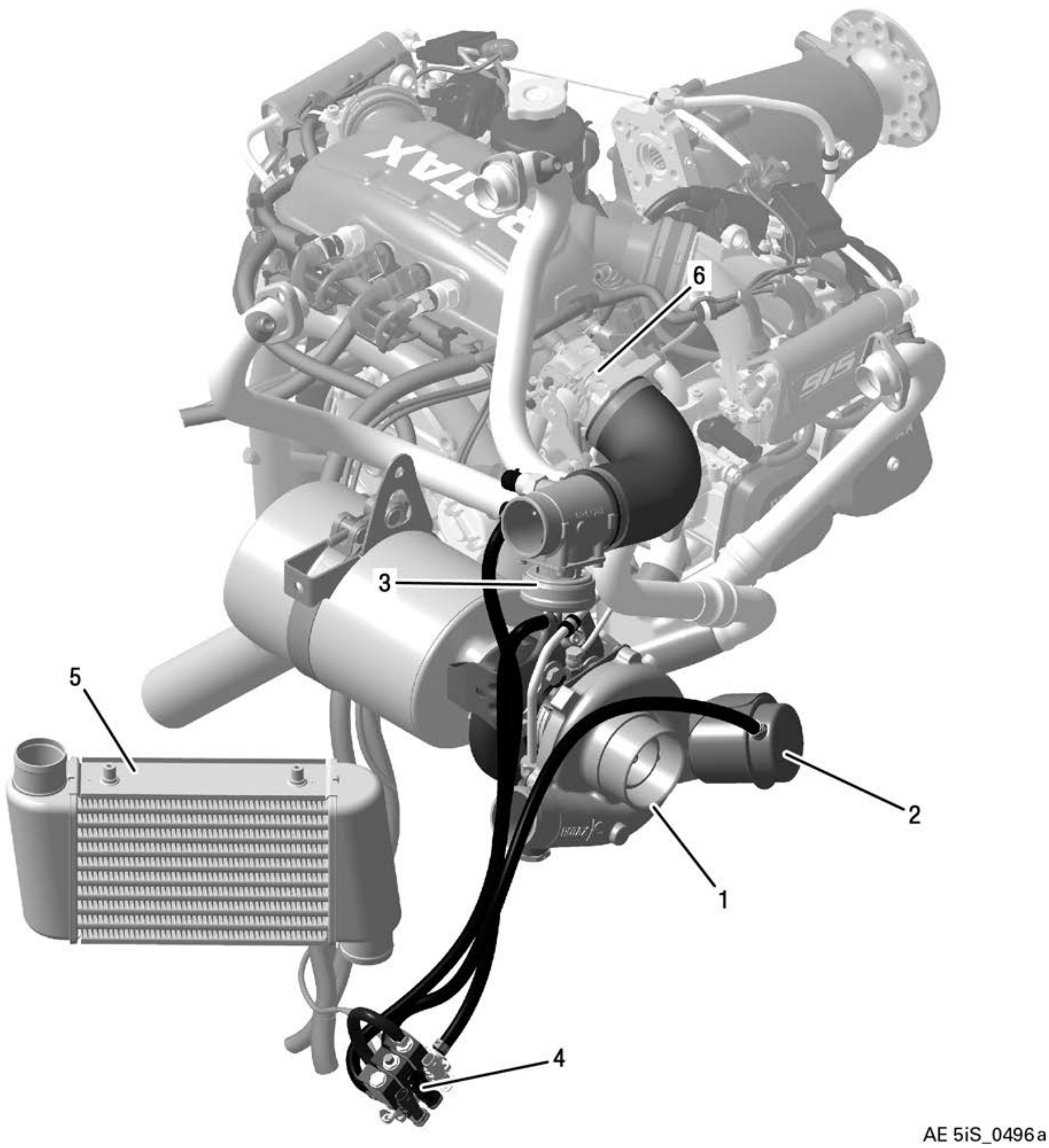


Figure 21.1: Turbo

1	*Turbocharger*	2	*Wastegate regulator*
3	*Overboost valve*	4	*Solenoid valve*
5	*Radiator*	6	*Throttle potentiometer*

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE 8151	297434
LOCTITE 243	897651

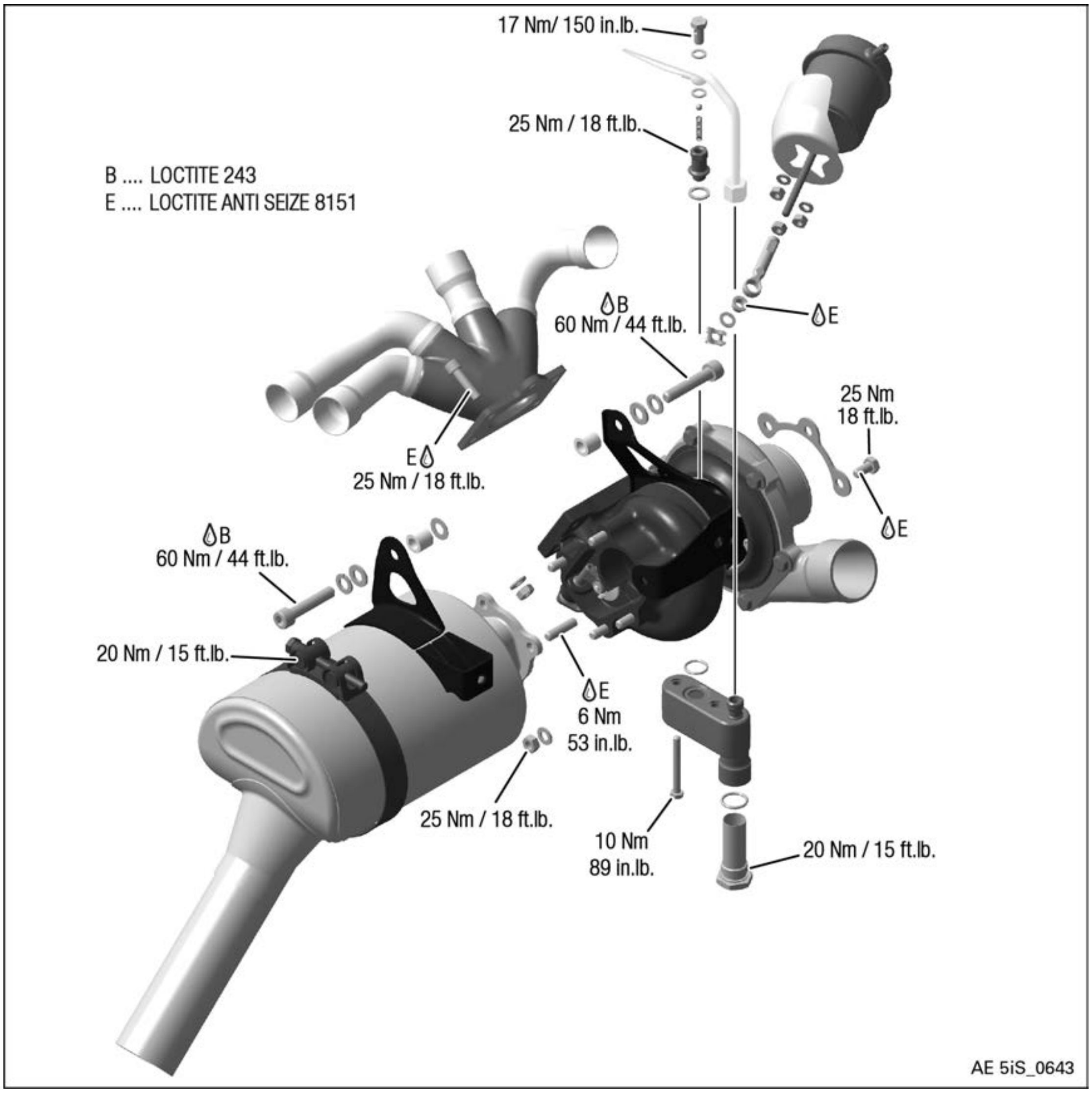


Figure 21.2: Exhaust

SYSTEM DESCRIPTION

ROTAX® engines of the 915 i A Series are equipped with an exhaust turbocharger which makes use of the energy in the exhaust gas for pre-compression of the intake air. The exhaust collects all gases which accumulate in the combustion chamber of the cylinders and routes them via exhaust bends and exhaust manifold to the exhaust turbocharger. There, the combustion gases drive the exhaust gas turbine to achieve a power increase. From the exhaust turbocharger, the combustion gases are routed to the muffler, which is fitted for noise reduction.
The airbox pressure is controlled by a flap (wastegate) at the exhaust gas turbine, which is driven by a pressurized regulator. The operation of the flap works via a linkage of the pressurized regulator.

Exhaust turbocharger

The exhaust turbocharger is basically an arrangement of two fans, a turbine and a blower, on a common shaft. The turbine transforms the energy of the hot exhaust gases and drives a blower which aspirates ambient air and transfers it pre-compressed via the carburetors into the cylinders.
The sole operational connection between engine and turbo is the air and exhaust stream. The speed of the turbo depends mainly on the pressure ratio at the turbine impeller but not directly on engine speed.

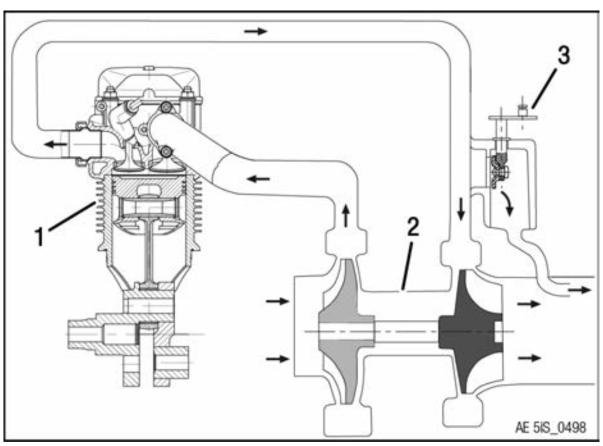


Figure 21.3: Schematic of a boost pressure

1	*Engine*	2	*Exhaust turbocharger*
3	*Boost pressure regulating valve – wastegate*		

NOTE

The figure shows a schematic arrangement of a boost pressure control with the wastegate in the exhaust stream

Because of the large speed range of the engine and the varying power requirement, control of the exhaust turbocharger is necessary to achieve the respective nominal pressure in the airbox.
The wastegate directs part of the engine exhaust gases so that they bypass the turbine and flow directly into the exhaust (by-pass).

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series915 i B Series.

CONNECTIONS FOR DISPLAY SYSTEMS

ATTENTION
Follow the instructions in the installation manual regarding connections for instrumentation.

REMOVAL

TURBOCHARGER ASSY.— REMOVAL

⚠ WARNING
Danger of severe burns and scalds! Allow the engine and exhaust system to cool to ambient temperature before starting work.

ATTENTION
Follow the aircraft manufacturer's instructions for removal.

- Drain the oil
- Remove the air filter
- Remove connection turbocharger/intercooler
- Remove coolant hoses

Step	Procedure
1	Disconnect the turbo pressure oil line and the suction oil line.
2	Remove the cable clamp (Allen screw M5x20 and lock nut) for supporting the suction line on the turbocharger bracket.
3	Remove hose from wastegate regulator.

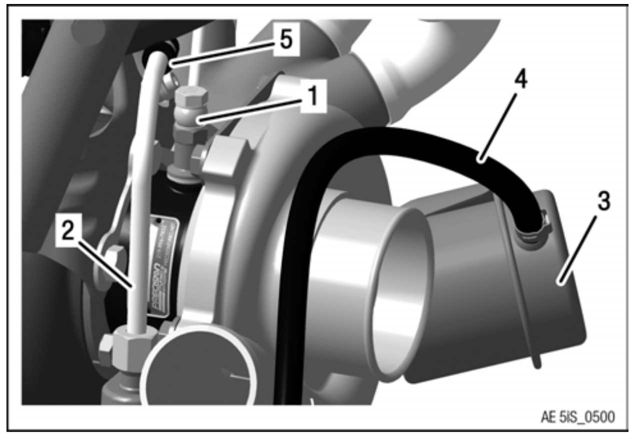


Figure 21.4

1	*Turbo pressure line*	*2*	*Suction oil line*
3	*Wastegate regulator*	*4*	*Hose (wastegate regulator)*
5	*Cable clamp*		

Step	Procedure
4	Remove M8 hex. nuts and washers from turbocharger flange.
5	Remove M8x30 screws to disconnect turbocharger from exhaust manifold assy.

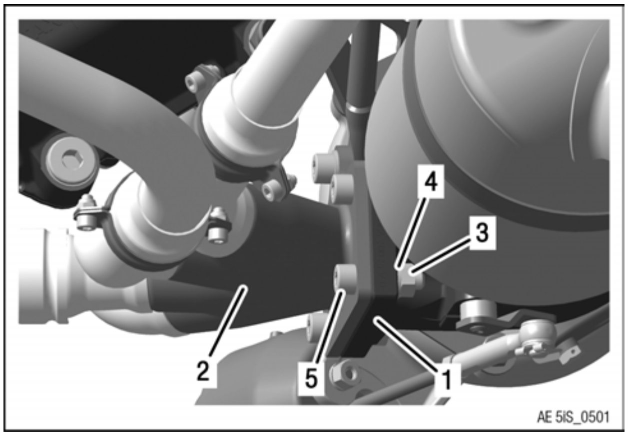


Figure 21.5

1	*Turbocharger flange*	2	*Exhaust manifold assy.*
3	*M8 hex. nut*	4	*Washer*
5	*M8x30 screw*		

Step	Procedure
6	Slacken tension clamp but do not detach or remove it from the muffler bracket.

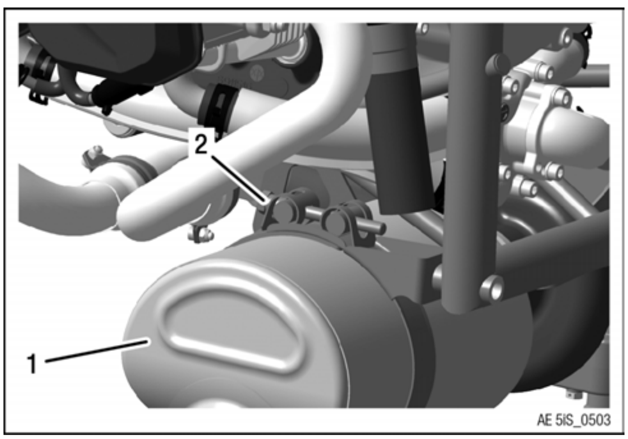
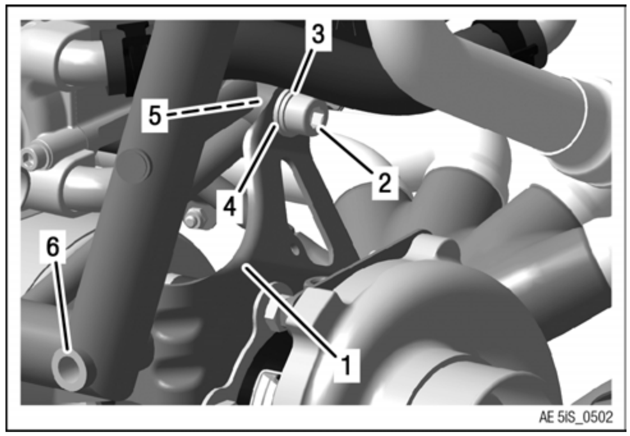


Figure 21.6

1	*Muffler*	2	*Tension clamp*

Step	Procedure
7	Remove the Allen screw M10x50 (attachment of the turbocharger bracket) together with the lock washer and washer. **NOTE** *This screw is sealed with LOCTITE 243.*
8	Loosen the connection turbocharger bracket - engine suspension frame (not supplied with the engine).



1	*Turbocharger bracket*	2	*Allen screw M10x50*
3	*Lock washer*	4	*Washer*
5	*Distance sleeve*	6	*Connection turbocharger bracket with engine suspension frame*

Figure 21.7: TYPICAL

Step	Procedure
9	Support the complete unit of exhaust - turbocharger - manifold, remove the tension clamp and take off the complete unit.
10	Remove muffler assy. and turbocharger bracket, see Chapter 78-10-00 section Muffler assy. - removal.

OIL SUMP ASSY. — REMOVAL

Step	Procedure
1	Loosen the Plug screw assy. M22x1.5 with the O-ring 18x2.5.
2	Drain the residual oil from the oil sump assy.

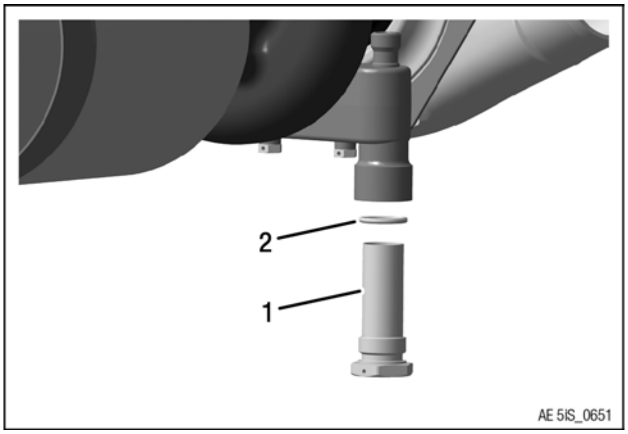


Figure 21.8: Plug screw assy.

1	*Plug screw assy. M22x1.5*	*2*	*O-ring 18x2.5*

Check the oil sump assy and the plug screw assy., see Maintenance Manual Line for the engine type 915 i A Series.

Step	Procedure
3	Loosen the 2 Allen screw M6x50 of the oil sump assy. and remove the oil sump assy. with the 15.9 –2.3 O-ring.

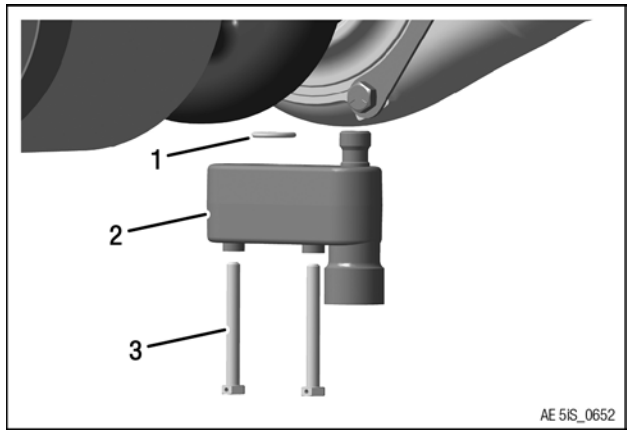


Figure 21.9: Oil sump assy.

1	*O-ring 15.9 –2.3*	*2*	*Oil sump assy.*
3	*Allen screw M6x50*		

WASTEGATE REGULATOR ASSY. — REMOVAL

Preparation
Before removal, check the wastegate regulator assy. as described in the latest Maintenance Manual Line.

⚠ WARNING
Danger of severe burns and scalds! Allow the engine and exhaust system to cool to ambient temperature before starting work.

Step	Procedure
1	Loosen hose clamp and remove low pressure hose from the wastegate regulator.

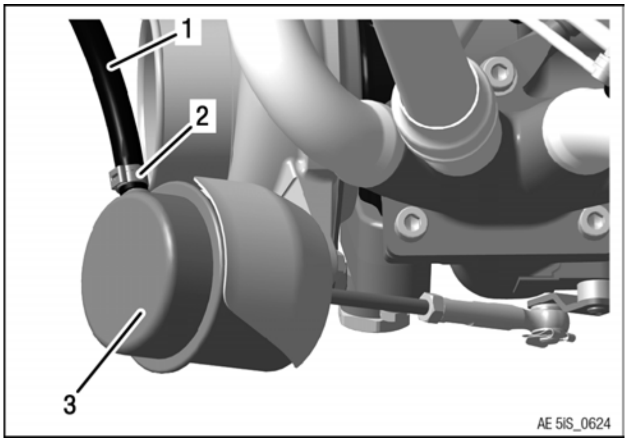


Figure 21.10

1	*Low pressure hose*	2	*Hose clamp*
3	*Wastegate regulator*		

Step	Procedure
2	Loosen locking nut from the rod end.
3	Remove the locking clip, washer and rod end from the wastegate lever.
4	Remove bushing from the wastegate lever.

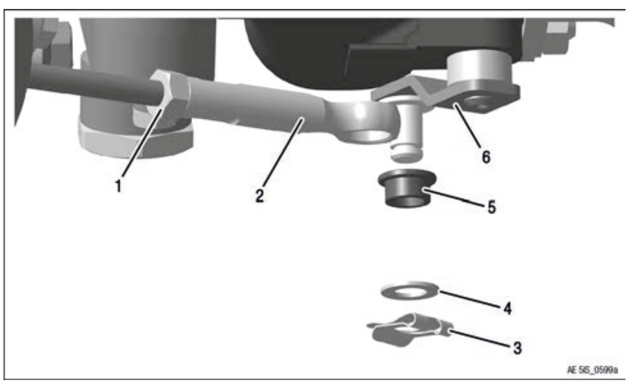


Figure 21.11

1	*Locking nut*	2	*Rod end*
3	*Locking clip*	4	*Washer*
5	*Bushing*	6	*Wastegate lever*

Step	Procedure
5	Remove two collar nuts with washers from wastegate regulator protection plate of the turbocharger housing.
6	Remove wastegate regulator assy. and protection plate.

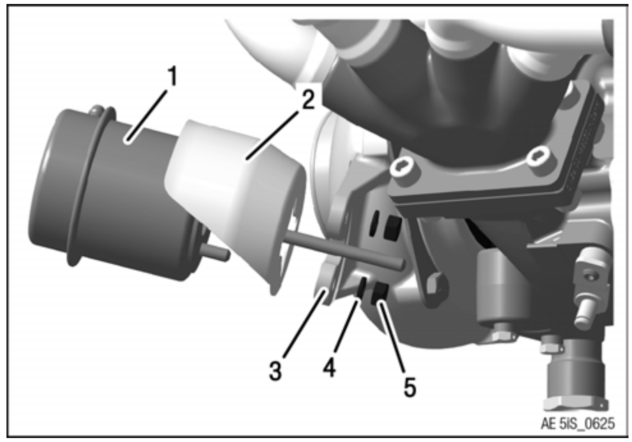


Figure 21.12

1	*Wastegate regulator assy.*	2	*Protection plate*
3	*Turbocharger housing*	4	*Washer*
5	*Collar nut*		

INSPECTION

TURBOCHARGER— CHECK

ATTENTION
Follow the aircraft manufacturer's instructions for inspection.

Preparation

- Clean all parts carefully.

General visual inspection.
See see Maintenance Manual Line for the engine type 915 i A Series Chapter 12-20-00.

NOTE

The turbocharger is handled as a complete unit, i.e. no spare parts are available from BRP-ROTAX®. In the event of damage, the complete unit has to be replaced.

PLANE SURFACES OF THE TURBINE OPENING — CHECK

Step	Procedure
1	Use a straight edge to test for distortion. A distortion of max. 0.1 mm (0.004 inch) is permissible. If the maximal allowed distortion is exceeded then it is possible to rework the surface up to 0.5 mm (0.02 inch). The amount of the rework has to be recorded in the appendix.

Figure 21.13

THREADED HOLE — CHECK

ATTENTION
It is not allowed to repair any of the threads inside of the turbine housing with thread inserts.

Step	Procedure
1	Check the threaded hole for damage and wear.

ROTOR TURBINE — CHECK

Step	Procedure
1	Apply slightly a radial pressure onto the shaft to minimize the gap between the compressor casing and the compressor wheel. The gap must never be less than 0.1 mm (0.004 inch). Check the complete circumference of 360°.

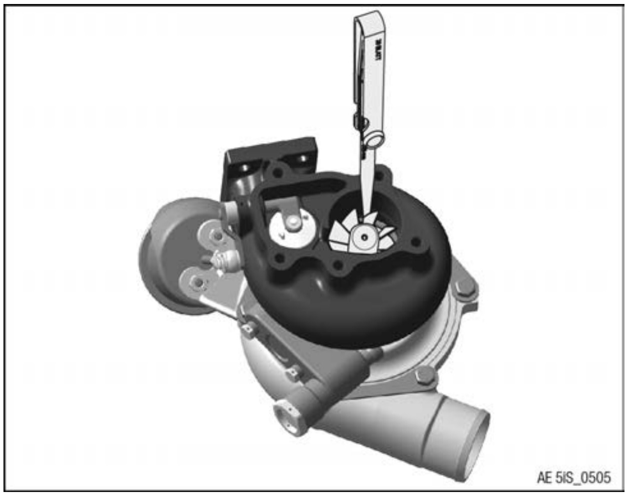


Figure 21.14

COMPRESSOR WHEEL — CHECK

Step	Procedure
1	Apply slightly a radial pressure onto the shaft whereby it must not contact the compressor housing. Check the complete circumference of 360°.

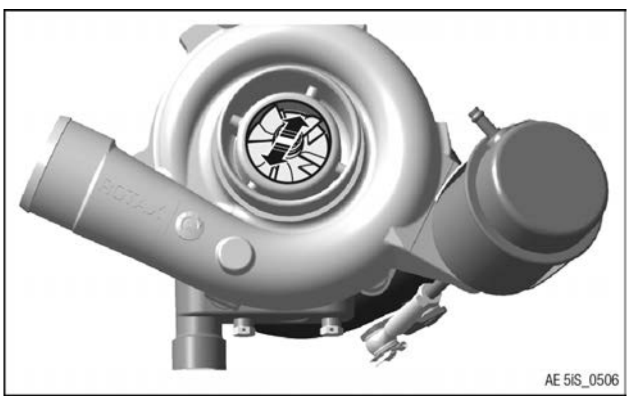


Figure 21.15

CHECKING OF THE WASTEGATE LEVER

Step	Procedure
1	Check the wastegate lever for free movement. If it does not move freely, lubricate the axle of the waste gate with LOCTITE ANTI SEIZE 8151.

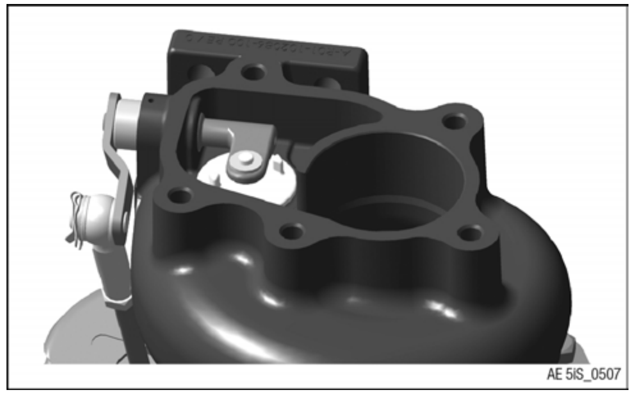


Figure 21.16

CHARGER SHAFT — CHECK

Step	Procedure
1	Record the readings in the appendix.

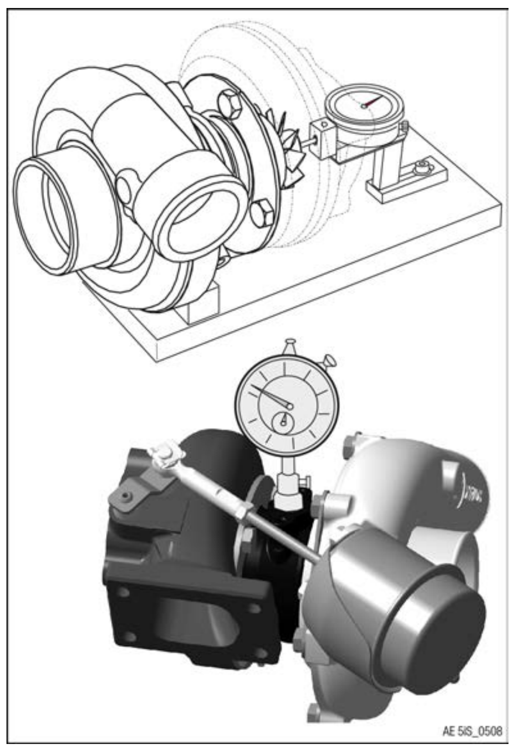


Figure 21.17

IMPELLER SHAFT — CHECK

The bearings are tested by means of the pressure drop measuring method.

ATTENTION
For this test, compressed air at approx. 2 bar (29 psi) and a testing device are needed.

Testing device consisting of:

- 2 pressure gauges
- 1 orifice jet (inner diameter = 1 mm (.039 in.) / length = 3 mm (.12 in.)
- 1 connecting nipple M12x1.5 for the thread in the middle section of the turbocharger
- 1 cover plate for the oil outlet
- connecting hoses (as required)

Step	Procedure
1	Screw in the connecting nipple and close the oil outlet with the cover plate.
2	Connect the pressure gauges together with the regulating valves.
3	Apply a constant pressure of 2 bar (29 psi) to the connection cable. The pressure drop must not exceed 50%. (From 2 bar (29 psi) to max. 1 bar (14.5 psi))

NOTE

For optimum results, the position of the shaft should always be changed slightly during the check, i.e. the shaft should be moved backwards and forwards in axial and radial directions.

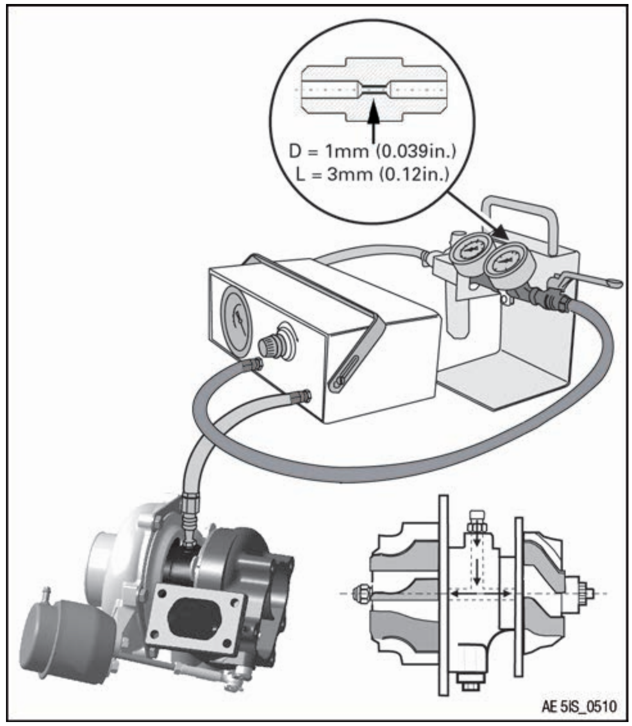


Figure 21.18

WASTEGATE REGULATOR ASSY. — INSPECTION

- General visual inspection. See for other tests (leakage test) section 05-00-00 and 12-20-00 in the corresponding Maintenance Manual Line for the 915 i A Series engine type.

WEAR LIMITS

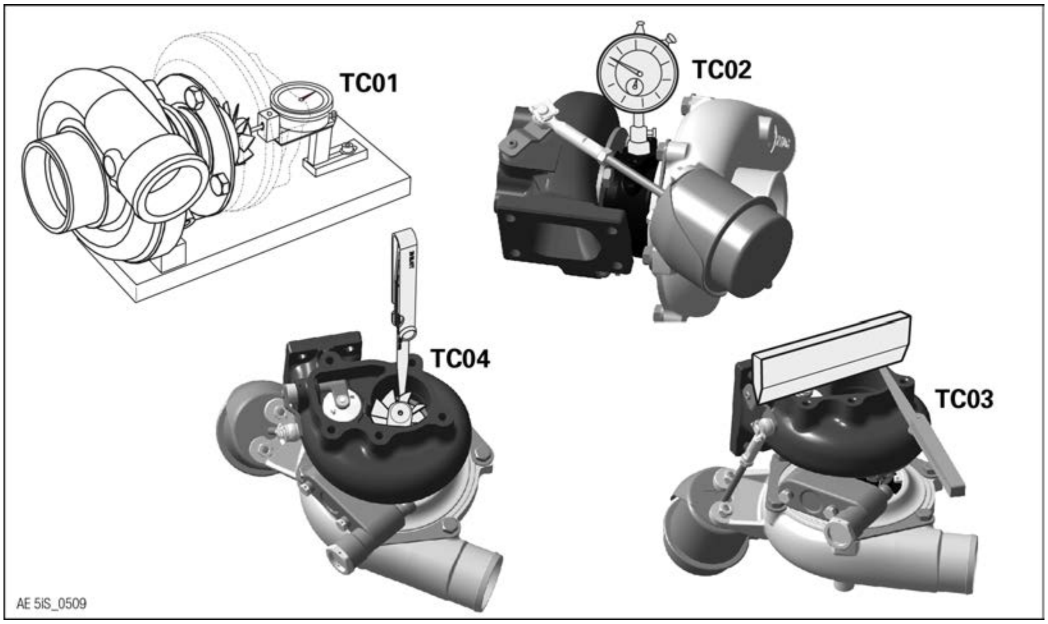


Figure 21.19

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Bearing bushing in gear cover							
Axial clearance	TC01			0.025 mm (0.0010 in.) to 0.084 mm (0.0033 in.)	0.040 mm (0.0016 in.) to 0.070 mm (0.0028 in.)	cur-rent re-plac-ed	
Radial clearance	TC02			0.056 mm (0.0022 in.) to 0.127 mm (0.0050 in.)	0.074 mm (0.0029 in.) to 0.109 mm (0.0043 in.)	cur-rent re-plac-ed	
Rework tur-bine hous-ing flange	TC03			0.5 mm (0.02 in.)			
Rotor turbine	TC04			0.1 mm (0.004 in.)			

INSTALLATION

ATTENTION

Follow the aircraft manufacturer's instructions for installation.

Preparation
See Chapter 78-10-00 Exhaust for previous work (muffler and turbocharger bracket installation).

OIL SUMP ASSY. — INSTALLATION

Step	Procedure
1	Place O–ring 15.9 –2.3 into the oil sump assy..
2	Install the oil sump assy. on turbocharger with 2 Allen screw M6x50. Tightening torque 10 Nm (89 in. lb).

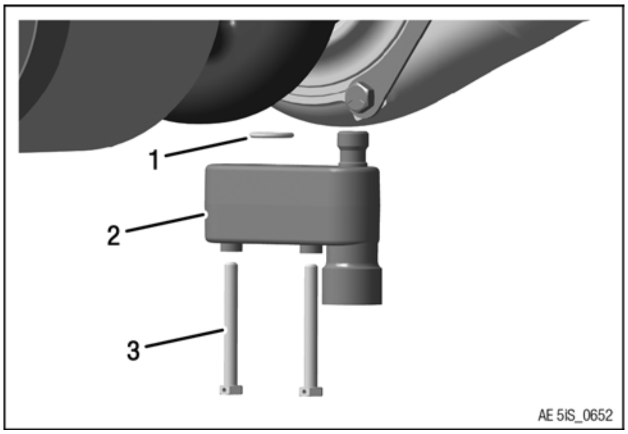


Figure 21.20: Oil sump assy.

1 O-ring 15.9 –2.3 *2 Oil sump assy.*

3 Allen screw M6x50

Step	Procedure
3	Install plug screw assy. M22x1,5 with O-ring 18x2.5 into the oil sump assy.. Tightening torque 20 Nm (15 ft.lb).

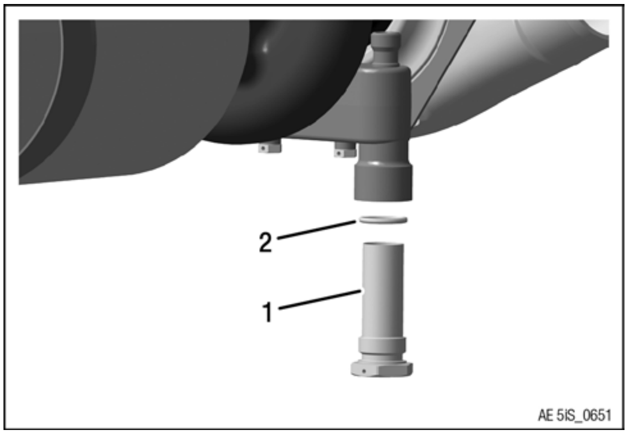


Figure 21.21: Plug screw assy.

1 Plug screw assy. M22x1.5 *2 O-ring 18x2.5*

See Maintenance Manual Line for the engine type 915 i A Series.

EXHAUST BRACKET — INSTALLATION

Step	Procedure
1	Place distance spacer 10.5/17/15 into engine suspension frame.
2	Install the exhaust bracket on engine housing with washer, lock washer and Allen screw M10x50, secure with LOCTITE 243. Tightening torque 60 Nm (44 ft. lb).

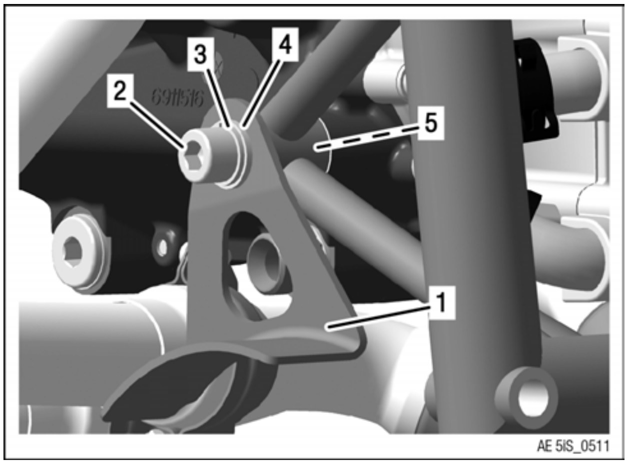


Figure 21.22

1	*Exhaust bracket*	2	*Allen screw M10x50*
3	*Lock washer*	4	*Washer*
5	*Spacer*		

TURBOCHARGER ASSY.— INSTALLATION

Step	Procedure
1	Place distance spacer 10.5/17/15 into the engine suspension frame.
2	Screw turbocharger assembly to the engine housing, complete with muffler and turbocharger bracket with washer, lock washer and Allen screw M10x50. Tightening torque 60 Nm (44 ft. lb).

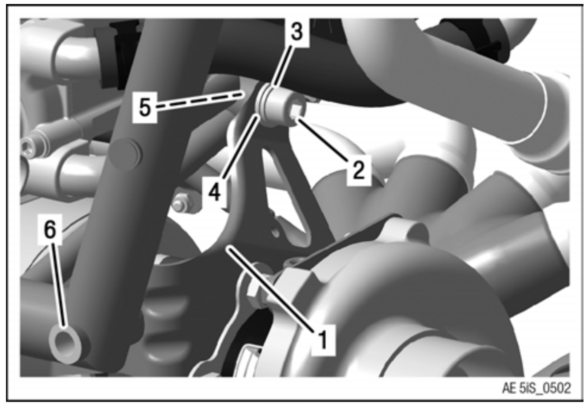


Figure 21.23: TYPICAL

1	*Turbocharger bracket*	2	*Allen screw M10x50*
3	*Lock washer*	4	*Washer*
5	*Spacer*	6	*Connection turbocharger bracket with engine suspension frame*

Step	Procedure
3	The muffler is attached to the exhaust bracket with the tension clamp tightened to a torque of 20 Nm (15 ft. lb).

ATTENTION

Position tension clamp so that the tension free zone comes to rest on the edge of the exhaust bracket.

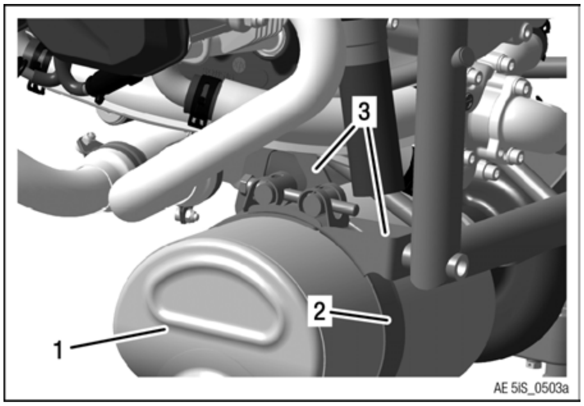


Figure 21.24

1	*Muffler assy.*	2	*Tension clamp*
3	*Exhaust bracket*		

Step	Procedure
4	Install exhaust manifold using Allen screws M8x30 with hex. nuts M8 and washers. Apply LOCTITE ANTI SEIZE to the screws. Tightening torque 25 Nm (18 ft. lb).

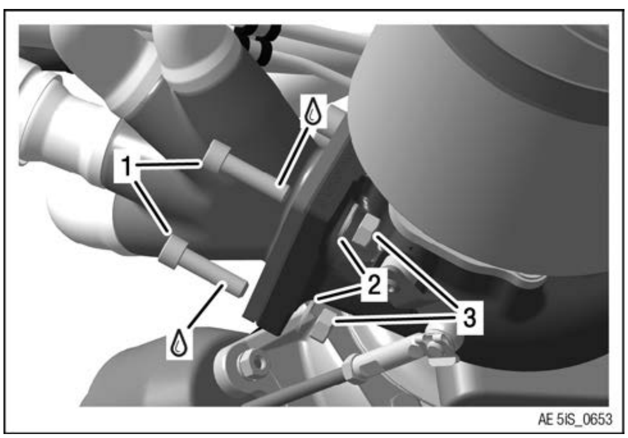


Figure 21.25

1	*Screws stainless steel M8x30*	2	*Washer stainless*
3	*M8 hex. nut stainless*		

Step	Procedure
5	Re-establish attachment (turbocharger bracket engine suspension frame (not supplied with engine). Tightening torque as specified by the aircraft manufacturer.
6	Install spring and ball of pressure oil line, see Chapter 79-00-00 Oil line (steel line) installation.
7	Re-connect the two oil lines for turbocharger on the oil pump, see Chapter 79-00-00 Oil line (steel line) installation.
8	Install turbo suction oil line with clamp, M5x20 screw and new M5 lock nut on turbocharger bracket, see Chapter 79-00-00 Oil line (steel line) installation.
9	Install hose on wastegate regulator assy.

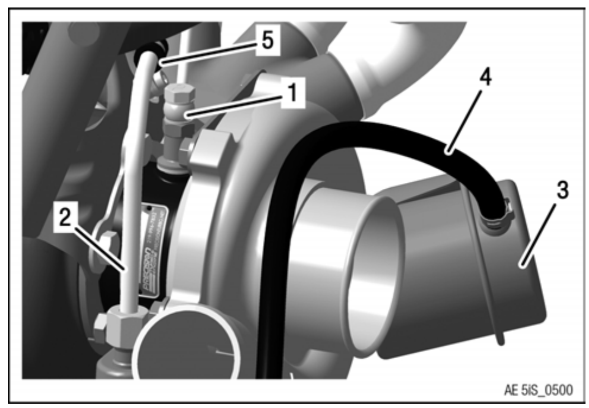


Figure 21.26

1	*Turbo pressure line*	2	*Suction oil line*
3	*Wastegate regulator*	4	*Hose (wastegate regulator)*
5	*Cable clamp*		

NOTE

If the location of the oil line connection does not correspond with oil pump housing, correction can be achieved by slightly turning the turbo-charger center section.

After completion of installation as described, all the screw connections on the turbocharger bracket, ex-haust manifold, exhaust bends and the tension clamp must be tightened to the specified torques.

Descrip-tion	Application	Tightening torque
Allen screw M8x30	Turbo flange	25 Nm / 18 ft. lb
Allen screw M10x50	Turbocharger bracket	60 Nm / 44 ft . lb
Allen screw M10x50	Exhaust bracket	60 Nm / 44 ft . lb
Hex. screw M10	Tension clamp	20 Nm / 15 ft . lb

ATTENTION

In the high temperature zone of the turbocharger and exhaust system, use exclusively high grade, stainless steel screws.

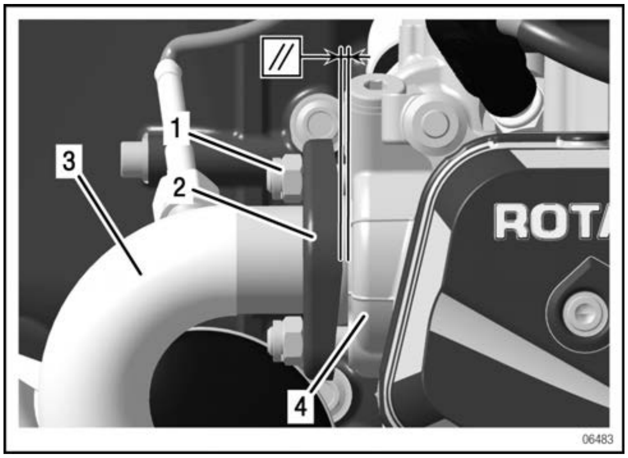


Figure 21.27

1 *Hex. nut M8*
2 *Exhaust flange*
3 *Exhaust pipe*
4 *Cylinder head*

WASTEGATE REGULATOR ASSY.— INSTALLATION

ATTENTION

Check for leakage of the wastegate regulator assy. before installation.

Step	Procedure
1	Install wastegate regulator assy. and heat shield with two collar nuts with washers onto the turbocharger housing. **NOTE** *The heat shield must be positioned to provide maximum shielding of radiant heat from the exhaust system. The heat shield must point towards the ex-haust manifold.*

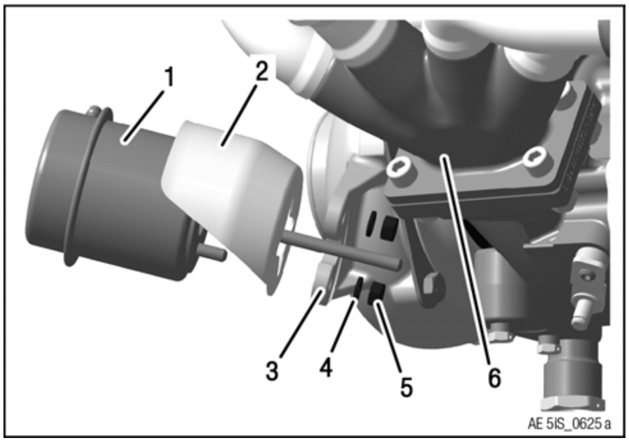


Figure 21.28

1	*Wastegate regulator assy.*	2	*Heat shield*
3	*Turbocharger housing*	4	*Washer*
5	*Collar nut*	6	*Exhaust manifold*

Step	Procedure
2	Mount locking nut and rod end.

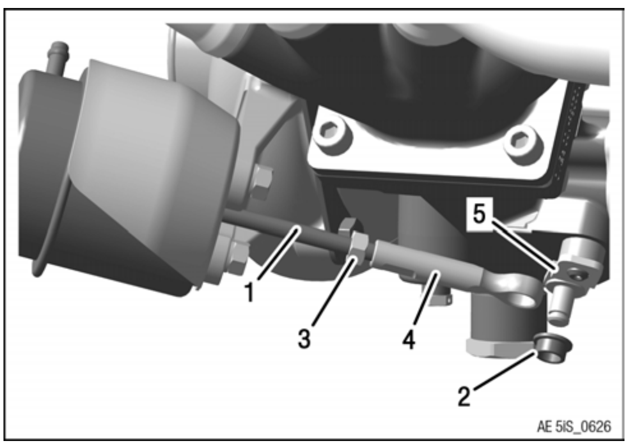


Figure 21.29

1	*Rod*	2	*Bushing*
3	*Locking nut*	4	*Rod end*
5	*Wastegate lever*		

Step	Procedure
3	Lubricate the bushing with LOCTITE ANTI SEIZE 8151 or equivalent.
4	Place the bushing onto the wastegate lever shaft with the bushing collar facing towards the wastegate lever.
5	Press wastegate lever to closed position and hold it.
6	Adjust the rod end so, that the wastegate is in closed position.
7	Fix this position with the locking nut.

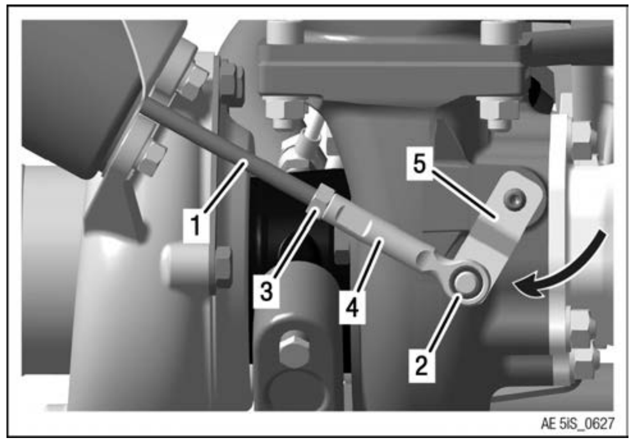


Figure 21.30

1	*Rod*	2	*Bushing*
3	*Locking nut*	4	*Rod end*
5	*Wastegate lever*		

Step	Procedure
8	Place the washer over the wastegate shaft and hold in place.
9	Place the open end of the locking clip into the groove of the wastegate shaft and the beveled portion of the clip over the end of the shaft.

Step	Procedure
10	Push the locking clip into place until the beveled end retains the clip over the shaft.
11	Mount low pressure hose and fix with hose clamp.

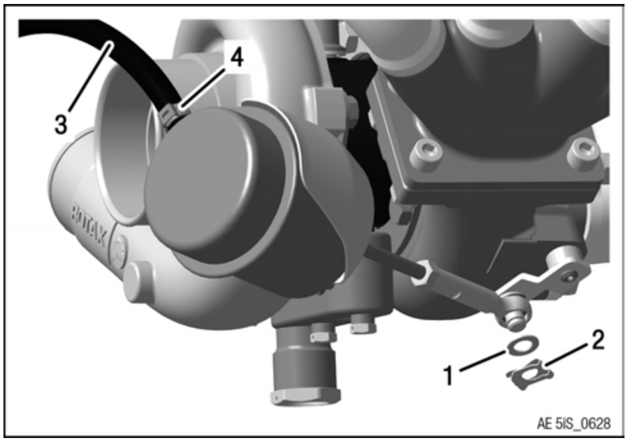


Figure 21.31

1	*Washer*	2	*Locking clip*
3	*Low pressure hose*	4	*Hose clamp*

ADJUSTMENT OF THE WASTEGATE

Step	Procedure
1	Check the wastegate for proper adjustment. Pressurize the wastegate and observe the following calibration table and figure. Around 150-160 mbar the wastegate must be closed, if not adjust by turning the hex. nut on wastegate lever. **NOTE** *Proper adjustment allowed only while installed / connected to wastegate lever. Wastegate shaft movement has to be without friction.*

Control pressure (mbar / psi)	A = Rod travel mm [inches]	Notes / tolerance mm [inches]
150 - 160 / 2.18 - 2.32	0	closed
185 / 2.60	2 [0.079]	1 [+/- 0.04]

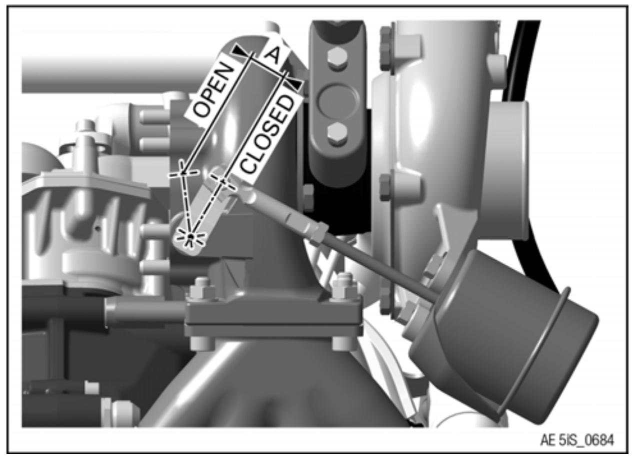


Figure 21.32

FINISHING WORK

- Install coolant hoses, see Chapter 75-00-00 section Expansion tank and coolant hose — installation.
- Install air filter.
- Install hose from intercooler to turbocharger, see documentation of aircraft manufacturer.

Fill with fresh oil. See Maintenance Manual Line for the engine type 915 i A Series .

Purge the oil system. See Maintenance Manual Line for the engine type 915 i A Series .

- Carry out an engine test run and leakage check.

Chapter: 79–00–00
LUBRICATION SYSTEM

TOPICS IN THIS CHAPTER

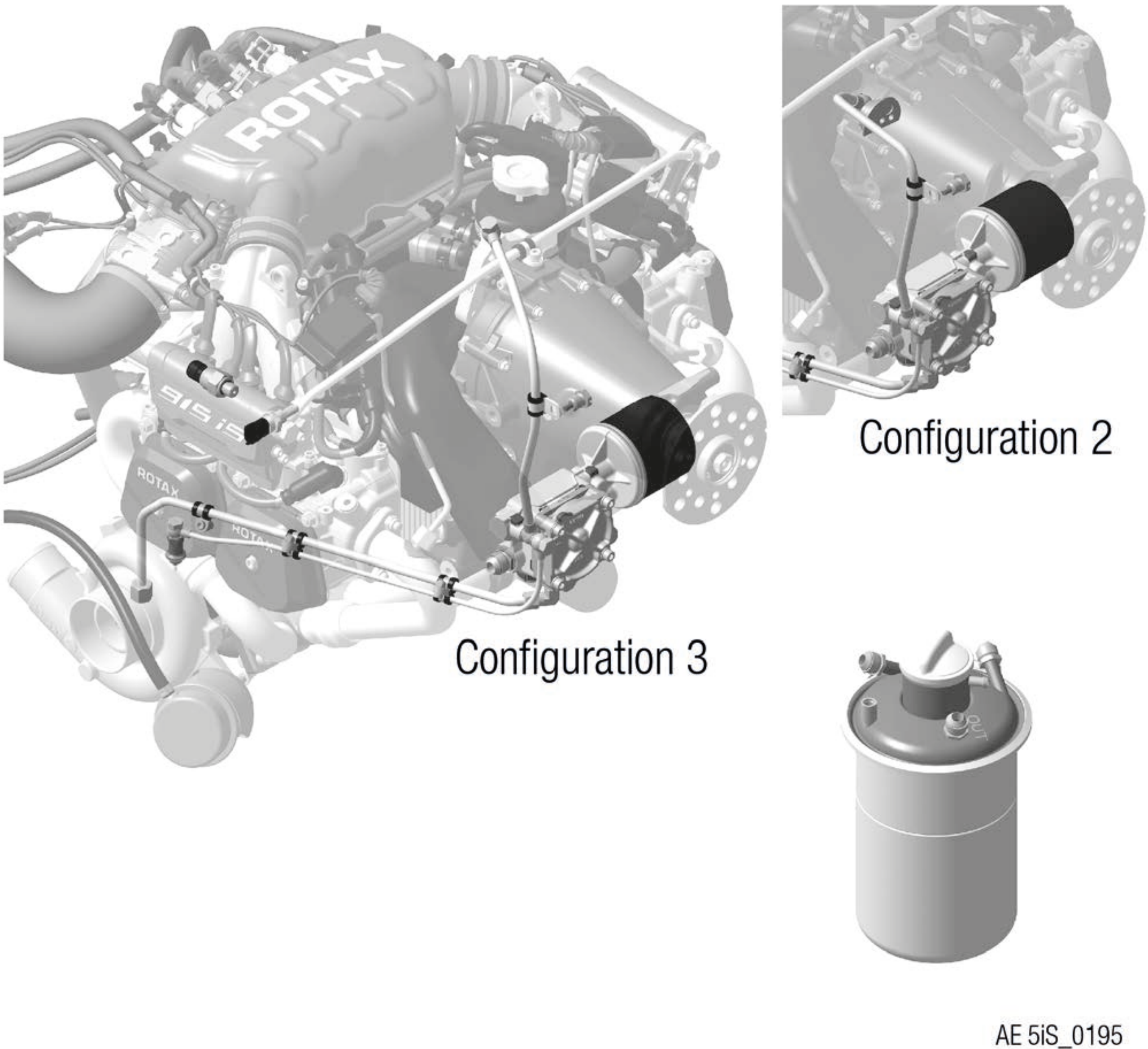

ROTAX
915 iS
ROTAX
ROTAX
Configuration 3
Configuration 2
OUT
AE 5iS_0195

Figure 22.1

SPECIAL TOOLS

Description	Part number	
Oil filter wrench	877620	Non certified part
Socket wrench	876075	Non certified part
Socket wrench	876130	Non certified part

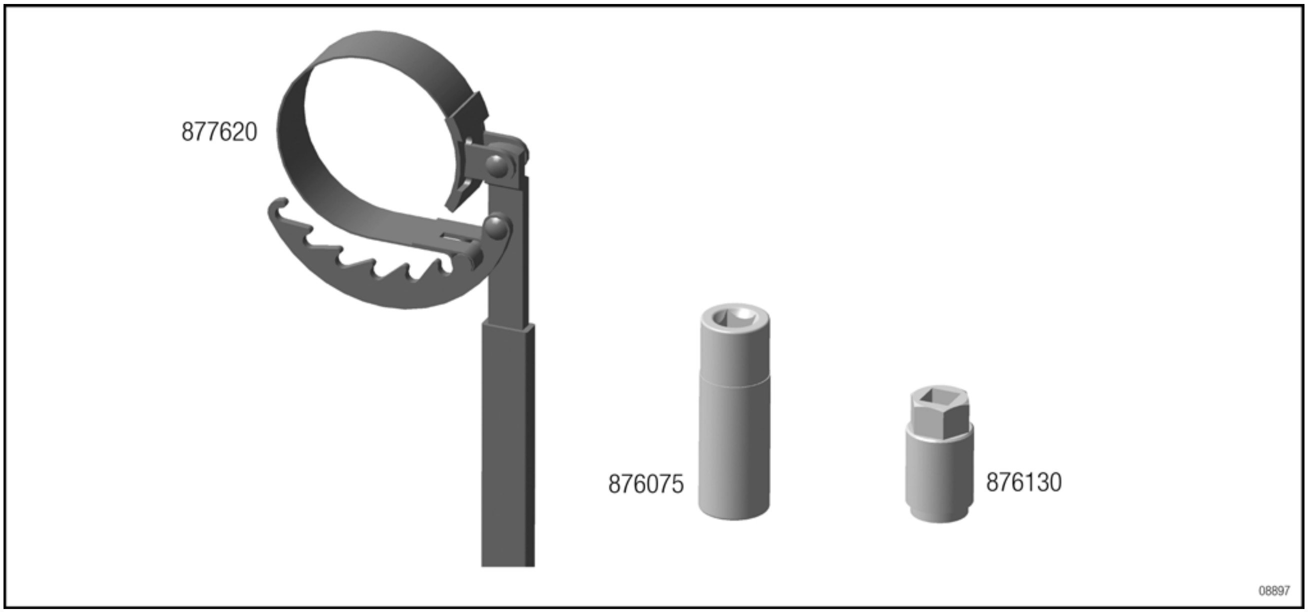


Figure 22.2

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE 8151	898351
LOCTITE 5910	899791
LOCTITE 243	897651
LOCTITE 648	899788
Engine oil	n.a.
Insulating tape	n.a.

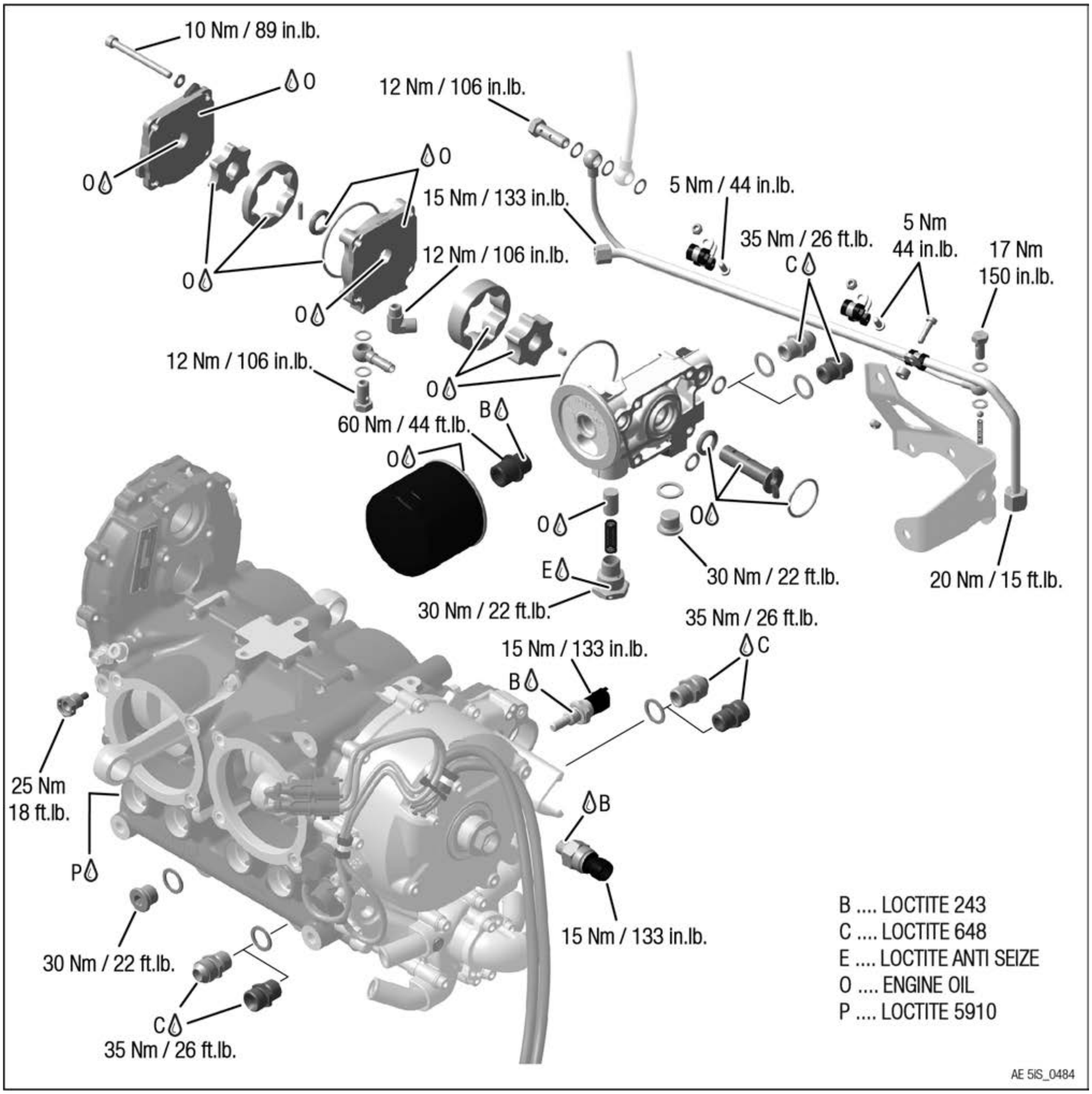


Figure 22.3: Lubrication system

SYSTEM DESCRIPTION

The engines is provided with a dry sump forced lubrication system with a main oil pump with integrated pressure regulator.

Oil flow
The oil pump (driven by the camshaft) sucks the motor oil from the oil tank through the oil cooler and forces it through the oil filter, through, to the points of lubrication in the engine and the turbo charger. The escaping oil emerging from the points of lubrication accumulates on the bottom of crankcase and is forced back to the oil tank by the piston blow-by gases.
The ventilation of the oil system is done by the vent fitting on the oil tank.

Turbocharger
The turbocharger is lubricated via a separate oil line (from the main oil pump).
The oil emerging from the turbocharger collects in a stainless steel oil sump and is sucked back, through a finger sieve to the secondary oil pump and then pumps back to the main oil tank via the oil line.

CRANKCASE

The engine oil emerging from the lubrication points accumulates on the bottom of crankcase and is forced back to the oil tank by the constant excessive pressure in the crankcase (blow-by gases).

OIL PUMP

The oil pump is driven by the camshaft.

SAFETY INSTRUCTION

⚠ WARNING

Danger of severe burns and scalds! Always allow the engine to cool down to ambient temperature before starting any work.

⚠ WARNING

Danger of serious injury! During work on the lubrication system there is a risk of injury due to pressure!

- Ensure that the engine is in the horizontal position!

ENVIRONMENTAL NOTE

Please observe the disposal regulations applicable in your area.

ENVIRONMENTAL NOTE

Observe the safety instructions of the manufacturer of hazardous substances (coolant, oil) or fuels and the applicable regional waste disposal regulations.

ENVIRONMENTAL NOTE

Work with the utmost care to ensure that no water pollutants can penetrate into the soil, water or the sewerage system.

CONNECTIONS FOR DISPLAY SYSTEMS

Follow the instructions in the installation manual regarding connections for instrumentation.

TEMPERATURE SENSOR

The temperature sensor is situated on the crankcase and measures the oil inlet temperature.

PRESSURE SENSOR

The pressure sensor is situated on the ignition housing and measures the oil pressure.

MAINTENANCE

As well as the maintenance and special checks, See Maintenance Manual Line for the engine type 915 i A Series .

NOTE

Whenever the lubrication system is removed or disassembled, O-rings and other sealing elements must be replaced with new parts.

OIL PUMP

OIL PUMP ASSY. REMOVAL

Preparation

- Switch the ignition key OFF
- Drain the oil.

ATTENTION
Follow the aircraft manufacturer's instructions for removal.

ENVIRONMENTAL NOTE
Dispose of used oil according to local environmental regulations.

ATTENTION
Prevent the ingress of debris particles into all disconnected lines and connections. Use appropriate protective coverings.

Remove surrounding assemblies and detach oil lines.

NOTE

The assemblies and lines are only to be removed if necessary and only as far as is necessary!

Step	Procedure
1	Disconnect the regulator pressure oil line (turbo and governor).
2	Remove the safety wire of the plug screw (regulator piston).
3	Loosen the plug screw (regulator piston), otherwise it is very difficult to unscrew when the oil pump is removed.
4	Disconnect the turbo return line.
5	Remove return line to oil tank.

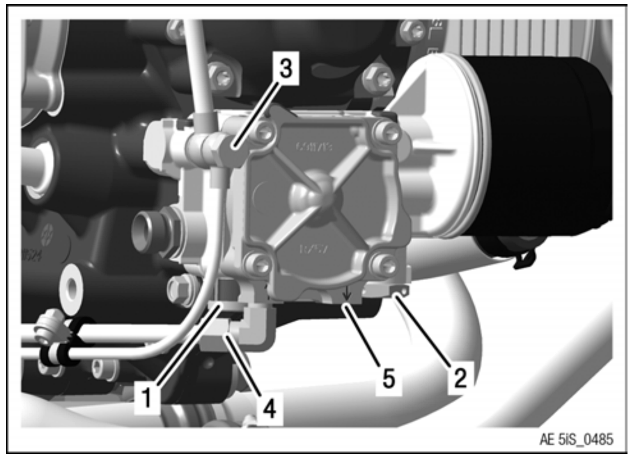


Figure 22.4

1	*Plug screw for regulator pressure oil line*	2	*Plug screw (regulator piston)*
3	*Regulator pressure oil line*	4	*Turbo return line*

Step	Procedure
6	Unscrew the oil filter with oil filter wrench part no. 877620.

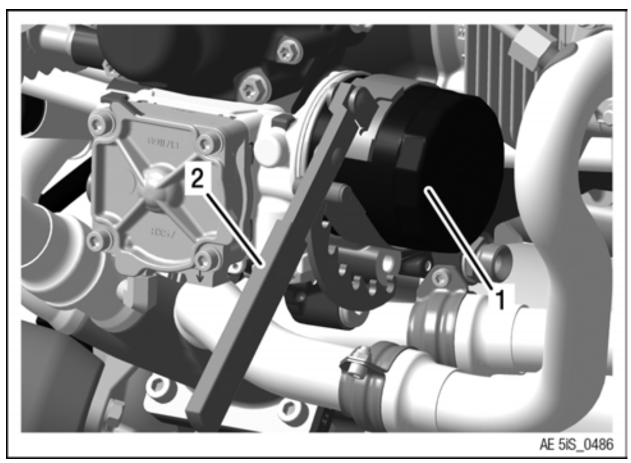


Figure 22.5

1	*Oil filter*	2	*Special tool*

Step	Procedure
7	Loosen 4 Allen screws with lock washers.
8	Remove the whole oil pump unit and O-rings.

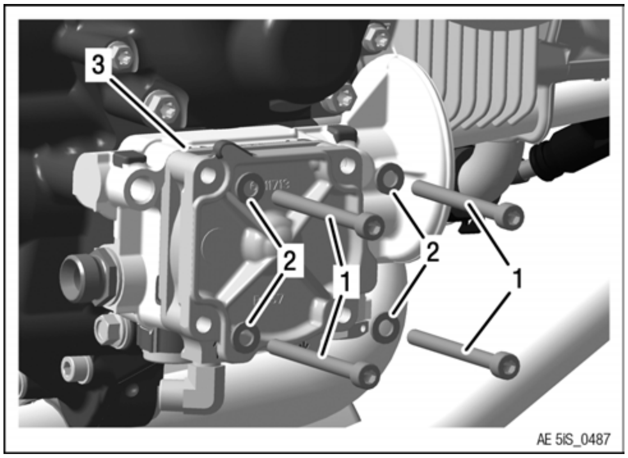


Figure 22.6

1 Allen screws M6x65 *2 Washer 6.4*

3 Oil pump housing

OIL PUMP — DISASSEMBLY

Step	Procedure
1	Remove the plug screw, compression spring and regulator piston.

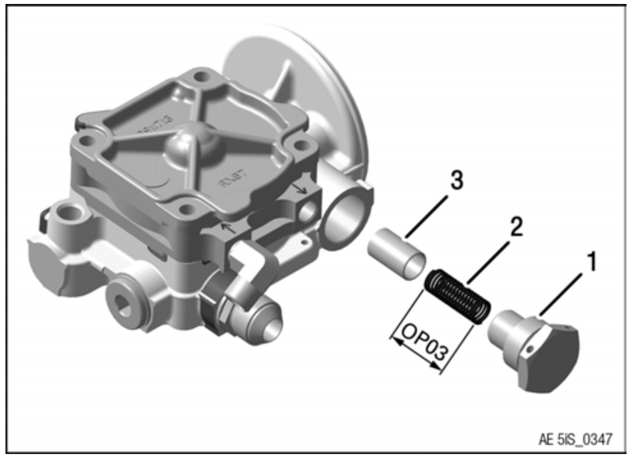


Figure 22.7

1 Plug screw *2 Compression spring*

3 Regulator piston

Step	Procedure
2	Remove the oil pump cover.

NOTE

If the cover sticks (from interfacial tension), carefully release it with a soft-faced hammer.

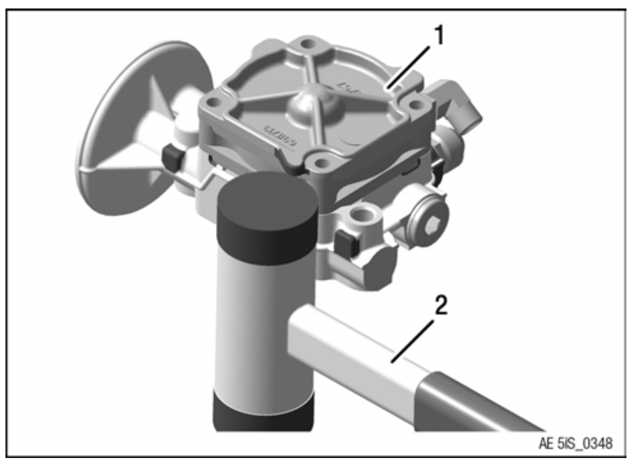


Figure 22.8

1 Oil pump cover *2 Soft-faced hammer*

ATTENTION

The rotary piston and rotor are marked.

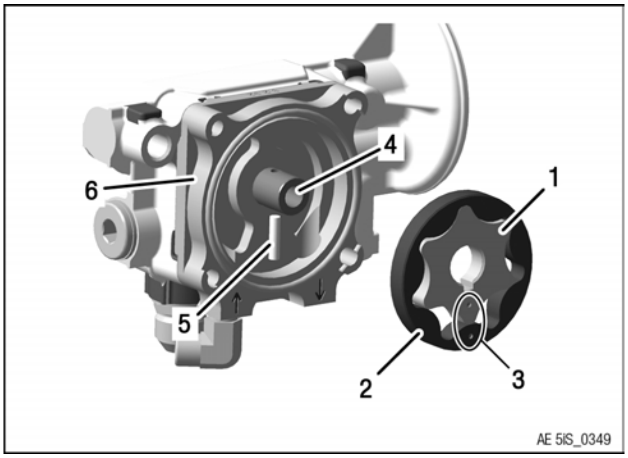


Figure 22.9

1	*Rotor (inner rotor)*	2	*Rotary piston (outer rotor)*
3	*Mark (dot)*	4	*Oil pump shaft*
5	*Needle pin 4x15.8*	6	*Oil pump housing*

Step	Procedure
3	Pull out the rotor and rotary piston.
4	Remove the pin
5	Remove oil pump housing.
6	Remove the feather key.

ATTENTION

The sealing lip of the oil seal is damaged when the oil pump shaft is pulled out and must be replaced.

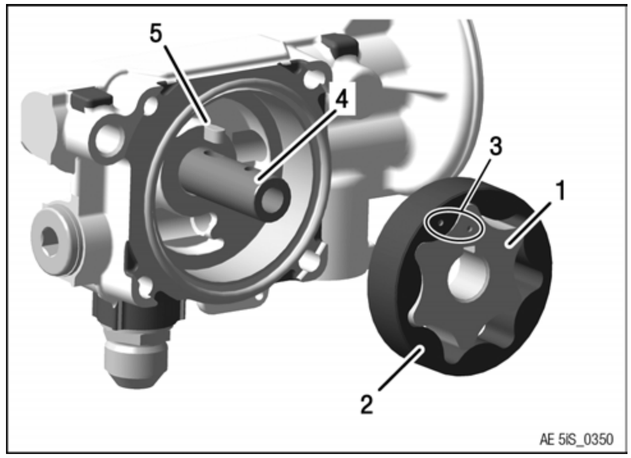


Figure 22.10

1	*Rotor (inner rotor)*	2	*Rotary piston (outer rotor)*
3	*Mark (dot)*	4	*Oil pump shaft*
5	*Feather key*		

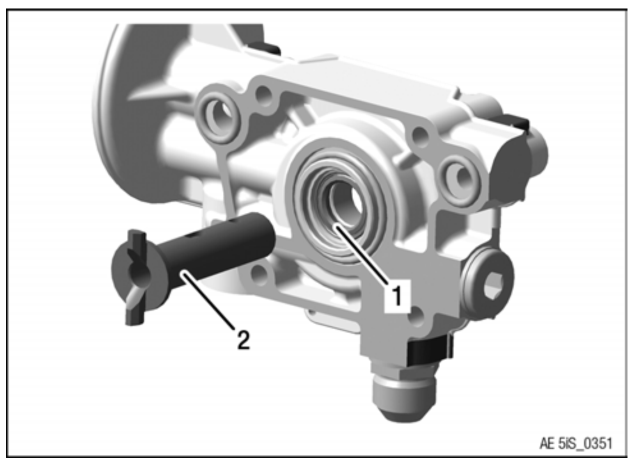


Figure 22.11

1	*Oil seal*	2	*Oil pump shaft*

Step	Procedure
7	Carefully lever the oil seal out of the oil pump housing and cover with a screwdriver.

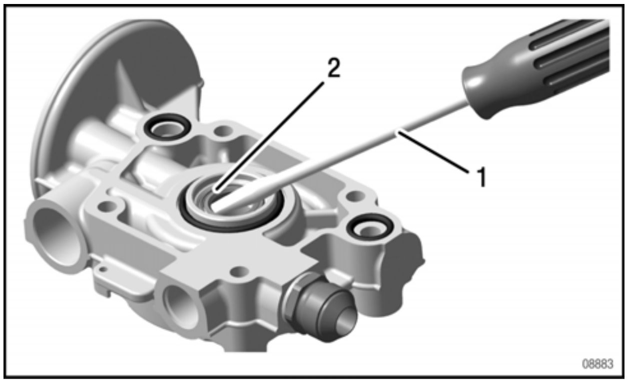


Figure 22.12

1 Screwdriver *2 Oil seal*

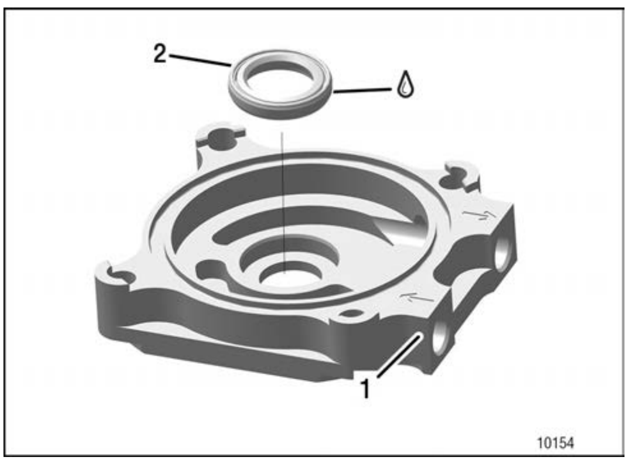


Figure 22.13

1 Oil pump cover *2 Oil seal*

OIL PUMP SINGLE PARTS — CHECK

Preparatory work

Clean all parts carefully.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-00-00 section Procedures.

OIL PUMP HOUSING — INSPECTION

Step	Procedure
1	Visually inspect all the components of the oil pump.
2	All the O-rings must be replaced.
3	Check the oil pump cover for wear on the inside using a straight-edge.

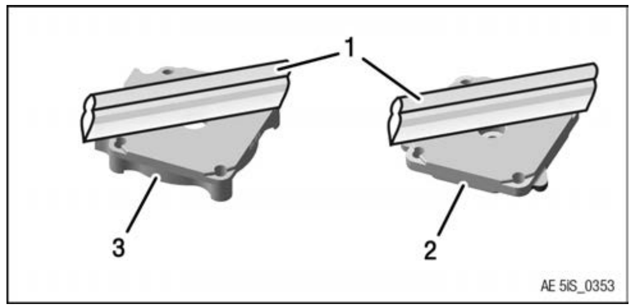


Figure 22.14

1 Straight-edge *2 Oil pump cover*
3 Oil pump housing

Step	Procedure
4	Check the sealing surface of the oil pump housing and pump cover for scoring. Dress of them out on a surface plate if necessary.

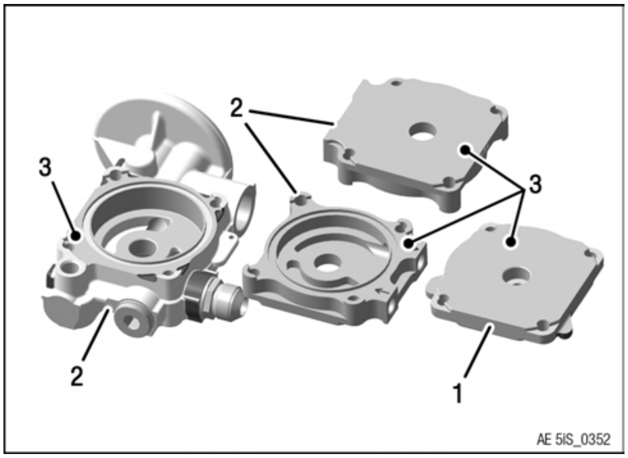


Figure 22.15

1 Oil pump cover *2 Oil pump housing*

3 Sealing surface

ROTARY PISTON/ROTOR — INSPECTION

Step	Procedure
1	Check the rotary piston and rotor for grooves.

NOTE

If there are noticeable grooves on the outer side of the rotor or inner side of the rotary piston, they must both be replaced.

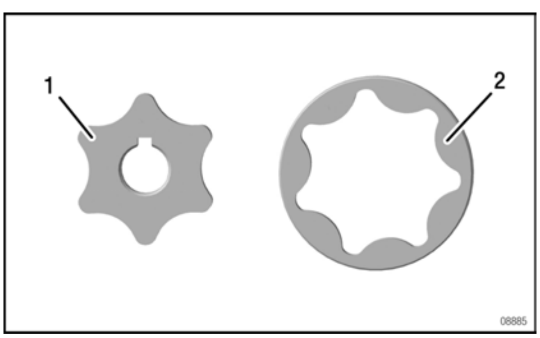


Figure 22.16

1 Rotor *2 Rotary piston*

OIL PUMP SHAFT — INSPECTION

Step	Procedure
1	Check the oil pump shaft at the bearing points.
2	Check the feather key groove and feather key for wear.
3	Check the needle pin.

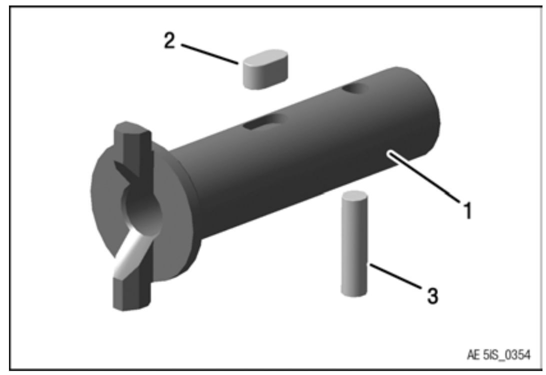


Figure 22.17

1 Oil pump shaft *2 Feather key*

3 Needle pin 4x15.8

OIL PUMP — ASSEMBLY

NOTE

New acid-free greased O-rings and other sealing elements must always be used correctly!

Step	Procedure
1	Apply LOCTITE ANTI SEIZE to the plug screw.
2	Screw the plug screw with the pressure spring and the regulator piston finger-tight into the oil pump housing.

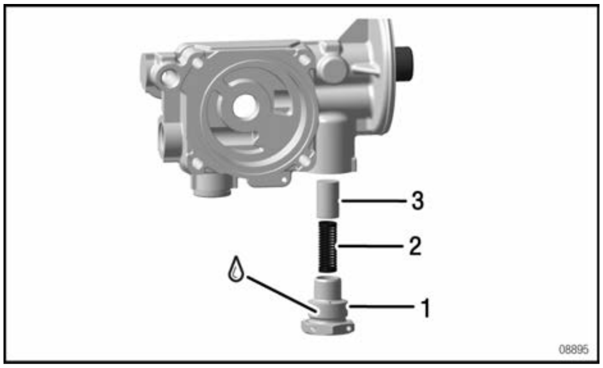


Figure 22.18

1	*Plug screw*	2	*Pressure spring DM9.1 D1.0 L65.6*
3	*Regulator piston*		

Step	Procedure
3	Wrap tape over the feather key groove and bore.

ATTENTION

Press in the oil seal so that the closed side points towards the oil pump housing.

Step	Procedure
4	Apply Engine oil to the oil pump shaft and push oil seal A 14x22x4 onto the oil pump shaft while turning slightly.

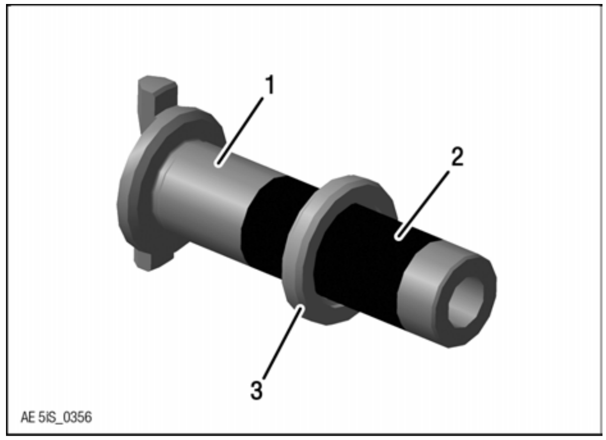


Figure 22.19

1	*Oil pump shaft*	2	*Insulating tape*
3	*Oil seal A 14x22x4*		

Step	Procedure
5	Place the oil pump housing on a firm surface.
6	Remove the insulating tape from the oil pump shaft.
7	Insert the oil pump shaft with the oil seal and press it in as far as it will go with a soft-faced hammer.

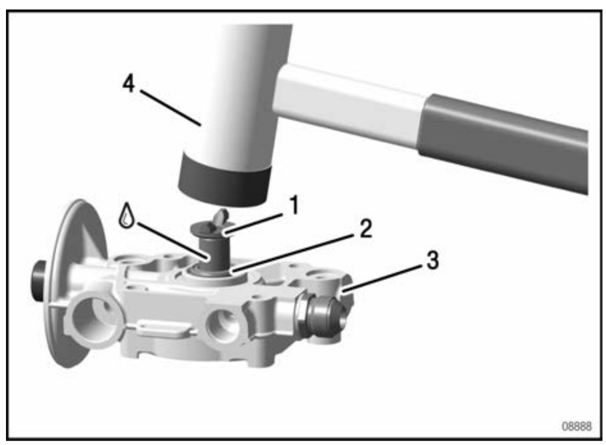


Figure 22.20: TYPICAL

1	*Oil pump shaft*	2	*Oil seal*
3	*Oil pump housing*	4	*Soft-faced hammer*

ATTENTION

If the oil pump shaft is pulled out again, replace the oil seal (unusable).

NOTE

Apply engine oil to the oil seal at replacement.

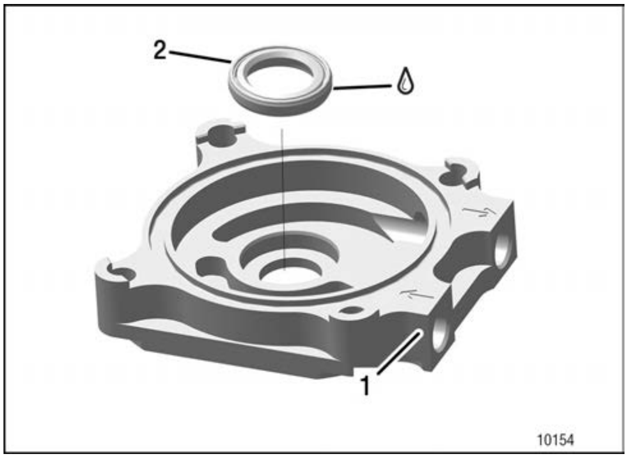


Figure 22.21

1	*Oil pump center housing*	*2*	*Oil seal*

Step	Procedure
8	Insert the feather key in the oil pump

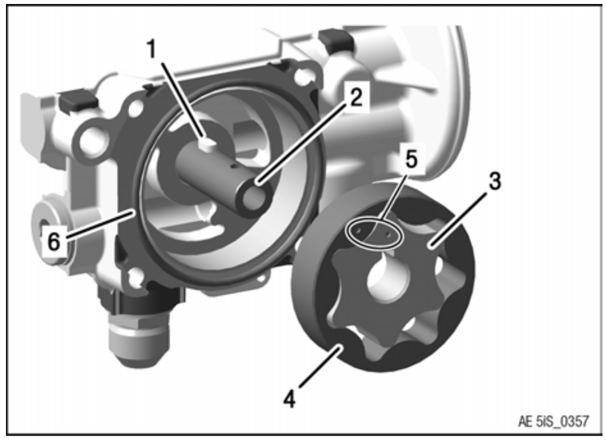


Figure 22.22: TYPICAL

1	*Feather key*	*2*	*Shaft*
3	*Rotor (inner rotor)*	*4*	*Outer rotor*
5	*Mark*	*6*	*O-ring*

ATTENTION

The rotor and rotary piston have a mark. The mark must be visible after inserting both rotors.

Step	Procedure
9	Push on the rotor (inner rotor).
10	Insert the rotary piston (outer rotor).
11	Install O-ring.
12	Install oil pump center housing with new oil seal.
13	Insert needle pin.

NOTE

Apply Engine oil to the rotor and rotary piston.

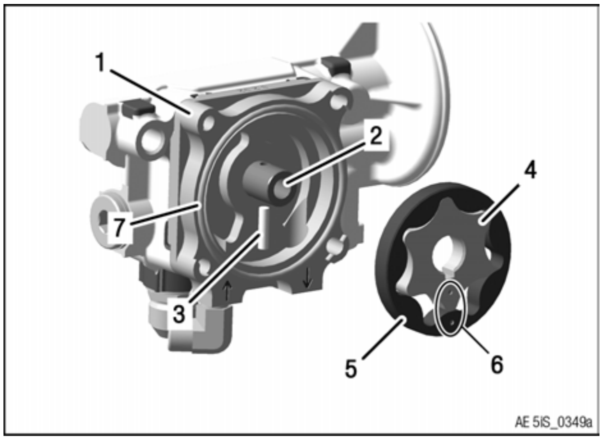


Figure 22.23: TYPICAL

1	*Oil pump center housing*	2	*Oil pump shaft*
3	*Needle pin 4x15.8*	4	*Rotor (inner rotor)*
5	*Outer rotor*	6	*Mark*
7	*O-ring 63–2.5*		

OIL PUMP HOUSING O-RINGS

ATTENTION
All the O-rings must be replaced!

Step	Procedure
1	Insert new O-rings in the oil pump housing.

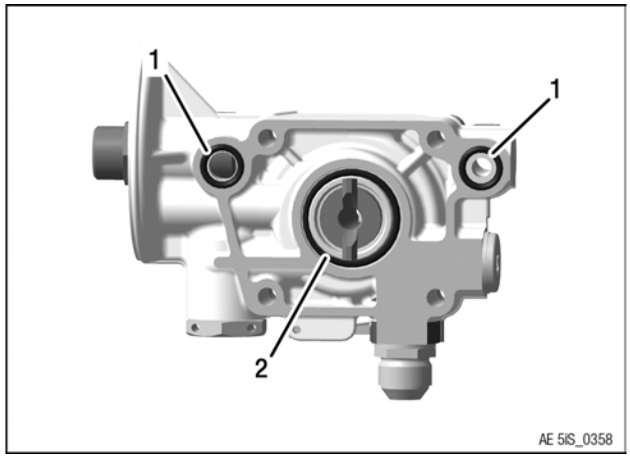


Figure 22.24: TYPICAL

1	*11x2.7 O-ring*	2	*30x2.5 O-ring*

OIL PUMP COVER

Preparation

- Apply Engine oil to the bearing point and contact surface.

ATTENTION
Hold the oil pump shaft when putting the oil pump cover on it. Otherwise the oil pump shaft is pushed out by the air cushion.

ATTENTION
Make sure the oil pump cover is in the correct position when putting it on.

Step	Procedure
1	Place the oil pump cover on the oil pump center housing.

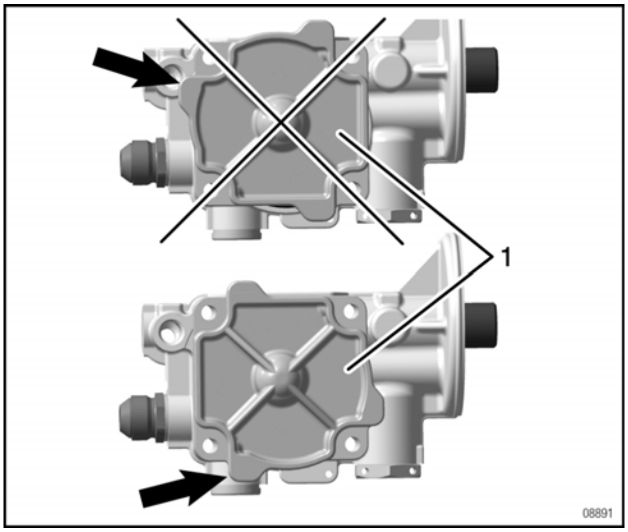


Figure 22.25: TYPICAL

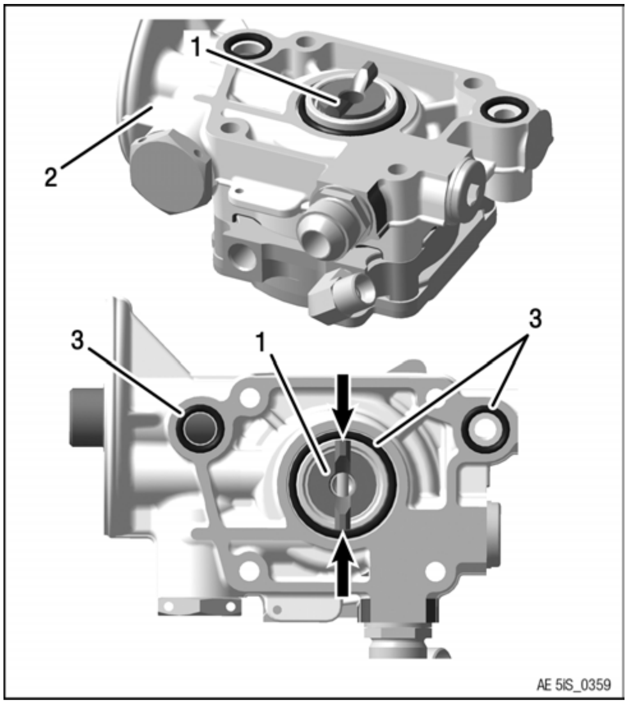
1 *Oil pump cover*

OIL PUMP — INSTALLATION

Preparation

- Check the fit of the O-rings on the oil pump housing.

ATTENTION
Ensure that the oil pump shaft is in the correct installation position.



1 Oil pump shaft *2 Oil pump housing*

3 O-rings

Figure 22.26: TYPICAL

Step	Procedure
1	Apply LOCTITE 5910 to the contact area on the crankcase.

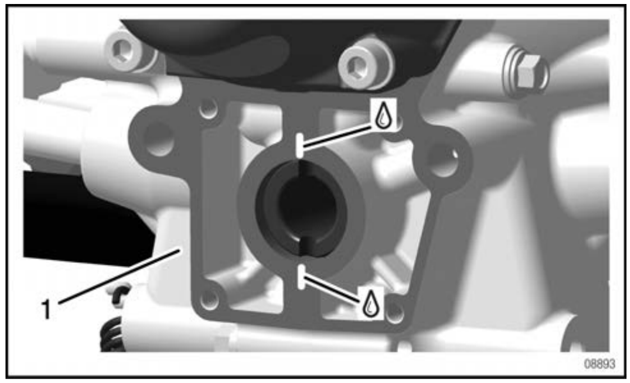


Figure 22.27

1 Crankcase

Step	Procedure
2	Install the oil pump housing with Allen screws M6x50 and washers 6.4 cross-wise and by hand. Then tighten the Allen screws crosswise. Tightening torque 10 Nm (89 in. lb.).
3	Tighten plug screw. Tightening torque 30 Nm (22 ft. lb.).
4	Attach the safety wire.

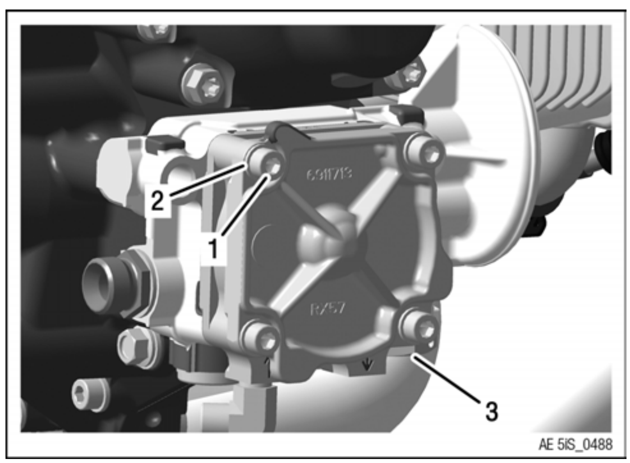


Figure 22.28: TYPICAL

1 Allen screws M6x50 *2 Washers 6.4*
3 Plug screw M22x1.5

OIL FILTER - INSTALLATION

Step	Procedure
1	Install the oil filter.

See Maintenance Manual Line for the engine type 915 i A Series .

NOTE

Oil the gasket of the oil filter.

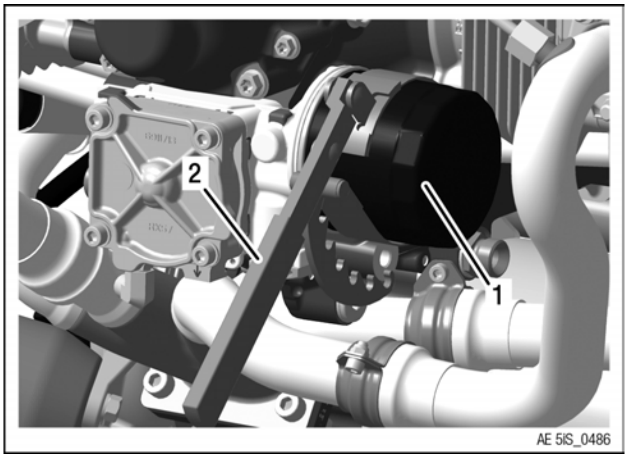


Figure 22.29

1 Oil filter *2 Oil filter wrench*

Step	Procedure
2	Install the oil lines/hoses.

FINISHING WORK

- Fill with fresh oil.

See Maintenance Manual Line for the engine type 915 i A Series .

Purge the oil system.
See Maintenance Manual Line for the engine type 915 i A Series .

- Carry out an engine test run and leakage check.

NOTE

Then check that the oil filter is securely fitted after the test run.

WEAR LIMITS

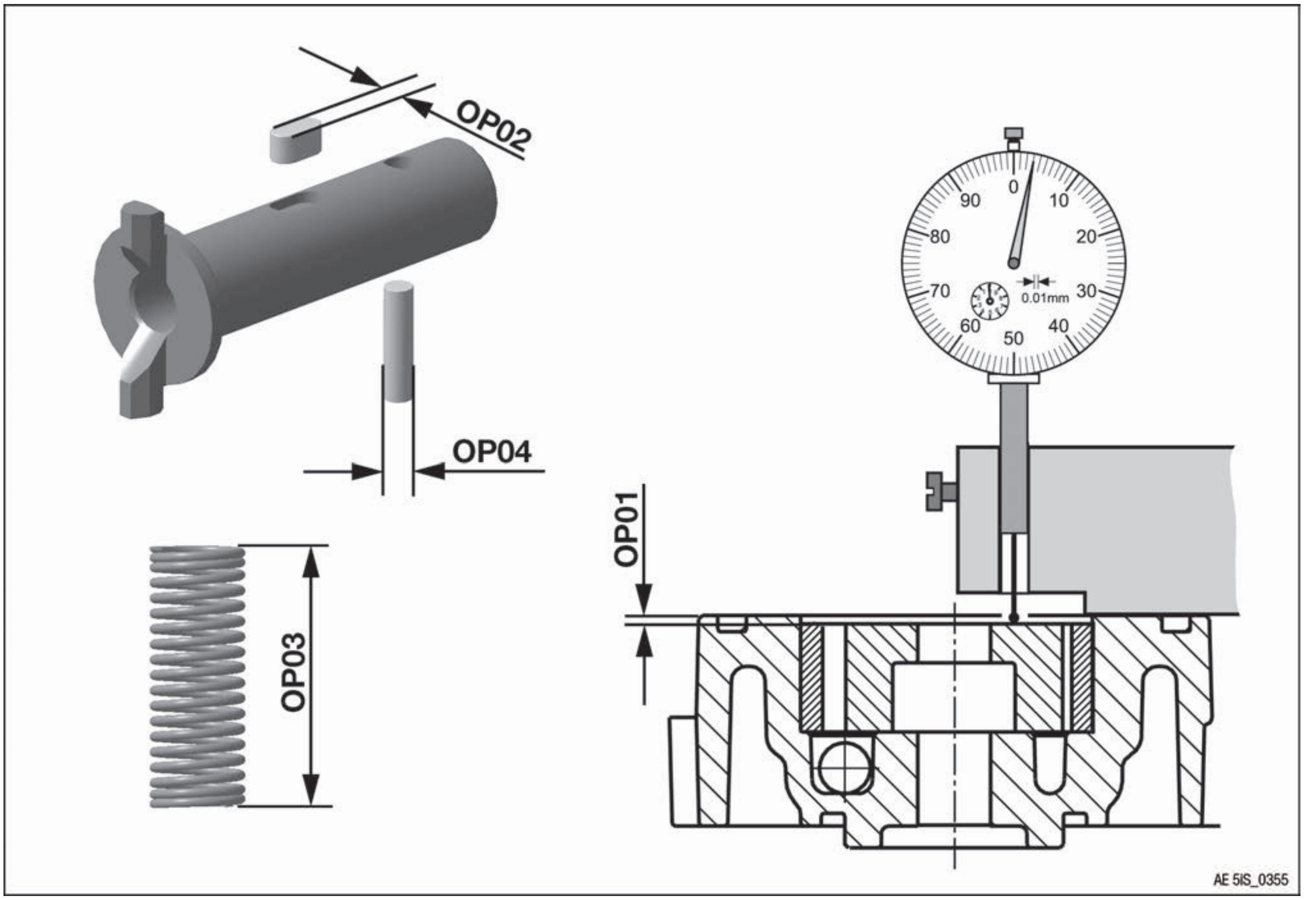


Figure 22.30: Oil pump

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Main pump spacing (pump cover/rotor)	OP01	0.02 mm 0.00079 in.	0.07 mm 0.0027 in.	0.20 mm 0.0079 in.	0.14 mm 0.0053 in.	current replaced	
Width of feather key in shaft	OP02	4 mm 0.1575 in.	4.085 mm 0.1604 in.	4.150 mm 0.163 in.	4.11 mm 0.1619 in.		
Pressure spring length	OP03	65.6 mm (2.58 in.)		62.6 mm (2.46 in.)	64.1 mm 2.52 in.		
Needle pin	OP04	4 mm (0.158 in.)		3.20 mm 0.126 in.	3.60 mm 0.142 in.		

OIL TANK

OIL TANK — REMOVAL

Follow the aircraft manufacturer's instructions for removal.

⚠ WARNING

Danger of severe burns and scalds!
Always allow the engine to cool down to ambient temperature before starting any work.

⚠ WARNING

Danger of electric shock! Switch off the ignition and pull out the ignition key! Disconnect the negative terminal of the battery.

Preparation

- Turn the Master, Start and Lane Switch OFF
- Drain the oil
- Remove the oil tank according to the aircraft manufacturer's specifications.

ENVIRONMENTAL NOTE

Dispose of used oil according to local environmental regulations.

ATTENTION

Prevent the ingress of debris particles into all disconnected lines and connections.
Use appropriate protective coverings.

NOTE

The assemblies, hoses and lines are only to be removed if necessary and only as far as is necessary.

Step	Procedure
1	Remove surrounding assemblies and detach oil hoses.

ENVIRONMENTAL NOTE

Ensure that no oil gets into the waste water system or the ground – risk of contaminating drinking water!

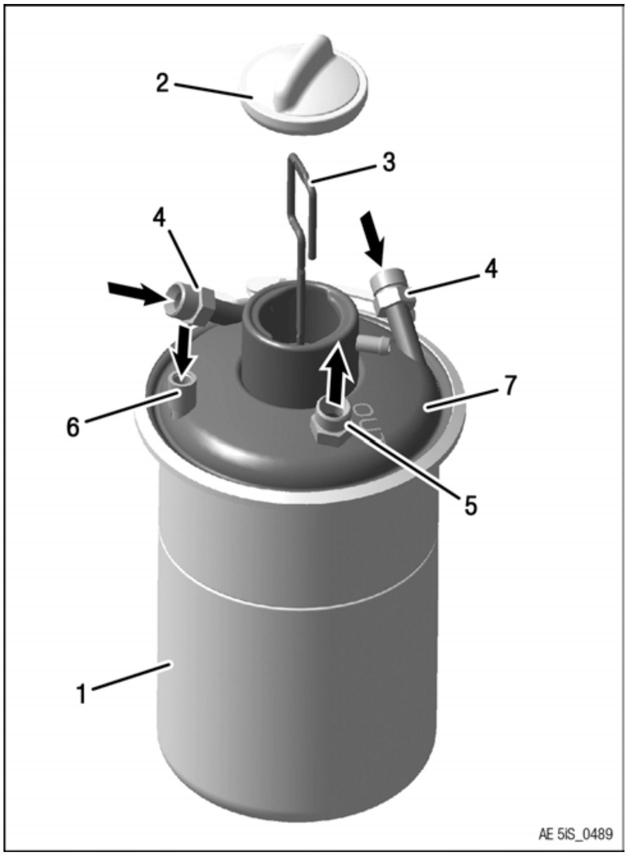


Figure 22.31

1	*Oil tank*	2	*Oil tank cover*
3	*Oil dipstick*	4	*Oil return lines*
5	*Oil pump supply*	6	*Turbo scavenge*
7	*Cover*		

OIL TANK — DISASSEMBLY

Step	Procedure
1	Open profile clamp 163.
2	Remove the oil tank cover assy. and O-ring.

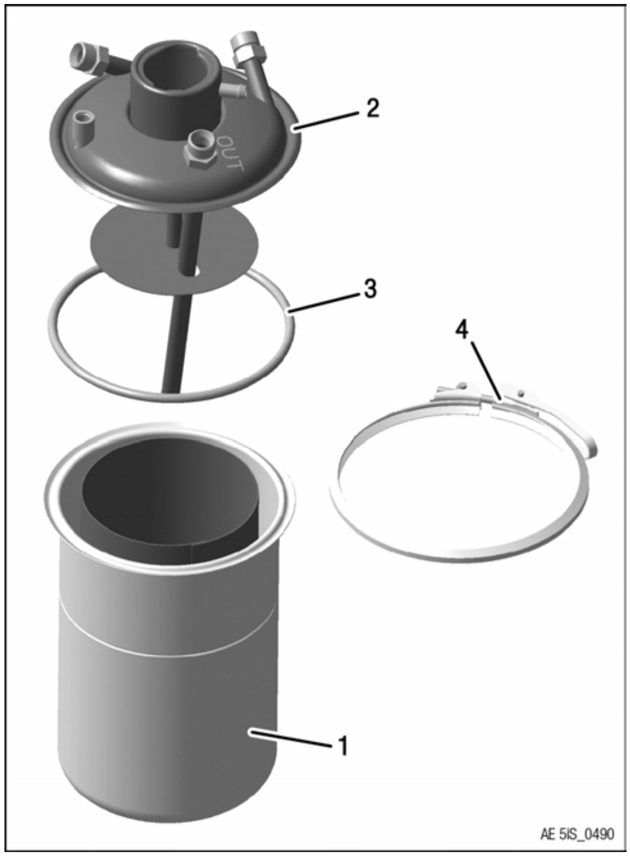


Figure 22.32

1	*Oil tank*	2	*Oil tank cover assy.*
3	*O-Ring*	4	*Profile clamp 163*

Step	Procedure
3	Remove the baffle insert (screen) and partition from the oil tank.

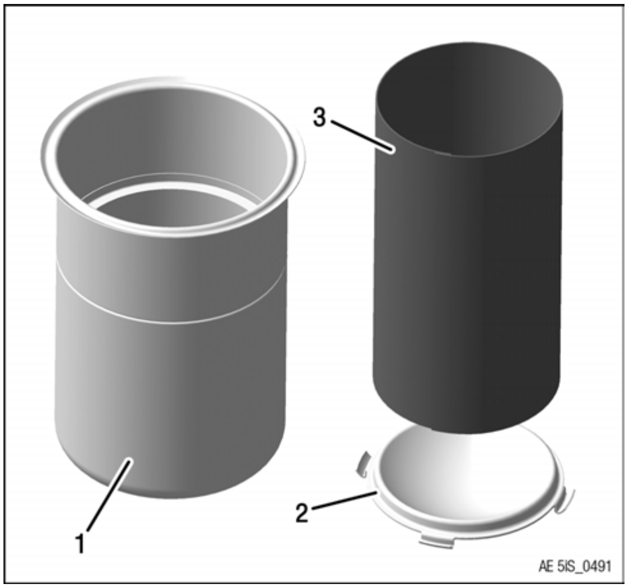


Figure 22.33

1	*Oil tank*	2	*Partition*
3	*Baffle insert (screen)*		

OIL TANK SINGLE PARTS — CHECK

Preparation

Clean all parts carefully.
See See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-00-00 section Procedures.

General visual inspection. See Maintenance Manual Line for the engine type 915 i A Series .

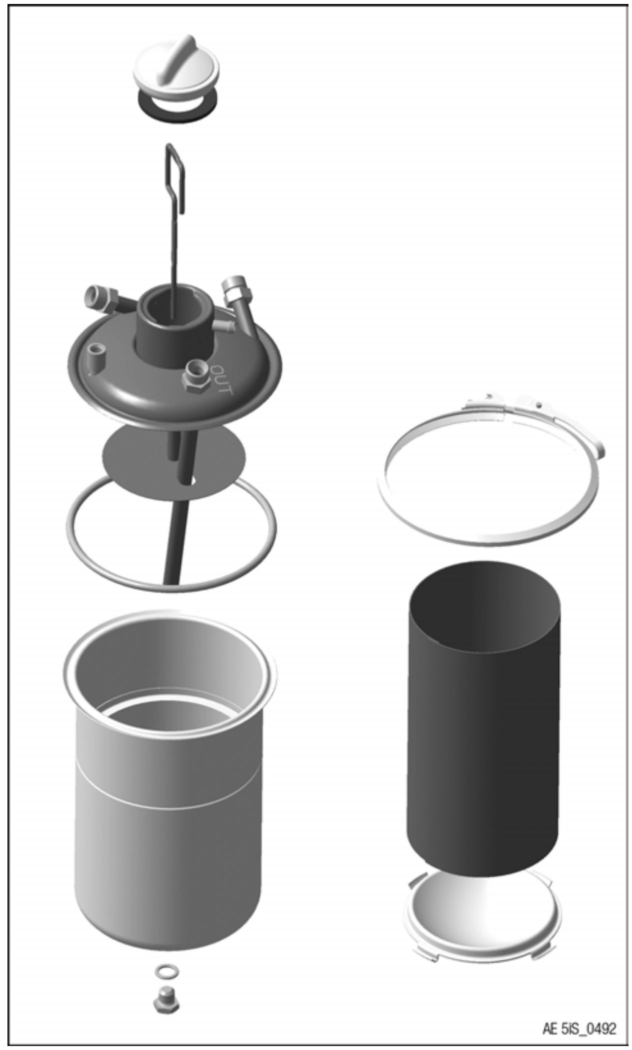


Figure 22.34: Typical

OIL TANK — INSTALLATION

Preparation

Install the oil tank according to the aircraft manufacturer's specifications.

CHECK VALVE – REMOVAL

For removal of the check valve. see the latest documentation of the aircraft manufacturer.

CHECK VALVE – INSPECTION

For inspection of the check valve. see the latest documentation of the aircraft manufacturer.

NOTE

Check valve opening pressure: 170 - 220 mbar.

CHECK VALVE – INSTALLATION

For installation of the check valve. see the latest documentation of the aircraft manufacturer.

FINISHING WORK

Fill with fresh oil. See Maintenance Manual Line for the engine type 915 i A Series .

Bleed the oil system. See Maintenance Manual Line for the engine type 915 i A Series .

- Carry out an engine test run and leakage check.

OIL RADIATOR

For removal, inspection and installation of the oil radiator, see SI-PAC 014.

OIL HOSES

REMOVAL OF THE OIL HOSES

ATTENTION

The oil hoses are not included in the delivery of the engine and must be maintained according to the aircraft manufacturer's instructions.

Remove the oil hoses and clamps according to the instructions in the aircraft manufacturer's manual.

REMOVAL OF THE OIL LINE (STEEL LINE)

ATTENTION

The steel oil lines, which are included in the delivery, are only removed if they are damaged, maintenance or for cleaning.

Step	Procedure
1	Remove the cable clamp for supporting the line on the side of the gearbox.
2	Loosen the M10 banjo bolt and gasket ring on the governor flange. See Chapter 61-20-00 section Governor.
3	Loosen the banjo bolt on the oil pump housing and remove it along with the gasket rings. See Chapter 61-20-00 section Governor.
4	Loosen cap nut from the turbo oil suction line.

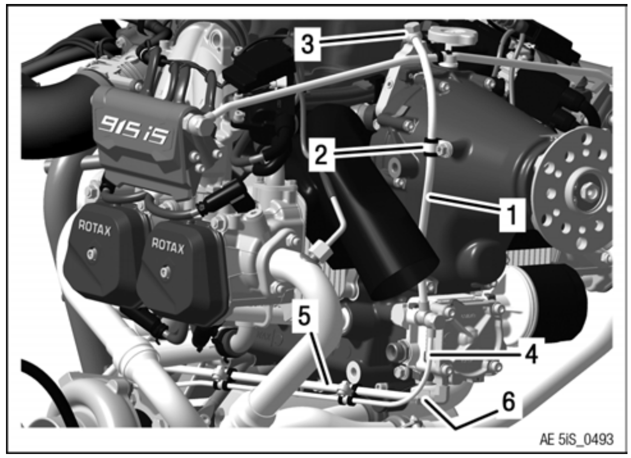


Figure 22.35

1	*Governor pressure oil line*	2	*Cable clamp*
3	*M10 banjo bolt*	4	*Turbo pressure oil line*
5	*Turbo oil suction line*	6	*Cap nut*

Step	Procedure
5	Remove the cable clamp from the turbo oil lines.

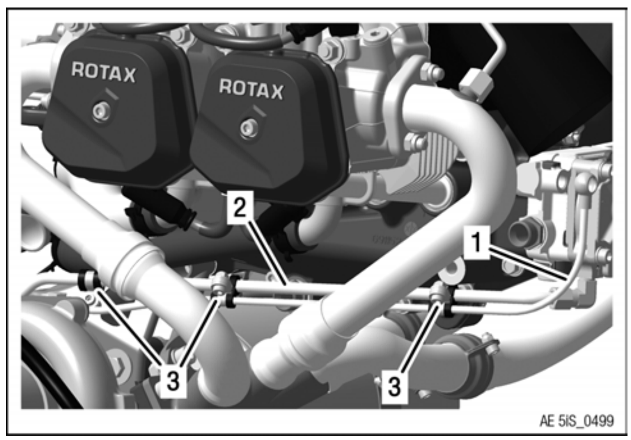


Figure 22.36

1	*Turbo pressure oil line*	2	*Turbo oil suction line*
3	*Cable clamp*		

Step	Procedure
6	Loosen the M10 banjo bolt and sealing ring on the turbo housing. Remove the ball and compression spring.
7	Loosen cap nut on oil sump.
8	Remove the turbo return line from turbo and oil pump housing. See also Chapter 78–20–00 section Turbocharger.
9	Remove oil return line.

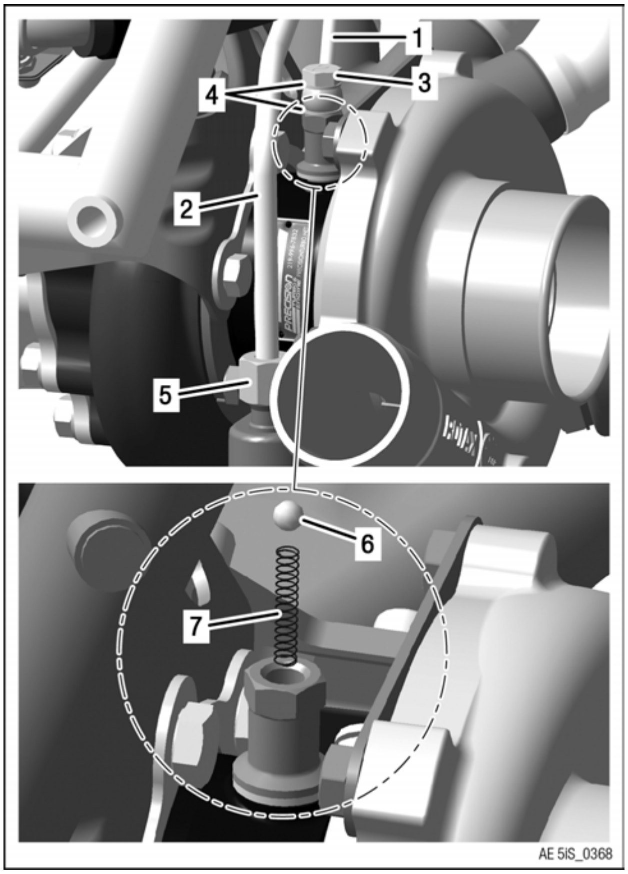


Figure 22.37

1 Turbo pressure line
2 Turbo oil suction line
3 Banjo bolt M8x1x17
4 Sealing ring
5 Cap nut
6 Ball
7 Compression spring

OIL HOSE— INSPECTION

Preparation

Clean all parts carefully.
See Maintenance Manual Line for the engine type 915 i A Series Chapter 05-00-00 section Procedures.

General visual inspection.
See Maintenance Manual Line for the engine type 915 i A Series .

OIL HOSES — INSTALLATION

ATTENTION

Ensure that the hoses are installed without tension and are not scuffed. Observe minimum distances, e.g. 2 mm (0.0787 in.) from the housing.

Step	Procedure
1	Install the oil hoses and clamps according to the instructions in the aircraft manufacturer's manual.
2	Use original hoses with the corresponding aircraft manufacturers certification for replacement.
3	Only use suitable clamps, or crimp connections to fasten the hoses.

OIL LINE (STEEL LINE) INSTALLATION

Step	Procedure
1	Install the governor pressure oil line with the M10 banjo bolt and gasket ring on the governor flange. Tightening torque 17 Nm (150 in. lb). See also Chapter 61-20-00 section Governor.
2	Install the governor pressure oil line and turbo pressure oil line with the M10 banjo bolt on the oil pump housing with the gasket rings. Tightening torque 12 Nm (106 in. lb). See also Chapter 61-20-00 section Governor.

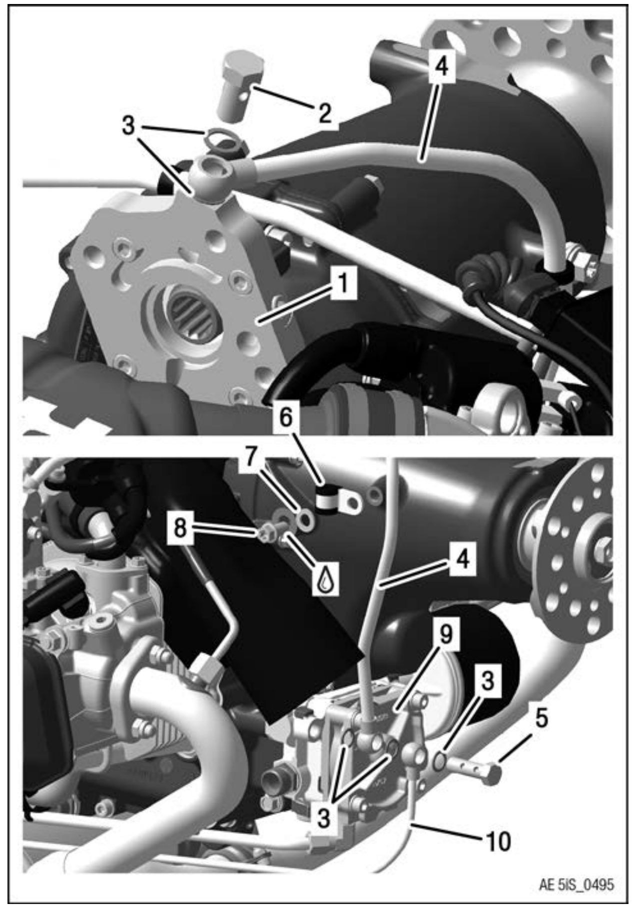


Figure 22.38

1	*Governor flange*	2	*Banjo bolt M10x1x23*
3	*Sealing ring A 10x14*	4	*Governor pressure oil line*
5	*Banjo bolt M10x1x34*	6	*Cable clamp*
7	*Lock washer A8*	8	*Hex/torx-flange screw M8x16*
9	*Oil pump*	10	*Turbo pressure oil line*

Step	Procedure
3	Install the turbo pressure oil line on the turbo housing. Tightening torque 17 Nm (150 in. lb). See also 78–20–00 Turbocharger. **NOTE** *Do not forget to install the ball and spring.*
4	Install the turbo suction oil line on the turbo and on the oil pump housing. See also 78–20–00 Turbocharger.

ATTENTION

Do not install ball and spring for check valve in wrong order. In this case the oil supply will be blocked completely.

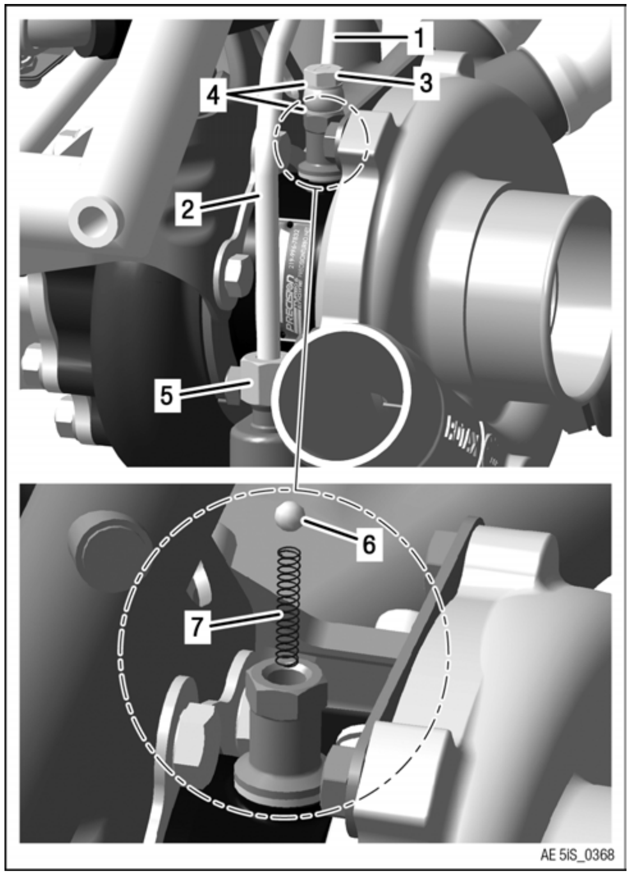


Figure 22.39

1	*Turbo pressure oil line*	*2*	*Turbo suction line*
3	*Banjo bolt M8x1x17*	*4*	*Sealing ring*
5	*Cap nut*	*6*	*Ball*
7	*Spring*		

Step	Procedure
5	Install the cable clamp for supporting the turbo oil suction line on the turbocharger bracket. Tightening torque 5 Nm (44 in. lb).
6	Install the cable clamps on the turbo pressure and oil suction line. Tightening torque 5 Nm (44 in. lb).

NOTE

Always use new lock nuts.

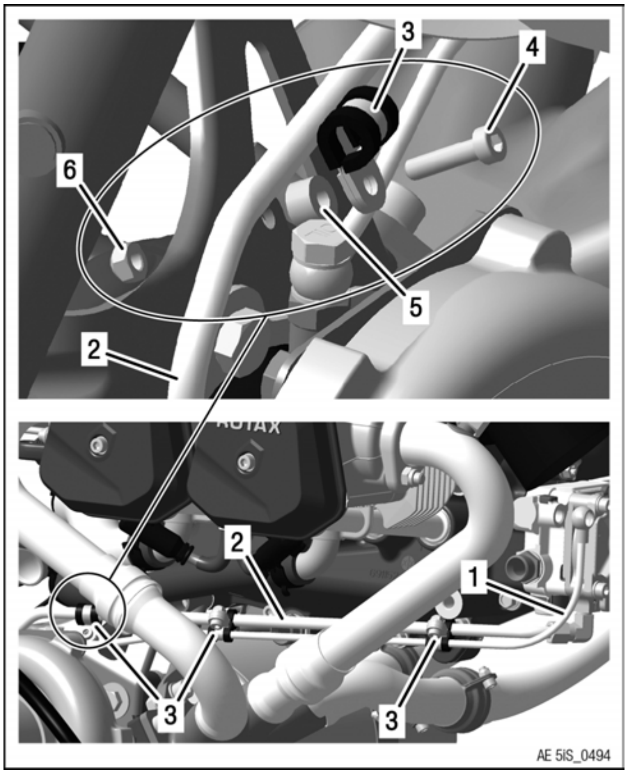


Figure 22.40

1	*Turbo pressure oil line*	2	*Turbo oil suction line*
3	*Cable clamp*	4	*Hex. screw*
5	*Washer*	6	*Lock. nut*

FINISHING WORK

Check the oil level.
See Maintenance Manual Line for the engine type 915 i A Series .

Purge the oil system.
See Maintenance Manual Line for the engine type 915 i A Series .

- Carry out an engine test run and leakage check.

TEMPERATURE AND PRESSURE MEASUREMENT SYSTEM

OIL TEMPERATURE SENSOR (OTS)

General note

The temperature sensor for measuring the oil temperature is screwed into the crankcase. The sensor is a NTC resistor and identical to the sensor for the engine coolant temperature.

ATTENTION

The max. operating temperature must not be exceeded.

If it rises above this, the following must be checked:

The lubrication system. See Maintenance Manual Line for the engine type 915 i A Series .

- the temperature sensor
- the indicating instrument
- the wire connection
- the measurement wire

NOTE

The ground connection of the temperature sensor is established directly via the housing.

OIL TEMPERATURE SENSOR (OTS) — REMOVAL

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators.
2	Clean the thread of the oil temperature sensor.

OIL TEMPERATURE SENSOR (OTS) — INSPECTION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators.

OIL TEMPERATURE SENSOR (OTS) — INSTALLATION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators.

OIL PRESSURE SENSOR (OPS)

General note

The pressure sensor for measuring the oil pressure is screwed into the ignition housing.

NOTE

The pressure sensor has a range from 0 to 10 bar (0–145 psi). This indicator can be seen on the circumference of the pressure sensor.

ATTENTION

The pressure range of the display device must match the pressure range of the pressure sensor. Otherwise the oil pressure will not be displayed correctly.

ATTENTION

The temperature must be within the specified operating temperature range.

See relevant Operators Manual for the 915 i A Series.

OIL PRESSURE SENSOR (OPS) — REMOVAL

Step	Procedure
1	To do this, see Chapter 76-70-00 section Pressure Sensor-removal.
2	Clean the thread of the pressure sensor.

OIL PRESSURE SENSOR (OPS) — INSPECTION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators inspection.

OIL PRESSURE SENSOR (OPS) — INSTALLATION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators-installation.

COMPONENT REPAIR

THREAD REPAIR

Magnetic drain plug

See Maintenance Manual Line for the engine type 915 i A Series .

NOTE

It is possible to repair the thread of the magnetic plug in the crankcase with a HeliCoil.

Drain plug

See Maintenance Manual Line for the engine type 915 i A Series .

MACHINED AREAS

ATTENTION

The sealing surfaces on oil pump components must not be repaired! If damage to these sealing surfaces is found, the corresponding component must be replaced with a new part.

- Machine areas on lubricant supply components (oil pump cover) up to a maximum of 0.3 mm (0.0118 in.).
- The indentations must not have sharp edges! Remove sharp edges carefully with a sharpening stone. Damage limits must not be exceeded!

Chapter: 80–00–00
ELECTRIC STARTER

TOPICS IN THIS CHAPTER

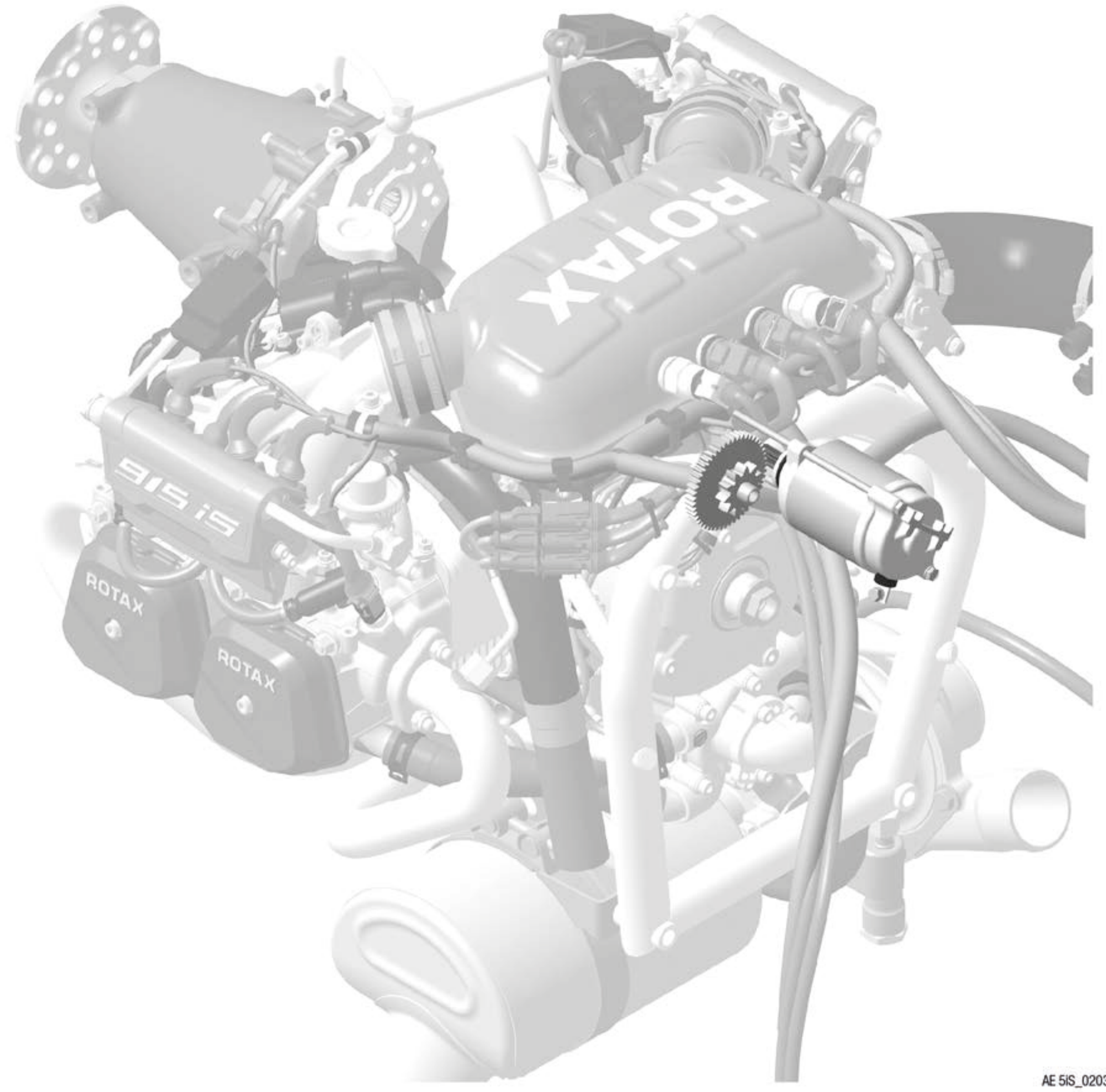


Figure 23.1

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE 8151	297434

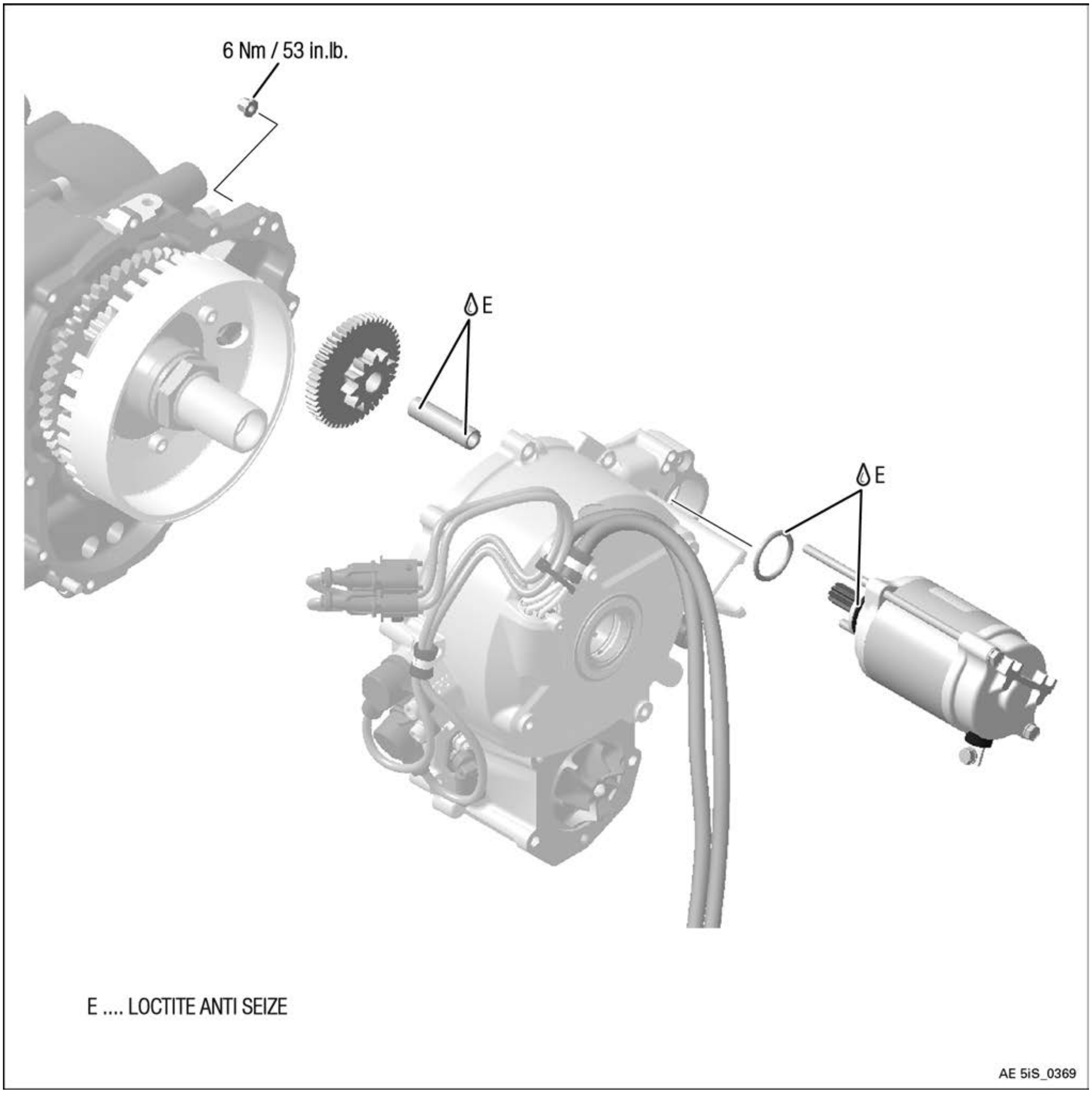


Figure 23.2: Electric starter

SYSTEM DESCRIPTION

The electric starter is a DC motor with a permanent magnet and carbon brushes. The geartooth system of the armature shaft is permanently engaged in the idler gear. During the starting process the sprag clutch forms a connection to the crankshaft via the idler gear and free wheel gear. As soon as the engine speed is higher than the speed generated by the electric starter, the sprag clutch breaks the connection.

SAFETY INSTRUCTION

⚠ WARNING
Danger of severe burns and scalds! Always allow the engine to cool down to ambient temperature before starting any work.

ATTENTION
Danger of damage to engine! There is a risk of short circuits and cable fires during work on the electric starter!

- All installation work on the electric starter must be carried out with the engine switched OFF and the battery (negative pole) disconnected!
- Starter Master and Lane selector switches must be "OFF"!

MAINTENANCE

As well as the maintenance and special checks, see Maintenance Manual Line for the engine type 915 i A Series .

ELECTRIC STARTER

Preparation

- Starter, Master and Lane selector switches must be "OFF"!
- Disconnect the battery (negative pole)

ELECTRIC STARTER — REMOVAL

Step	Procedure
1	Disconnect the positive pole on the electric starter.

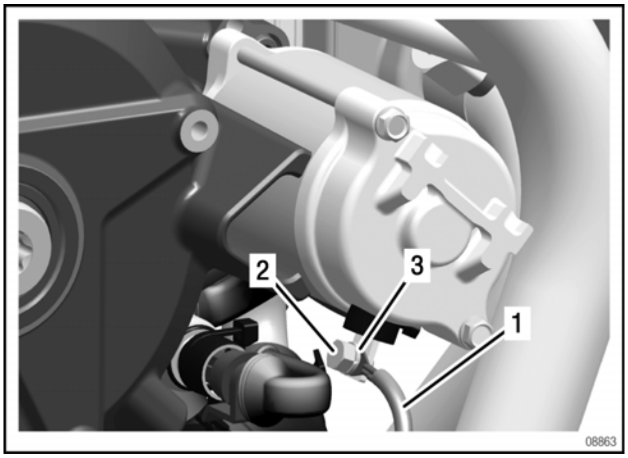


Figure 23.3: TYPICAL

1	*Positive (+) cable*	2	*Hex. screw*
3	*Washer*		

ATTENTION

Hold the M5x145 hex. screw still with a suitable tool. If the hex. screw is turned, then the electric starter itself is unscrewed!Do not unscrew or remove the long M5 screws!

Step	Procedure
2	Loosen the 2 hex. nuts M5 on the rear of the crankshaft housing.

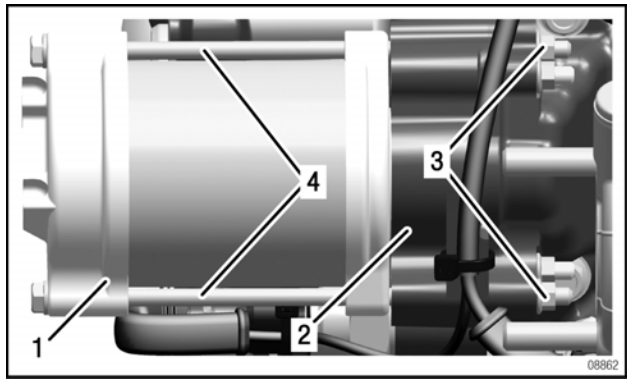


Figure 23.4

1	*Electric starter*	2	*Crankshaft housing*
3	*Hex. nuts M5*	4	*Hex. screw M5 x 145*

ATTENTION

Do not tap the electric starter with a hammer, the adhering magnets can come off.

NOTE

If the O-ring (fig. 3) sticks, first press the electric starter gently down with a screwdriver and then pull off the starter by hand.

ELECTRIC STARTER INSPECTION

ATTENTION
Disassembly of starter assy. is not allowed!

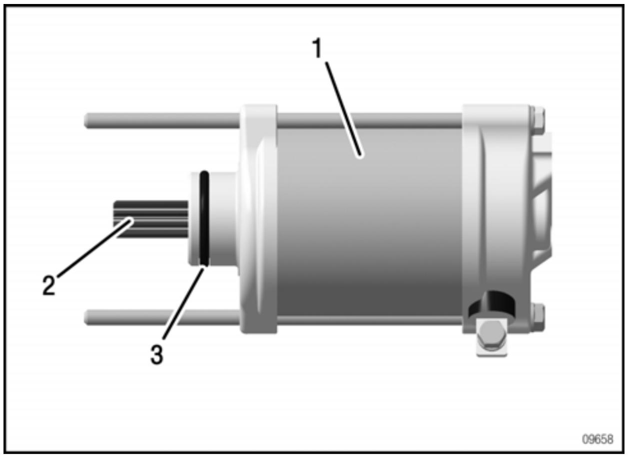


Figure 23.5

1	*Electric starter*	2	*Rotor*
3	*O-Ring*		

ELECTRIC STARTER — INSTALLATION

Preparation

- Check that the O-rings are securely fitted on the bearing flange.
- Lightly grease the O-ring on the bearing flange and the centring bore in the ignition housing with LOCTITE ANTI SEIZE.

ATTENTION
Ensure that the electric starter is in the correct installation position.

Step	Procedure
1	Push the whole electric starter into the ignition housing. **NOTE** *Propeller may need to be slowly rotated to align gears.*
2	Tighten the hex. nuts M5 equally. Tightening torque 6 Nm (53 in. lb.).
3	Connect the positive pole on the electric starter.

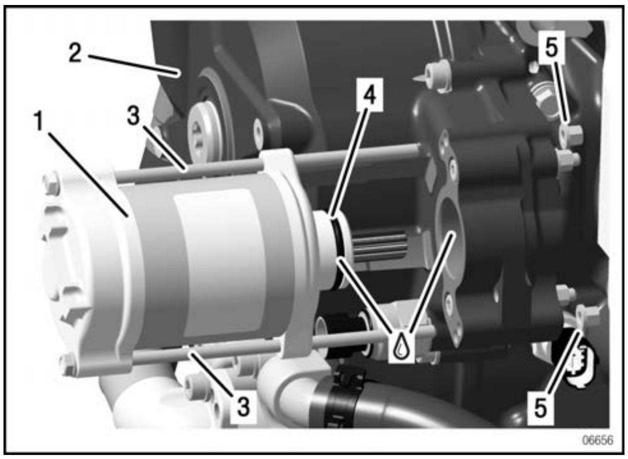


Figure 23.6: TYPICAL

1	*Electric starter*	2	*Ignition housing*
3	*Hex. screw M5*	4	*O-Ring*
5	*Hex. nut M5*		

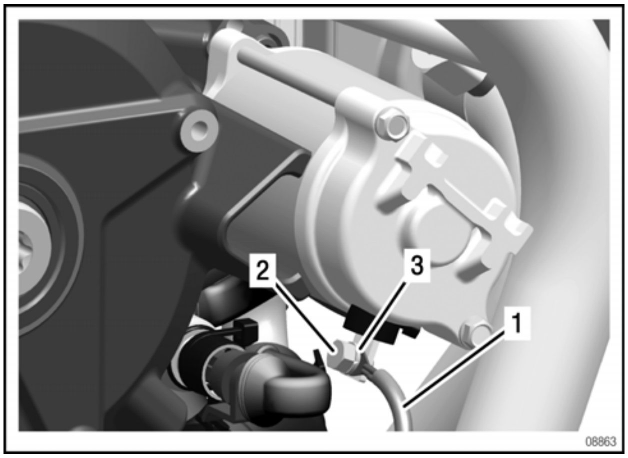


Figure 23.7: TYPICAL

1	*Positive (+) cable*	2	*Hex. screw*
3	*Washer*		

FINISHING WORK

- Connect the negative terminal of the aircraft battery.

Carry out an engine test run. See Maintenance Manual Line for the engine type 915 i A Series .

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