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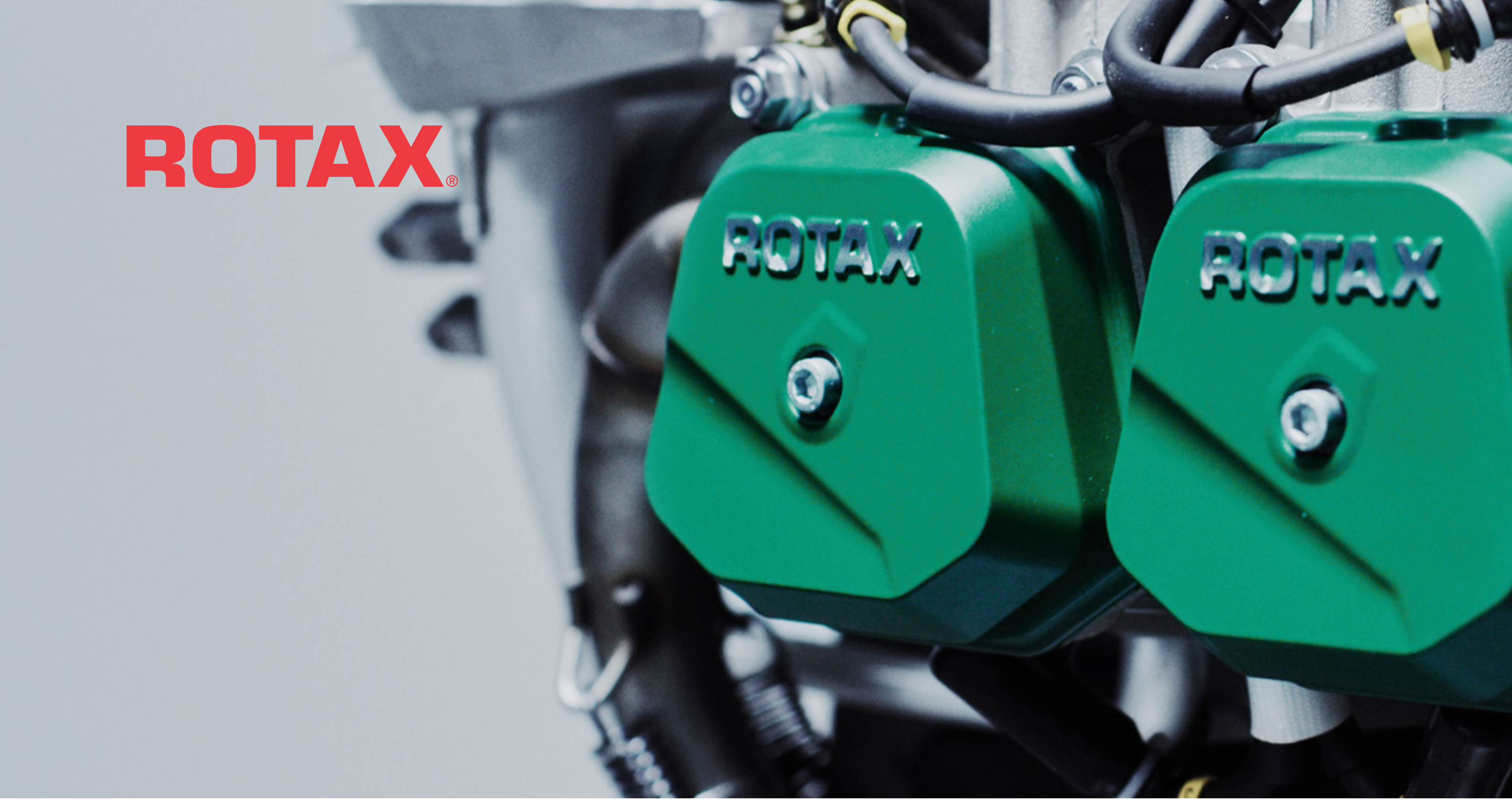

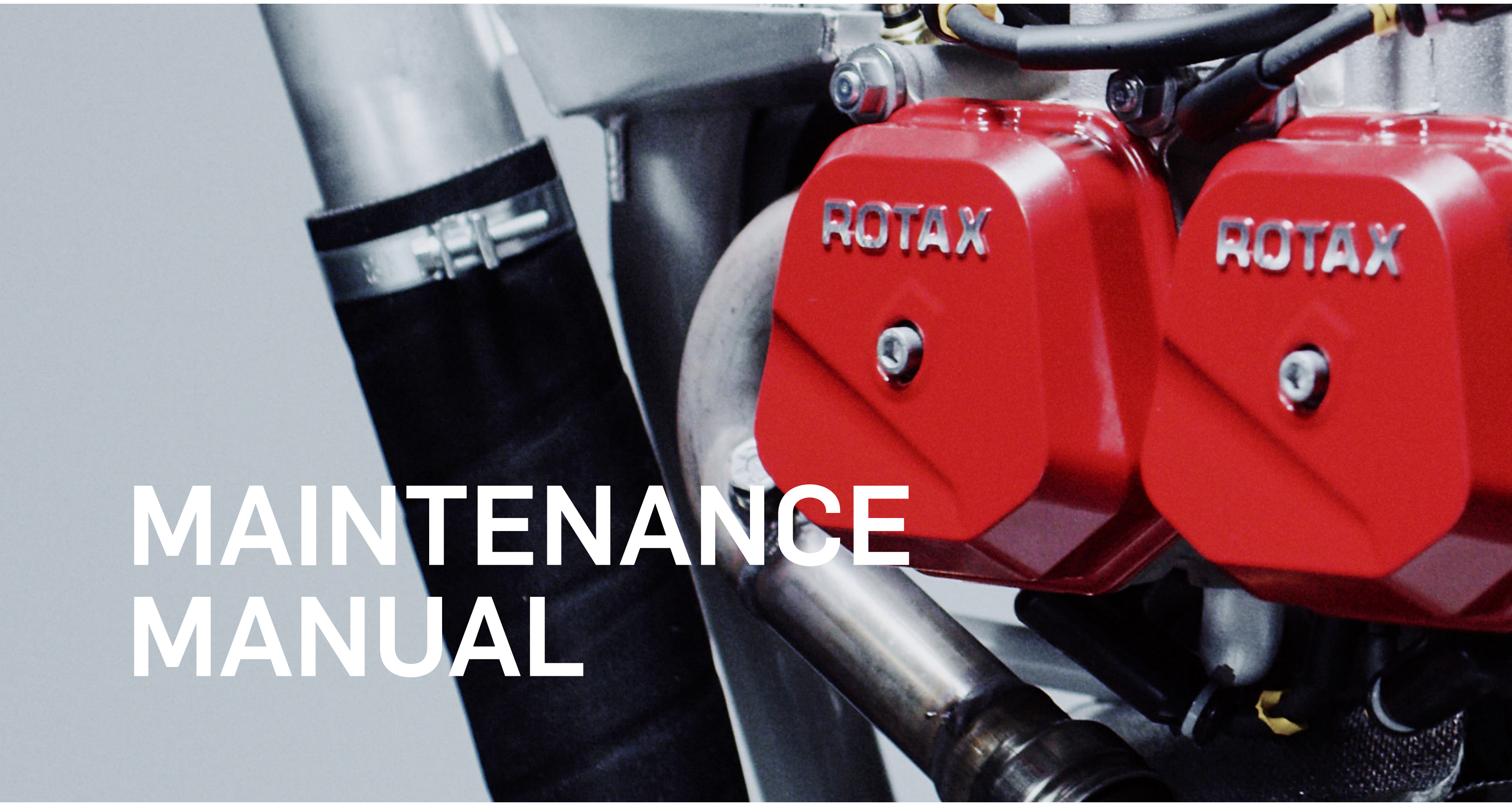

MAINTENANCE MANUAL

FOR ROTAX® ENGINE TYPE 912 AND 914 SERIES

HEAVY MAINTENANCE | REF. NO.: MMH-912 / MMH-914 | PART NO.: 899195

A BRP BRAND

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 Heavy will have a new List of Effective Pages.

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TABLE OF AMENDMENTS

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

Edition 1/Rev. 0	May 01 2007	Obsolete with Edition 2/Rev. 0, which is a complete re-revision
Edition 2/Rev. 0	Sept. 01 2022	

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Summary of amendments

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

Current Edition 2	Chapter	Page	Date of change	Comment
0	all	all	Sept. 01 2022	new layout, also changes in chapter structure; technical updates

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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 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 side of the ignition housing, magneto side.

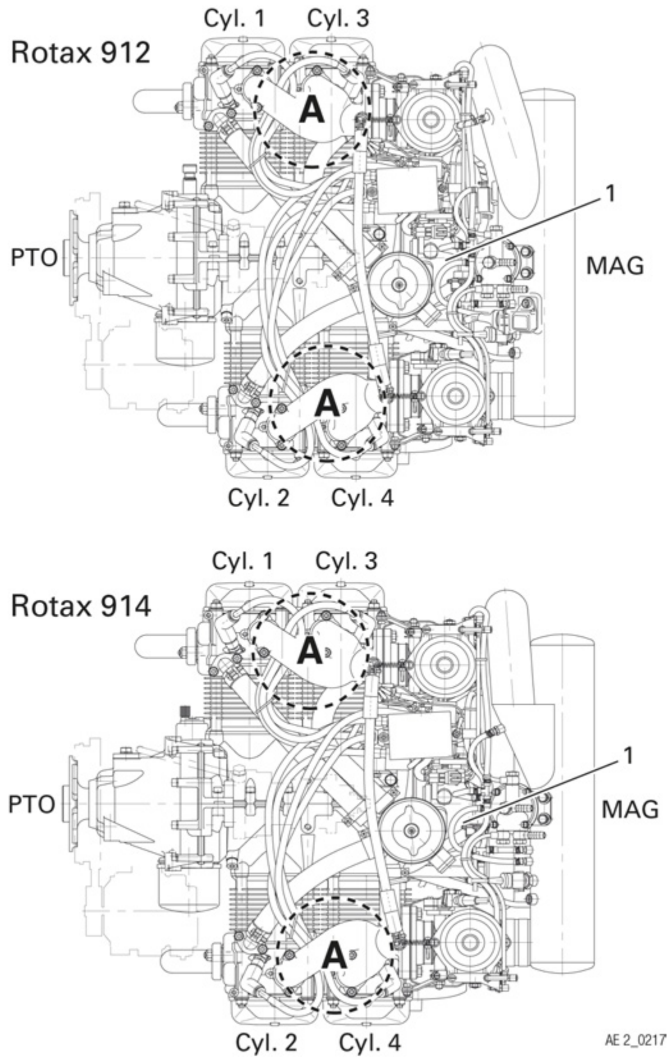

Figure 1.1: Engine serial number

1 *Engine serial number*

A *Engine suspension points*

TYPE DESCRIPTION (912 SERIES)

The type description consists of the following:

e.g. **ROTAX**	**912**	**A**	**2**	**-01**
	type	certification	configuration	Suffix

Designation

Designation		Description
Type	**912**	4 –cyl. horizontally opposed, normal aspirated engine
Certification	**A**	Certified to JAR 22 (TC No. EASA.E.121)
	F, S	Certified to FAR 33 (TC No. E00051 EN) JAR-E (TC No. EASA.E.121)
	UL, ULS	Non-certified aircraft engines
Configuration	**2**	Prop shaft with flange for fixed pitch propeller.
	3	Prop shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller.
Suffix	**–XX**	Explanation of the type designation suffix, see SB-912-068

Options

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

	external alternator	vacuum pump	drive for rev counter/ hour meter	governor
for configuration 2	yes	yes	yes	no
for configuration 3	yes	no	yes	yes

NOTE

Conversion of the configuration 2 to configuration 3 may be accomplished by RO-TAX® authorized aircraft engines distributors or their Independent service centers.

TYPE DESCRIPTION (914 SERIES)

The type description consists of the following parts:

e. g. **ROTAX**	**914**	**F**	**2**	**- 01**
	type	certification	configuration	Suffix

Designation

Designation		Description
Type	**914**	4–cyl. horizontally opposed, turbocharged engine
Certification	**F**	Certified to FAR 33 (TC No. E00058EN), JAR-E (TC No. EASA.E.122)
	UL	Approved according to ASTM F2339
Configuration	**2**	Prop shaft with flange for fixed pitch propeller
	3	Prop shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller
Suffix	**- XX**	Explanation of the type designation Suffix, see SB-914-049.

Options

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

	external alternator	**vacuum pump**	**drive for rev counter/ hour meter**	**governor**
for configuration 2	yes	yes	yes	no
for configuration 3	yes	no	yes	yes

NOTE

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

ENGINE TYPE PLATE

Location

The engine type plate is located on the top of the ignition housing.

NOTICE
Take care not to damage ignition housing, trigger coil wiring or any other engine or airframe components while performing this work.

ENGINE TYPE PLATE — REMOVAL

The following figures show an engine type plate for demonstration purpose only.

Step	Procedure
1	Remove the negative terminal of the battery.
2	Carefully move the ignition pickup and generator shielded wire bundles (A) so that you have clear access to the engine type plate and attachment pins.

NOTE

Depending upon aircraft installation, other items may need to be moved for access.

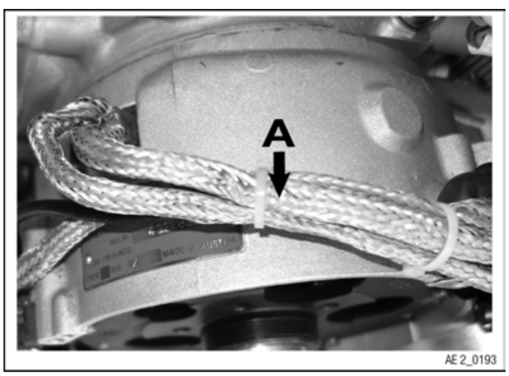

Figure 1.2: Generator wire bundles

Step	Procedure
3	Using a chisel, place the flat face of the chisel against the engine type plate and the edge of the chisel under one of the grooved pins.
4	Gently work the chisel under the head of the grooved pin by tapping with a hammer. Be very careful to not cut the head of the grooved pin.

Figure 1.3: Remove of the grooved pin

Step	Procedure
5	Use the chisel to pry the grooved pin out of the ignition housing.
6	Repeat for the second grooved pin.

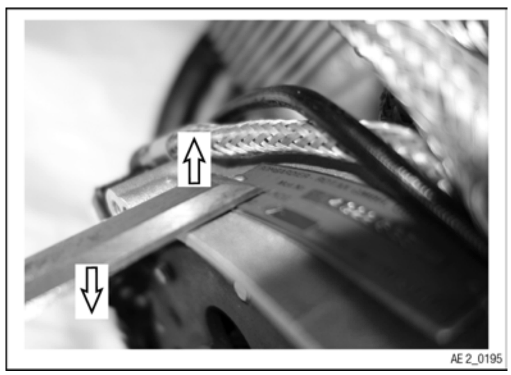

Figure 1.4: Removal of the grooved pin

ENGINE TYPE PLATE — INSTALLATION

NOTE

Always install with new grooved pins.

Step	Procedure
1	Align the hole on the right of the new type plate with the hole in the ignition housing.

Figure 1.5: New engine type plate with pin

1 Grooved pin *2 Engine type plate*

Step	Procedure
2	Place a new grooved pin (part no. 249071) into the hole.
3	Gently hammer the grooved pin into the ignition housing. Be careful to keep the grooved pin perpendicular to the ignition housing.

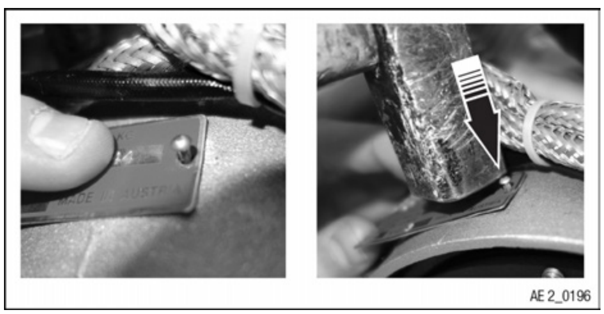

Figure 1.6: Installation of the engine type plate

1 Pin

Step	Procedure
4	Before the first grooved pin is fully inserted, place the second grooved pin into place and gently hammer fully into ignition housing.

Figure 1.7: Installation of the engine type plate

NOTE

To allow access for grooved pin installation, the removal of the carburetor from cylinder side 2/4 may be necessary.
Pay attention to carburetor removal and installation instructions in the Maintenance Manual Heavy (MMH) Chapter 73–00–00 Fuel system.

Step	Procedure
5	Place all wiring back into its original location and replace any tie wraps or other items removed during maintenance.

- Restore aircraft to original operating configuration.
- Connect negative terminal of aircraft battery.

ABBREVIATIONS AND TERMS (DEPENDING ON RESPECTIVE ENGINE TYPE)

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

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

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

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

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

WIRING COLOR CODES

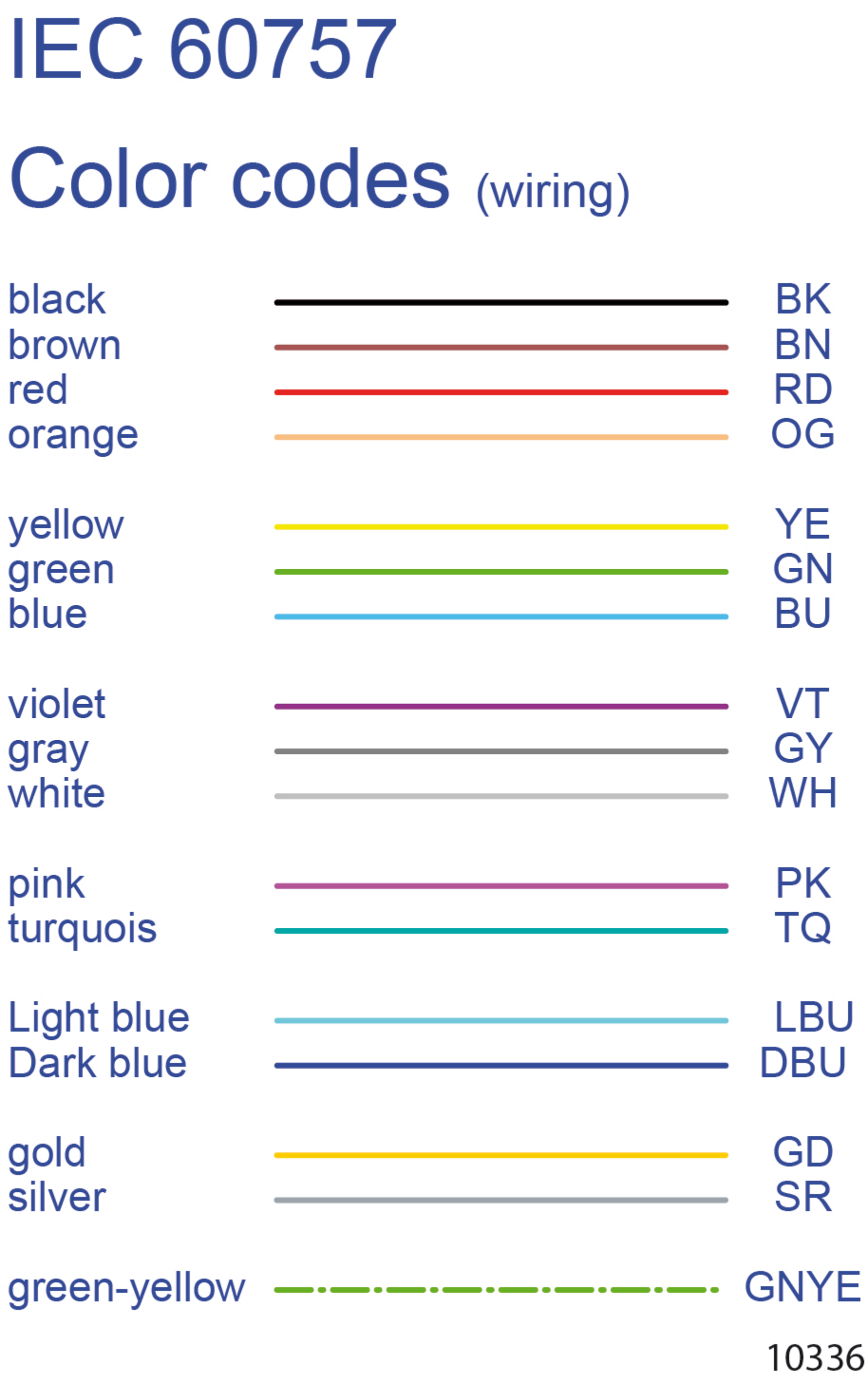

Figure 1.8

CONVERSION TABLE

<table>
<tr><th>Units of length:</th><th>Units of power:</th></tr>
<tr><td>1 mm = 0.03937 in
1 in = 25.4 mm
1 ft = 12 in
= 0.3048 m</td><td>1 kW = 1.341 hp
1 hp = 0.7457 kW
1 kW = 1.3596 PS
1 PS = 0.7355 kW</td></tr>
<tr><th>Units of area:</th><th>Units of temperature:</th></tr>
<tr><td>1 cm^2 = 0.155 sq. in (in^2)
1 sq. in (in^2) = 6.4516 cm^2</td><td>K = °C – 273,15
°C = (°F – 32) / 1,8
°F = (°C x 1.8) +32</td></tr>
<tr><th>Units of volume:</th><th>Units of velocity:</th></tr>
<tr><td>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</td><td>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</td></tr>
<tr><th>Units of mass:</th><th>spec. fuel consumption:</th></tr>
<tr><td>1 kg = 2.2046 lbs.
1 lb. = 0.45359 kg</td><td>1 g/kWh = 0.001644 lb/hph
1 lb/hph = 608.277 g/kWh</td></tr>
<tr><th>Density:</th><th>Units of torque:</th></tr>
<tr><td>1 g/cm^3 = 0.016018 lb/ft^3
1 lb/ft^3 = 62.43 g/cm^3</td><td>1 Nm = 0.737 ft lb
= 8.848 in lb
1 ft lb = 1.356 Nm
1 in lb = 0.113 Nm</td></tr>
<tr><th>Units of force:</th><th>Cable cross-section: Conversion table-Wire Gauge: AWG-mm^2</th></tr>
<tr><td>1 N = 0.224809 lbf
1 lbf = 4.4482 N</td><td rowspan="3">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</td></tr>
<tr><th>Units of pressure:</th></tr>
<tr><td>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</td></tr>
</table>

SAFETY NOTICE

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

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

Revisions

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

Measurement

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

Symbols used

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

NOTE

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

ENVIRONMENTAL NOTE

Environmental notes give you tips on environmental protection.

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

SAFETY INFORMATION

Use for intended purpose

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

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

- This engine is not suitable for aerobatics (inverted flight, etc.). Flight attitudes outside the permissible limits are not allowed
- This engine has exclusively been developed and tested for fixed wing, gyrocopter, pusher and tractor applications. In case of any other usage, the OEM is responsible for testing and the correct function of the engine
- It should be clearly understood that the choice, selection and use of this particular engine on any aircraft is at the sole discretion and responsibility of the aircraft manufacturer, assembler or owner/user
- Due to the varying designs, equipment and types of aircraft, BRP-Rotax grants no warranty on the suitability of its engines use on any particular aircraft. Further, BRP-Rotax grants no warranty on this engines suitability with any other part, component or system which may be selected by the aircraft manufacturer, assembler or user for aircraft application
- Unless correctly equipped to provide enough electrical power for night VFR (according to latest requirement as ASTM), the ROTAX® 914 UL is restricted to DAY VFR only

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

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

- This engine may be equipped with a vacuum pump. The safety warning accompanying the air pump must be given to the owner/operator of the aircraft into which the air pump has been installed

Engine operation

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

INSTRUCTION

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

Safety notice

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

Accessories

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

Spare parts

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

NOTICE

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

Standard tools / Special tools

NOTICE

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

State of delivery

⚠ WARNING

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

See latest Operators Manual (OM) and Service Instruction SI-914-019 and Service Instruction SI-912-016 “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 ROTAX® 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 "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 MML, Chapter 05–00–00 section “Authorized Personnel”) under normal conditions for engine removal and installation. Concerning design of engine installation in depth knowledge of aircraft design is required.
Due to the fast technical progress and fulfillment of particular specifications of the customers it may occur that existing laws, safety prescriptions, constructional and operational regulations may not be sufficient or cannot be transferred completely to the object bought, in particular for special constructions.

Documentation

- Installation Manual (IM)
- Operators Manual (OM)
- Maintenance Manual Line (MML)
- Maintenance Manual Heavy (MMH)
- Overhaul Manual (OHM)
- Illustrated Parts Catalog (IPC)
- Alert Service Bulletin
- 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 (OM), Maintenance Manuals and Illustrated Parts Catalog (IPC).

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

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

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

Illustrations

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

NOTE

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

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

Installation drawings

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

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

USE FOR INTENDED PURPOSE

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

Use

The engine ROTAX® 912 A/F/S / 914 F 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® 912 A/F/S/ 914 F 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® 912 UL/ULS/ULSFR / 914 UL are not type 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.

NOTICE
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".

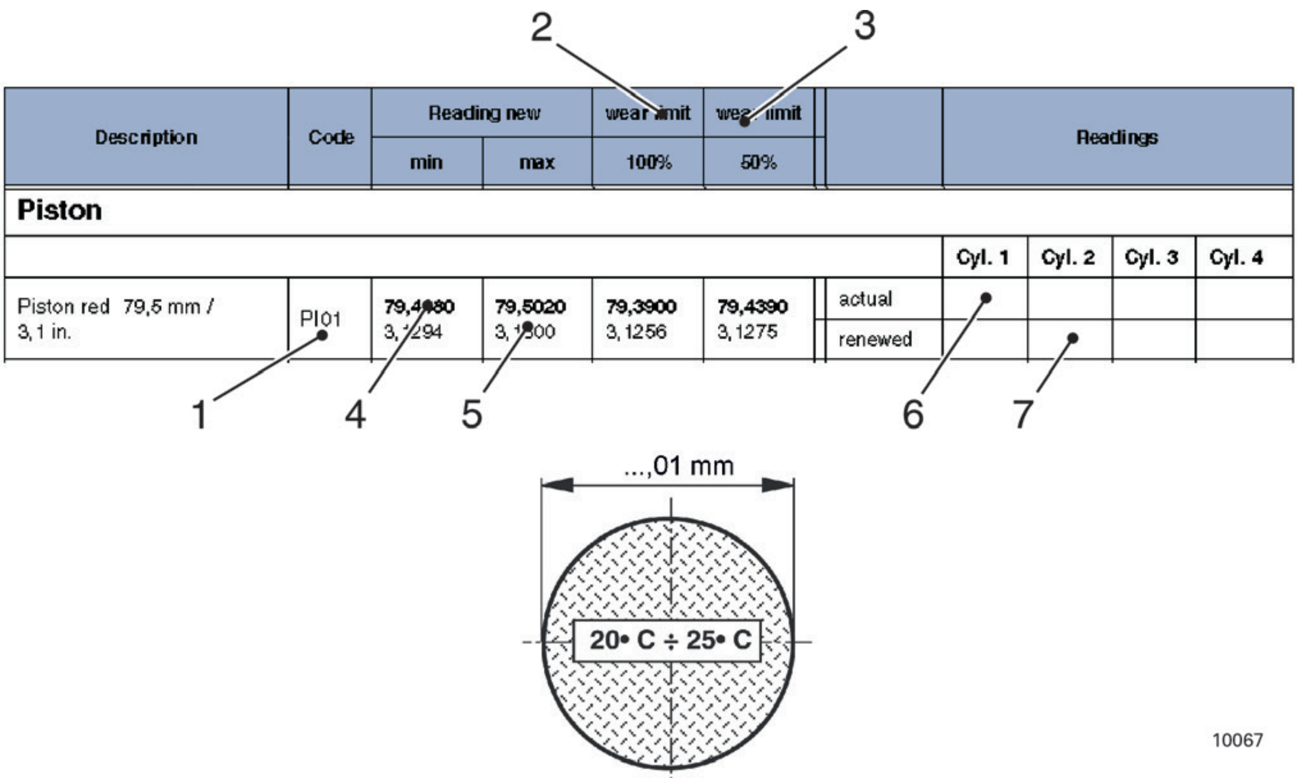

Figure 1.9: EXAMPLE ONLY

- 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	**p**iston **p**in
ST	**st**ator
VT	**v**alve **t**rain
WP	**w**ater **p**ump

NOTICE

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 for engines of Series 912:

TSN [h] Time Since New		**max. permissible wear for repair [%]**	**max. permissible wear for repair [%]**
from	**to**	**TBO 1500 h –**	**TBO 2000 h –**
0	50	4	4
51	100	12	12
101	150	18	18
151	200	24	24
201	250	30	30
251	300	36	36
301	350	42	42
351	400	46	46
401	450	52	52
451	500	56	56
501	550	60	60
551	600	62	62
601	700	68	67
701	800	73	72
801	900	78	76
901	1000	82	80
1001	1100	87	83
1101	1200	90	87

TSN [h] Time Since New		max. permissible wear for repair [%]	max. permissible wear for repair [%]
from	**to**	**TBO 1500 h –**	**TBO 2000 h –**
1201	1300	93	90
1301	1400	96	92
1401	1500	100	94
1501	1600		96
1601	1700		98
1701	1800		98
1801	1900		99
1901	2000		100

The classification is carried out as per following table for engines of Series 914:

TSN [h] Time Since New		max. permissible wear for repair [%]	max. permissible wear for repair [%]
from	**to**	**TBO 1200 h –**	**TBO 2000 h –**
0	50	6	4
51	100	14	12
101	150	24	18
151	200	30	24
201	250	36	30
251	300	44	36
301	350	50	42
351	400	54	46
401	450	60	52
451	500	64	56
501	550	68	60
551	600	72	62
601	700	76	67
701	800	82	72
801	900	87	76
901	1000	91	80
1001	1100	95	83
1101	1200	100	87
1201	1300		90

TSN [h] Time Since New		max. permissible wear for repair [%]	max. permissible wear for repair [%]
from	**to**	**TBO 1200 h –**	**TBO 2000 h –**
1301	1400		92
1401	1500		94
1501	1600		96
1601	1700		98
1701	1800		98
1801	1900		99
1901	2000		100

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

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

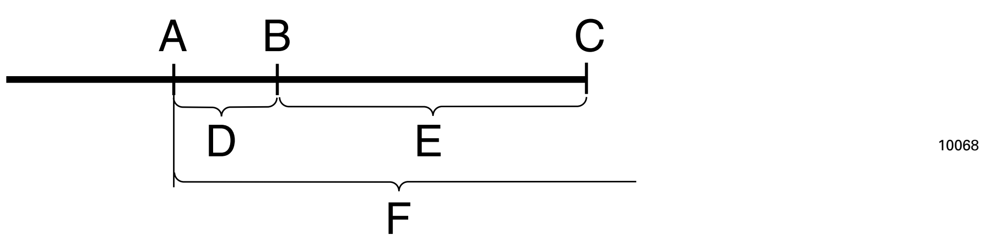

Figure 1.10: Formula

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

NOTICE

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 (OM) 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 (OM) for the engine Type .

Tightening torques

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

Accepted accuracy for different measuring tools:

Torque: +/- 10%

The changes above are accounting for:

- variations/errors of tools (when used in normal operating conditions)
- accuracy of tools and their related tolerance

⚠ 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

NOTICE

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.

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

Calibration

The professional calibration of your torque wrench is an essential prerequisite for ensuring the quality of the tightening torques in the long term. Calibration is also a fundamental part of ISO 9001 certification.

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.

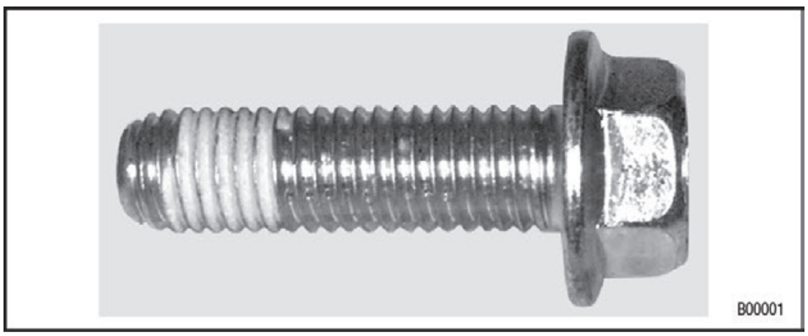

Figure 1.11: Fastener Information

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).

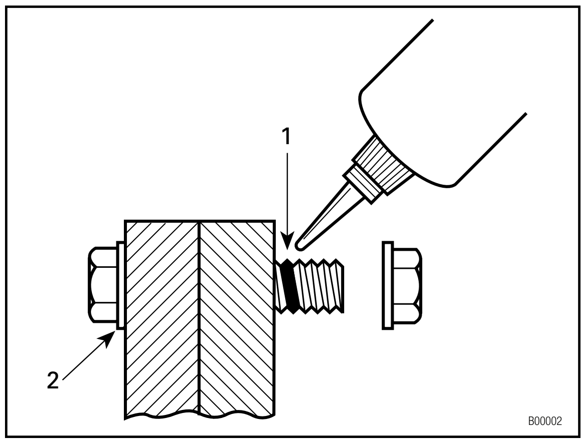

Figure 1.12: Application for uncovered holes (Bolts and nuts)

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.

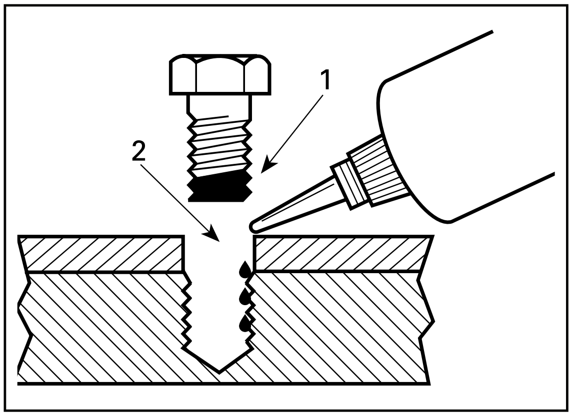

Figure 1.13: Application for blind holes

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.

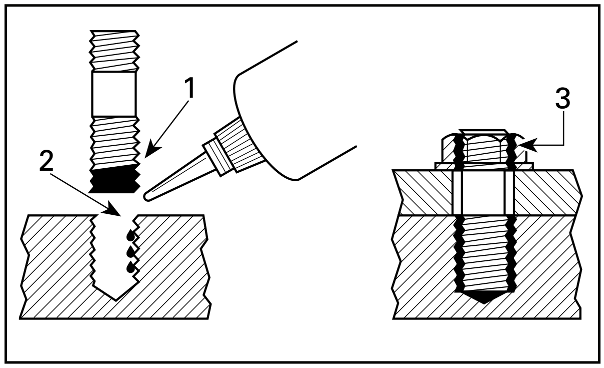

Figure 1.14: Application for stud installation in blind holes

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.

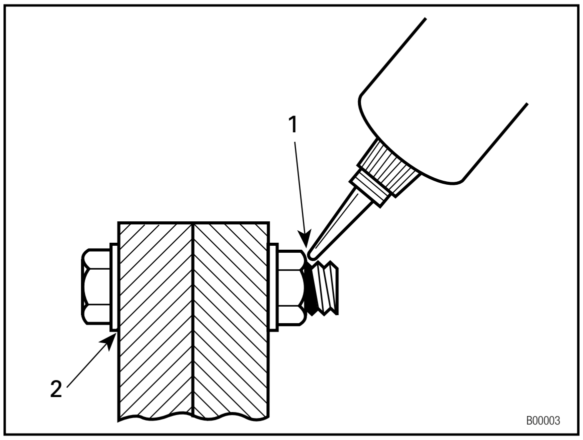

Figure 1.15: Application for pre-assembled parts

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.

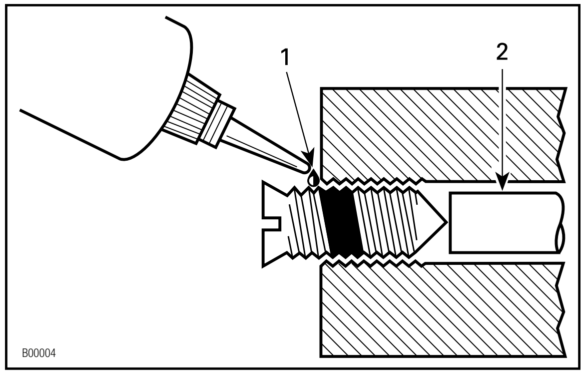

Figure 1.16: Application for an adjustment screw

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).

CONSUMABLE MATERIALS

NOTICE

Use only the specified or technically equivalent materials for all maintenance work.

NOTICE

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.

The materials listed have undergone long term testing and are suitable for all operating conditions indicated by the manufacturer.

NOTE

All lubricants are non certified.

No.	Part no.	Description, application	Qty.
AC	899796	**LOCTITE 577** Medium-strength, general purpose thread sealant for straight/straight and straight/taper threads and fittings	50 ml
AG	897186	**Silicone heat 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** Long-term lubricant for shaft seals	50 ml
F	n.a.	**LOCTITE 7063** For degreasing and cleaning surfaces	AR
H	897870	**FILTER OIL** For optimum filter efficiency and moisture protection	14.8 ml
I	897330	**LITHIUM-BASE GREASE** Electrical isolating	250 g

No.	Part no.	Description, application	Qty.
M	297433	**MOLYKOTE G-N** Solid lubricant paste for the assembly and running-in of metal components	100 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
Q	297386	**Silastic 732 RTV** One-component silicone adhesive/sealant	100 g
V	898570	**Locking paint**	20 ml
Z	899789	**LOCTITE 603** Oil tolerant retaining compound, heavy-duty	10 ml

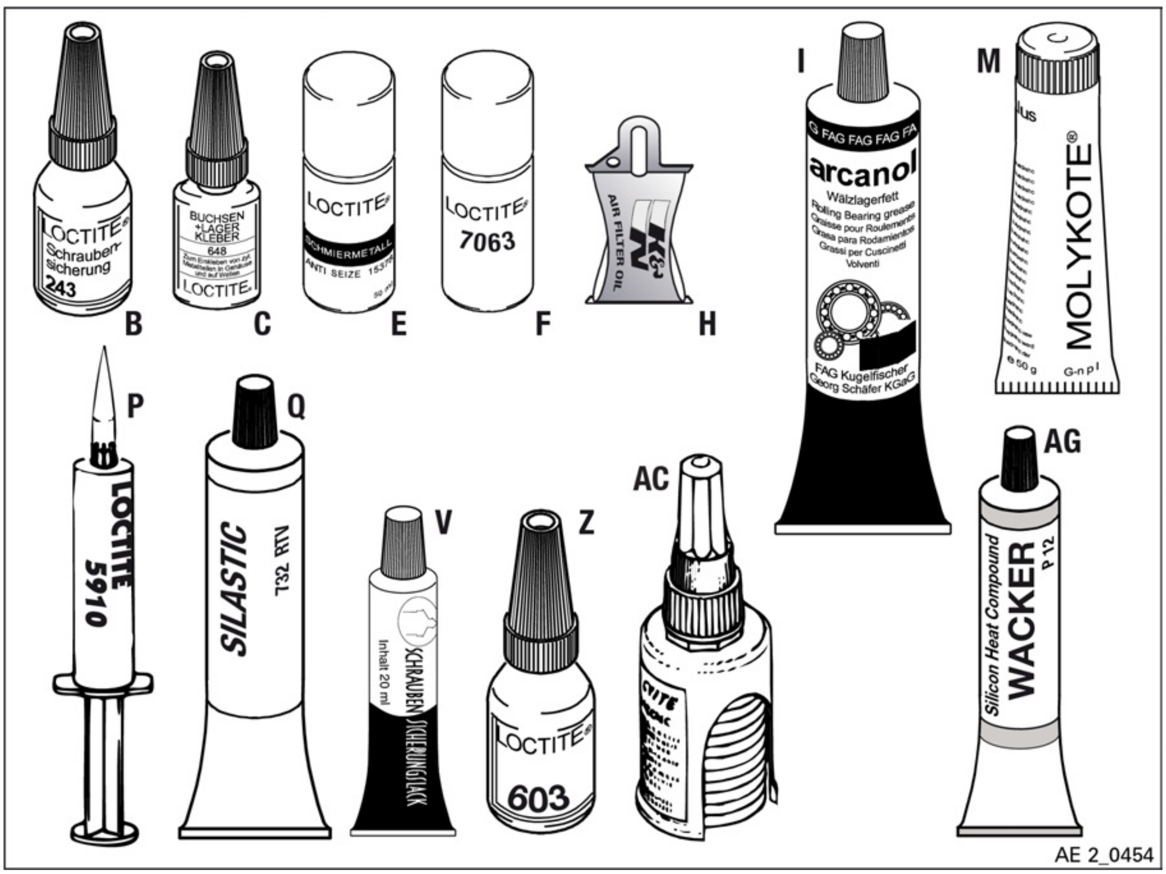

Figure 1.17: Lubricant tools

Additional materials

NOTICE

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** Use suitable cleaning agent. 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.	**Flexible web for surface finishing 3M Scotch-Brite Multi Flex - very fine or ultra fine (or equivalent)** 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
5	n.a.	**MS4 / DC4 corning #4 (or equivalent)** Electrical insulation compound for protection of electrical connections.	AR

No.	Part no.	Description, application	Qty.
6	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
7	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

NOTICE

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

- Differential 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
- Screw extractor set
- Torque wrench from 0 to 300 Nm (0 to 221 ft.lb)
- Magnetic particle tester – testing to be performed in accordance with ASTM E1444 (current edition)

NOTICE
Obey the manufacturers instructions!

Disassembly device

- Disassembly device for propeller gearbox
  Fig. shows one possible tensioning device for the disassembly of the propeller gearbox. The dimensions given are only intended for easier orientation and are not binding.

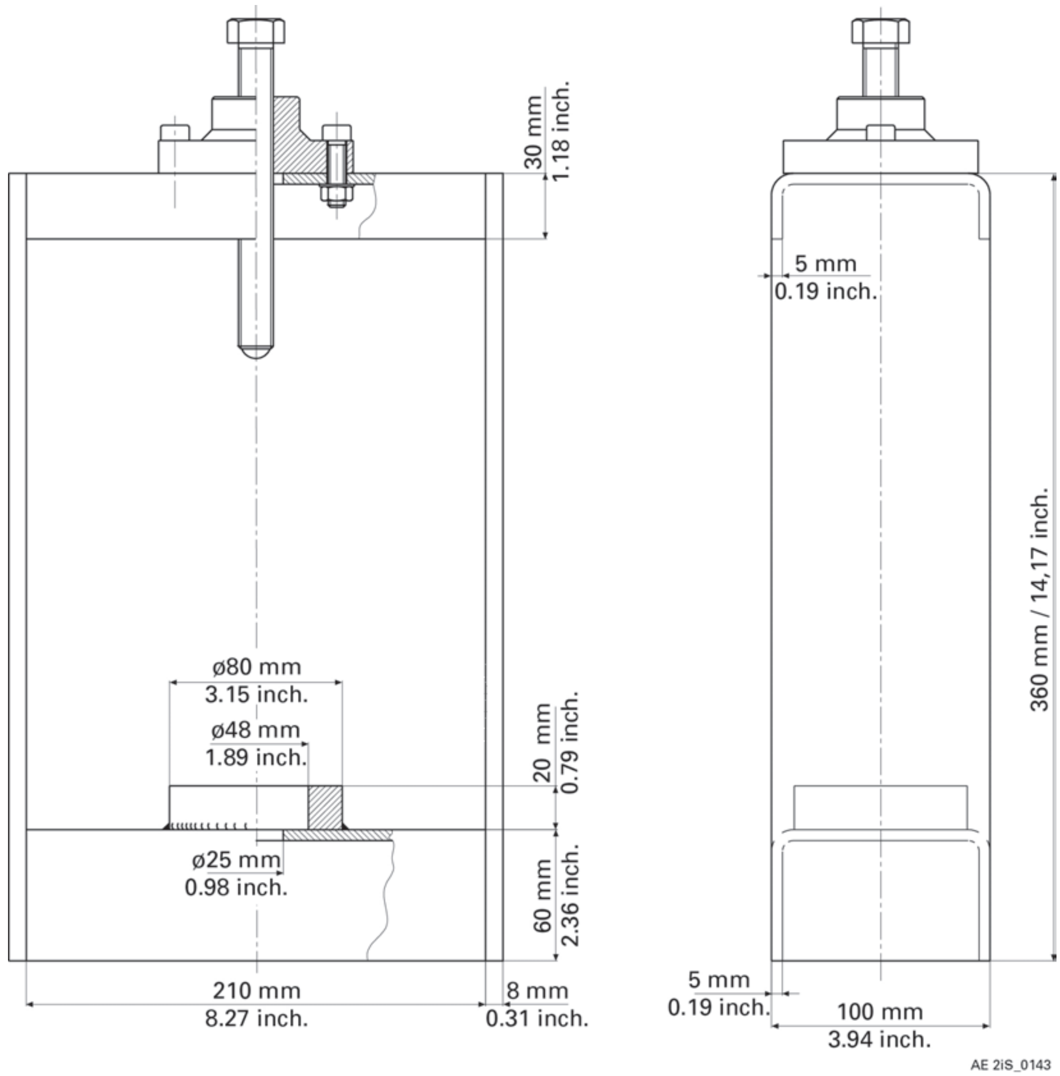

Figure 1.18: Disassembly device

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).

Accepted accuracy for different measuring tools:

Pressure: +/- 5%

Distances:

- Inside micrometer or similar: +/- 0.01 mm (0.0004 in.)
- Digital caliper or similar: +/- 0.001 mm (0.00004 in.)
- Bow micrometer or similar: +/- 0.002 mm (0.000079 in.)
- Caliper or similar: +/- 0.03 mm (0.0012 in.)

The changes above are accounting for:

- variations/errors of tools/measurement instruments (when used in normal operating conditions)
- accuracy of tools/measurement instruments and their related tolerance

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

Oscilloscope:

TEKTRONIX 2225 or equivalent

- 2 channels
- Analog
- Sensitivity 5 mV to 5V/div
- Frequency limit 50 MHz

Chapter: 24–20–00
INTERNAL GENERATOR

TOPICS IN THIS CHAPTER

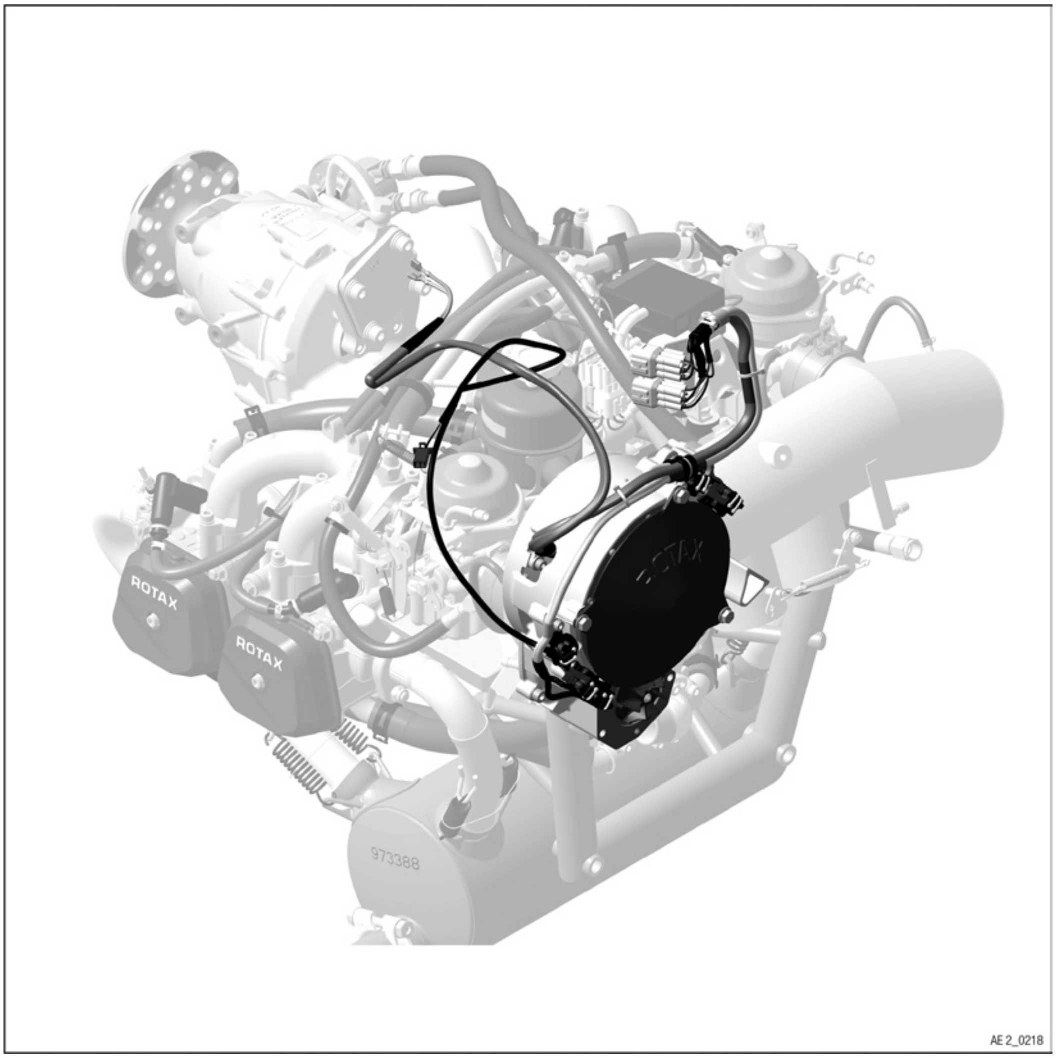

Figure 2.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Thread bolt M8x50	240880
Puller assy.	877377
Puller assy.	877375
Protection mushroom	877417
Insertion jig assy.	877270
Guide sleeve	877360
Pin release tool	877500

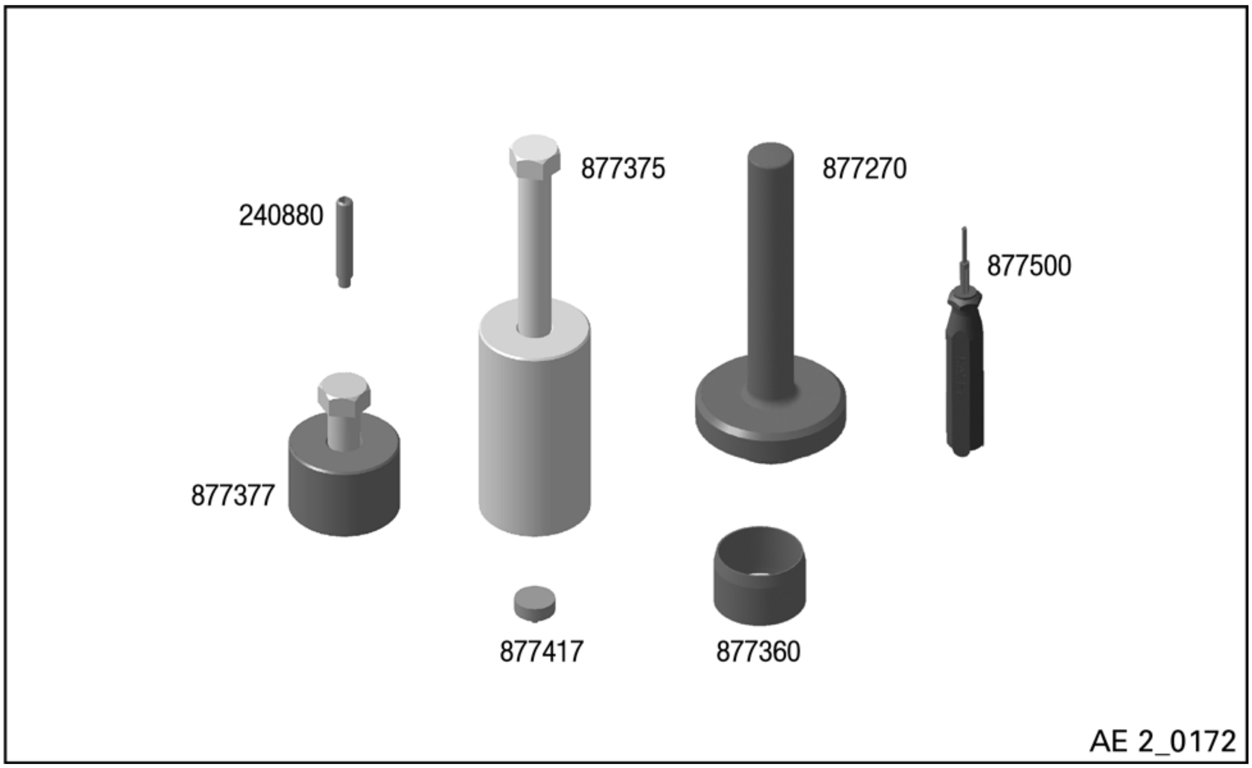

Figure 2.2: Special tools

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 5910	899791
LITHIUM-BASE GREASE	897330
Engine oil	n. a.

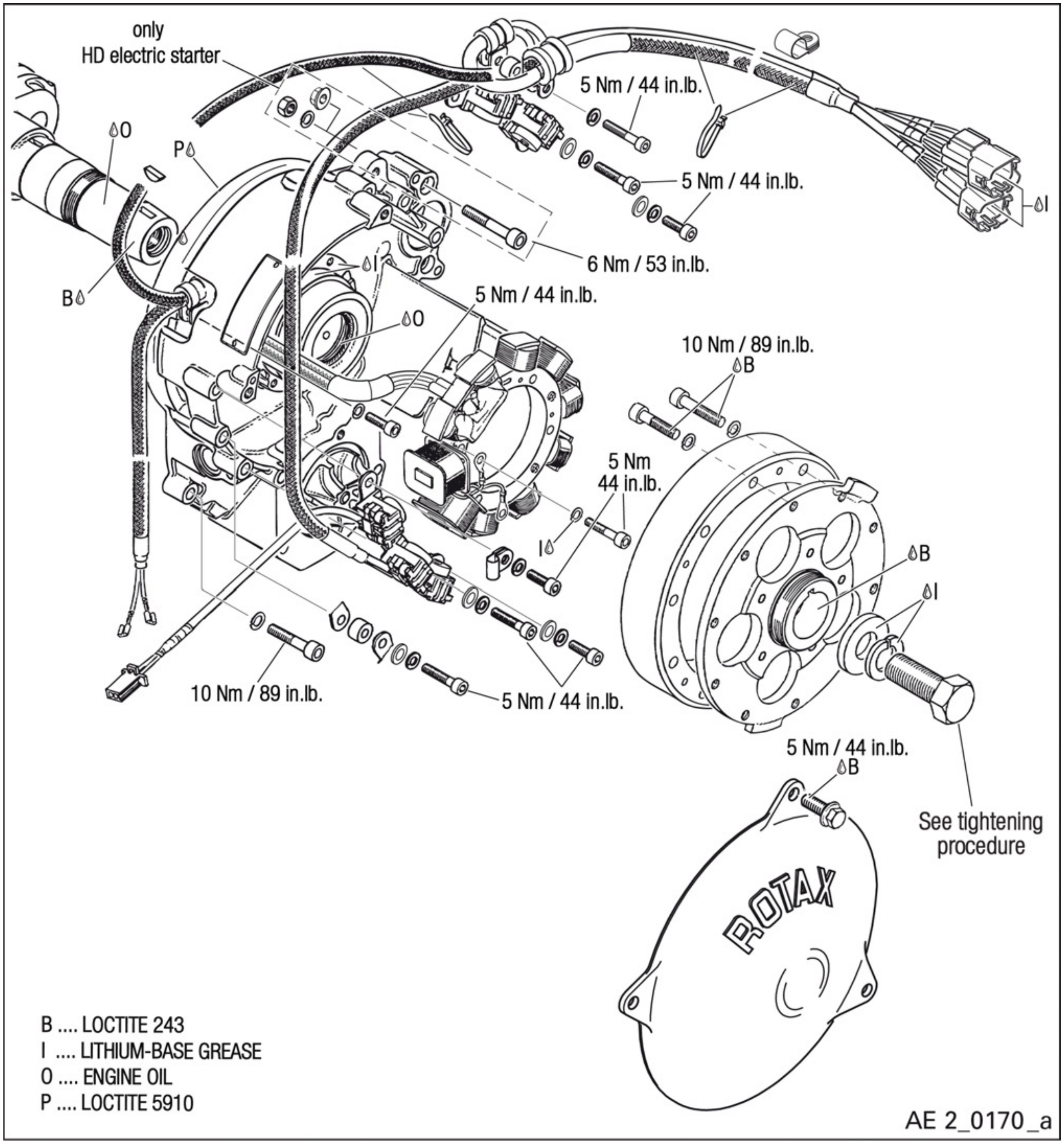

Figure 2.3: Service products

SYSTEM DESCRIPTION

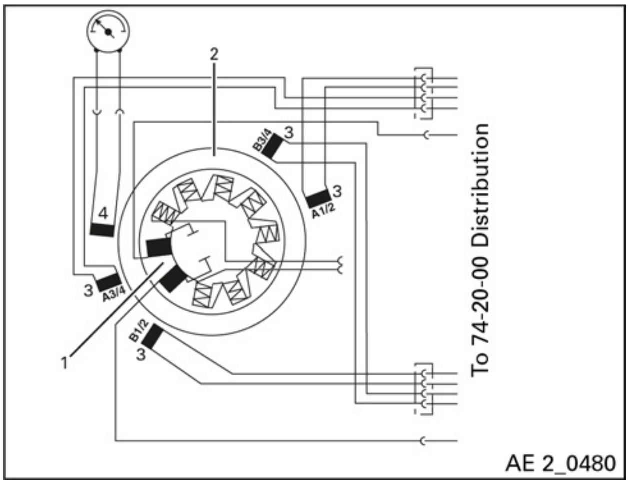

Figure 2.4

1	*Charging coils*	2	*Ignition magneto generator*
3	*Trigger coils*	4	*Electronic rev counter*
5	*AC generator*		

The ROTAX® engines of 912 / 914 Series are equipped with a breakerless dual ignition system (DCDI-Dual Capacitor Discharge Ignition).
The ignition unit needs no external power supply. Each of the two independent charging coils located on the generator stator supplies one of two ignition circuits. The energy is stored in capacitors of the SMD-electronic modules. At the moment of ignition, 2 each of the 4 external trigger coils actuate the discharge of the capacitors via the primary circuit of the double ignition coil assy..

NOTE

The standard equipment also includes an integrated AC generator with an external rectifier-regulator (12 V DC 250 W).
For higher power requirements, it is possible to install an external alternator (12 V 600 W).

NOTE

A rectifier-regulator is already integrated in the external alternator.

FIRING ORDER
1 – 4 – 2 – 3

ELECTRIC SYSTEM

The electric system comprises the internal generator with the charging coils for the ignition and the ignition electrics with the electronic boxes and the 4 double ignition coils.

INTERNAL GENERATOR
Consisting of stator with 8 generator coils and the independent ignition charging coils and the 10-pole magneto ring.
The fly wheel hub (ignition triggering) is attached to the magneto ring.
The 4 trigger coils are fitted externally on the alternator.

CHARGING COILS
The two independent charging coils arranged on the stator each supply one of the two ignition circuits.
The energy is stored in capacitors of the electronic modules.
At the moment of ignition, 2 each of the 4 external trigger coils actuate the discharge of the capacitors via the primary circuit of the double ignition coil assy.

NOTE

The 5th trigger coil is provided for the rev counter signal.

ELECTRONIC REV COUNTER
On the ignition housing there is an inductive pick-up triggering one each positive or negative impulse at every turn of the crankshaft. The optional rev counter is a specially adapted AC device.

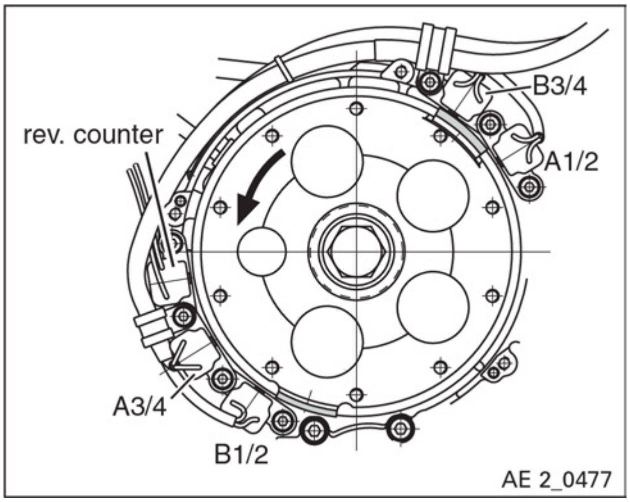

Figure 2.5

IGNITION ELECTRIC

Consists of 4 double ignition coils assy. connected together by their magnetic cores and two electronic modules positioned above.
The 3-point suspension is with one each support on crankcase, ignition housing and intake manifold.
For safety reasons, the ignition electrics must not be exposed to ambient temperatures higher then 80 °C (176 °F).

SAFETY INSTRUCTION

⚠ WARNING

Danger of electric shock! Switch off the ignition and pull out the ignition key! Disconnect the negative terminal of the battery.

⚠ 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 Chapter 00-00-00, section Safety Information.

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

REMOVAL

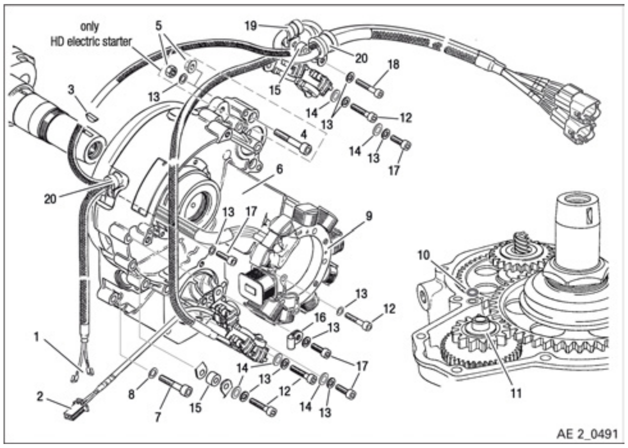

Figure 2.6

1	*Connector plug alternator cable*	2	*Connector plug control wiring for electric rev. counter*
3	*Woodruff key*	4	*Allen screw M5x45*
5	*Hex. nut M5 or collar nut M5*	6	*Ignition housing*
7	*Allen screw M6x30*	8	*Lock washer*
9	*Stator assy.*	10	*O-ring*
11	*Thrust washer*	12	*Allen screw M5x25*
13	*Lock washer*	14	*Washer*
15	*Spacer*	16	*Cable clamp 7/M5*
17	*Allen screw M5x16*	18	*Allen screw M5x30*
19	*Cable clamp 8/M5*	20	*Cable clamp 15/M5*

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

NOTICE

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 (MML) for the respective engine type.

Engine cleaning.
See Maintenance Manual Line (MML) for the respective engine type.

Carry out an engine test run.
See Maintenance Manual Line (MML) for the respective engine type.

Preparation

NOTICE

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

Drain coolant. See current Maintenance Manual Line (MML) for the respective engine type.

Drain oil. See current Maintenance Manual Line (MML) for the respective engine type.

- Remove coolant hoses from cylinder head, water inlet elbow and water pump housing. To do this, see Chapter 75-00-00 section Water pump housing — removal.
- Remove mechanical rev counter assy., if installed. To do this, see Chapter 75–20–00 Mechanical rev. counter – removal.
- Remove the electric starter, see Chapter 80-00-00 Electric starter – removal

NOTE

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

FLY WHEEL HUB — REMOVAL

Preparation

Lock crankshaft.
See current Maintenance Manual Line (MML) for the respective engine type.

Step	Procedure
1	Release the 3 hex. screw and remove the ignition cover.

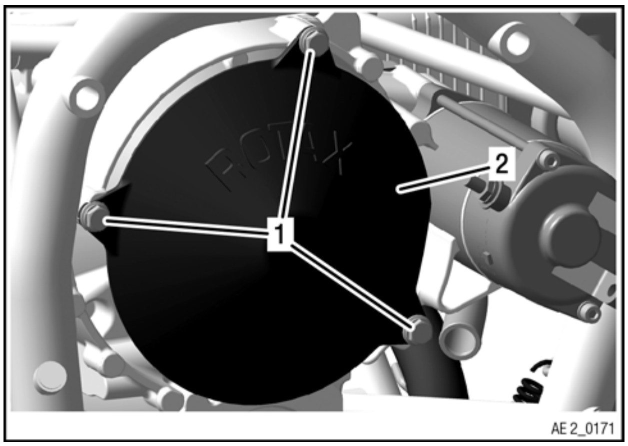

Figure 2.7

1 Hex. screw *2 Ignition cover*

Step	Procedure
2	Remove hex. screw together with lock washer and washer.
3	Place protection mushroom, part no. 877417, on crankshaft, screw puller, part no. 877375, fully onto the thread.
4	Press off fly wheel hub together with magneto ring with the hex. screw of the puller.

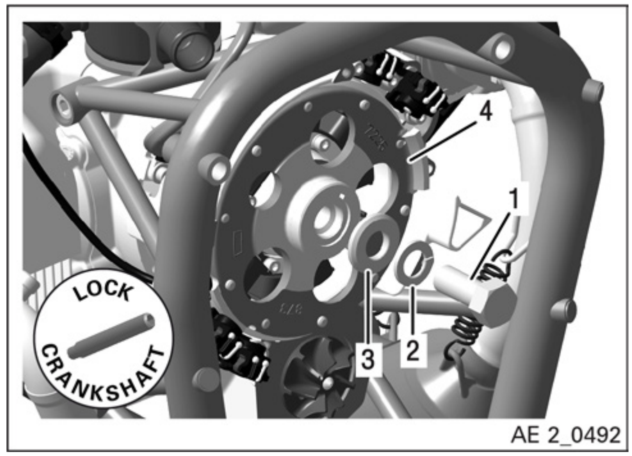

Figure 2.8

1 Hex. screw *2 Lock washer*
3 Washer *4 Fly wheel hub assy.*

NOTE

Store the fly wheel hub assy. in a bag so that no foreign objects can be attracted by the magnet.

IGNITION HOUSING – REMOVAL

Step	Procedure
1	Cut the cable tie. Unscrew Allen screw at the SMD-electronic module and remove cable clamp and grounding cable.
2	Unscrew hex. nut and remove rubber buffer from the bracket. Then remove the spacer.
3	Mark the two plug connections of the trigger coil cables and plug connection of the red charging cable and remove them from the connector bracket and unplug connection.

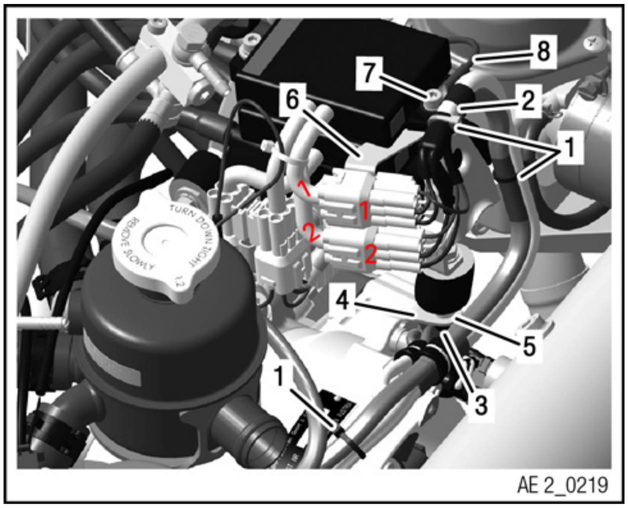

Figure 2.9

1	*Cable tie*	2	*Cable clamp*
3	*Hex. nut*	4	*Bracket*
5	*Spacer*	6	*Connector bracket*
7	*Allen screw*	8	*Grounding cable*

Step	Procedure
4	Detach both plug connectors of the generator cable and the control wiring for the electronic rev. counter.

NOTE

Decide whether the stator may remain in the ignition housing. Otherwise remove the cable clamps and remove the stator.

Step	Procedure
5	Remove the woodruff key from the crankshaft.

NOTE

Cover the groove for the woodruff key with a protective tape to avoid damage to the oil seal.

Step	Procedure
6	(HD electric starter only) Remove the two Allen screws M5x45 with cap nut M5 or hex nut M5 with lock washer.
7	Remove the seven Allen screws from the ignition cover on the bottom side of the ignition cover from the crankcase.
8	A smart blow with a mallet will separate the ignition cover from the crankcase so that it can be taken off.
9	Remove the O-ring.

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.

NOTE

The thrust washer of the intermediate starter gear may be stuck on the rear side of the ignition housing.

TRIGGER COIL KIT, ELECTRONIC REV COUNTER AND STATOR — REMOVAL

NOTE

For removal of trigger coil kit, electronic rev counter and Stator, the ignition housing need not be removed.

Step	Procedure
1	Remove the attachment screws M5, lock washers, washers and spacer.
2	Remove the cable clamps. **NOTE** *The stator need not be removed in this case.*
3	Remove 8 Pins (cable blue and white) from the connector housing with pin re-leases tool part no. 877500
4	Remove trigger coil kit and electronic rev counter from ignition housing.

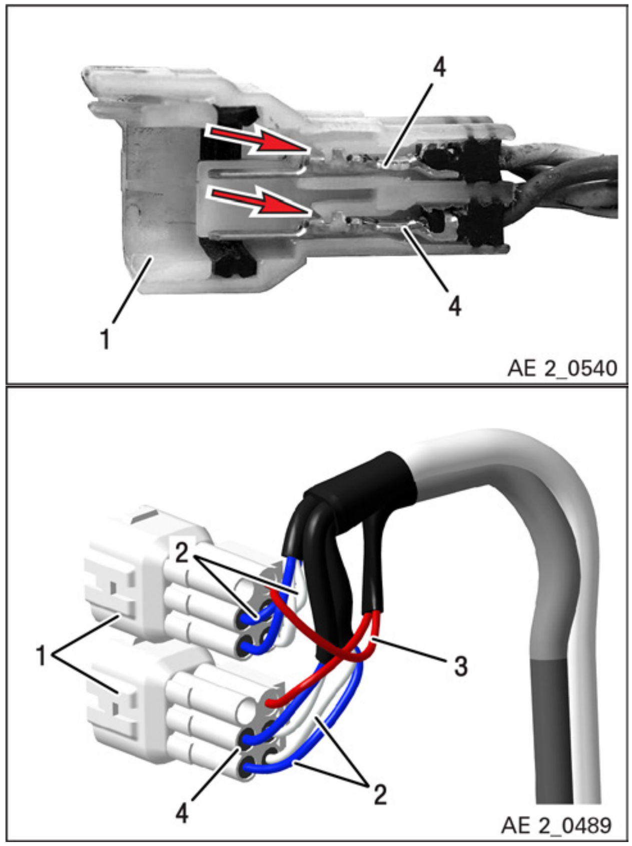

Figure 2.10

1	*Connector housing*	*2*	*Trigger coil cables (blue/white)*
3	*Charging cables (red)*	*4*	*Pins*

NOTE

Because of the shielding, the trigger coil kit can be exchanged only as a complete set.

Step	Procedure
5	If necessary, unscrew Allen screw with washer and remove bracket.
6	Remove four Allen screws and lock washers.
7	Remove the cable clamp from ignition housing.

Step	Procedure
8	Remove 2 pins (cable red) from the connector housing with pin release tool part no. 877500.
9	Remove stator assy. from ignition housing.

NOTE

Repair of the stator is not allowed.

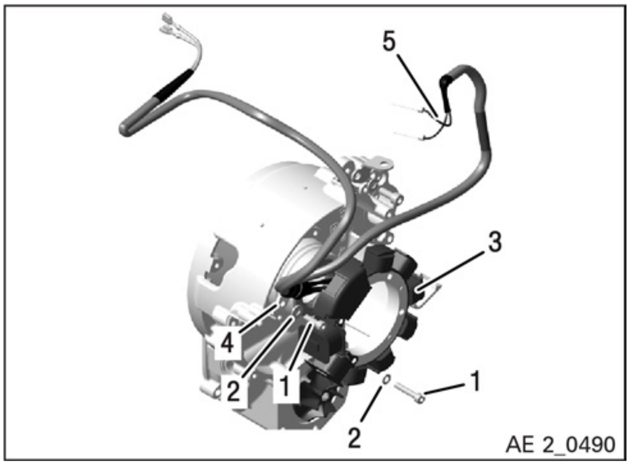

Figure 2.11

1	*Allen screw*	2	*Lock washer*
3	*Stator assy.*	4	*Cable clamp*
5	*Charging cables (red)*		

INSPECTION

Preparation

Clean all parts carefully. See current Maintenance Manual Line (MML) for the respective engine type.

General visual inspection. See current Maintenance Manual Line (MML) for the respective engine type.

IGNITION HOUSING — INSPECTION

Step	Procedure
1	Carry out visual inspection of sealing surfaces.
2	Blow compressed air through the lubrication bore and check it is clear.
3	Measure the bearing bore Ø 32 mm (1.26 in) of the bearing bushing (dimension IH01) for the crankshaft bearing (dimension CS05) and determine clearance. (see Section Wear limits figure Ignition housing)

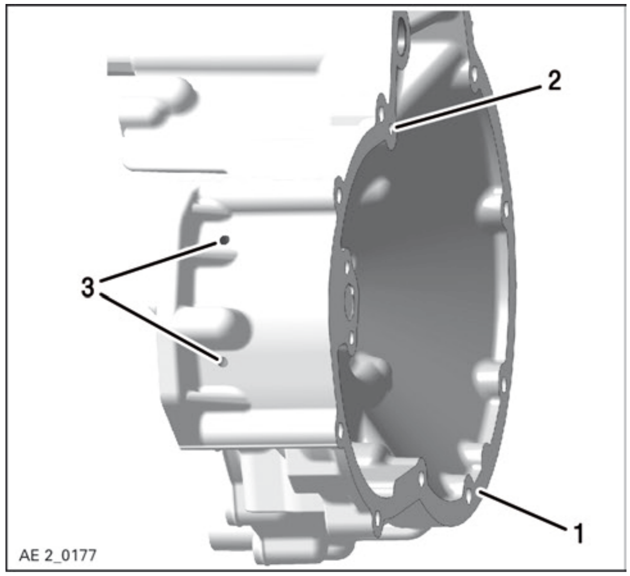

Figure 2.12

1 Sealing surface
2 Lubrication bore
3 Leakage bores

Step	Procedure
4	Carry out a visual inspection of the bearing for the electric starter.

BEARING BUSHING — INSPECTION

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.

OIL SEAL – INSPECTION

Step	Procedure
1	Check the oil seal and bushing for the crankshaft.
2	Check for oil or water from outside of the leakage bore.
3	Check the rotary seal for the water pump sealing. If liquid is leaking, replace the rotary seal and the shaft seal.

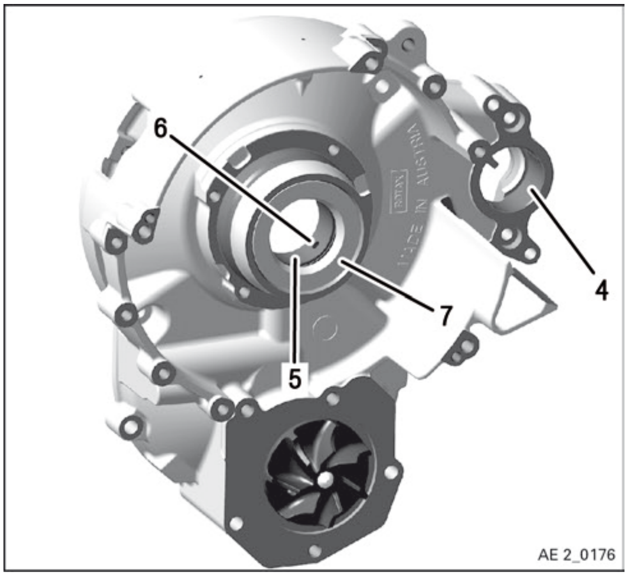

Figure 2.13

4	*Mounting service for electric starter*	5	*Bushing*
6	*Oil bore*	7	*Oil seal*

FLY WHEEL HUB AND MAGNETO RING — INSPECTION

Step	Procedure
1	Carry out visual inspection of magneto inner side and the taper surface of the fly wheel hub.
2	If necessary, unscrew 10 Allen screws with lock washers and remove fly wheel hub from magneto ring.
3	Clean the contact faces.

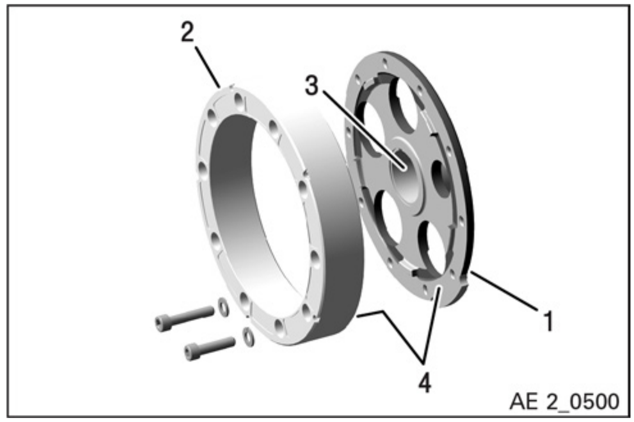

Figure 2.14

1	*Fly wheel hub*	2	*Magneto ring*
3	*Taper surface*	4	*Contact faces*

STATOR ASSY. — INSPECTION

NOTICE

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.

NOTICE

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 stator assy. and cable assy., checking for damage and wear.
2	The contact faces between stator and ignition housing must be clean to assure good grounding.
3	Check the resistance values of the components.

NOTE

Repair of the stator is not planned.

TRIGGER COIL KIT, ELECTRONIC REV COUNTER — INSPECTION

Step	Procedure
1	Carry out a visual inspection of the trigger coils and cable assy.
2	Check the resistance values of the components. Between the white/yellow and blue/yellow cable the resistance has to be from 230 Ω to 250 Ω with open connector.

NOTE

Because of the shielding, the trigger coil kit can be exchanged only as a complete set.

WEAR LIMITS

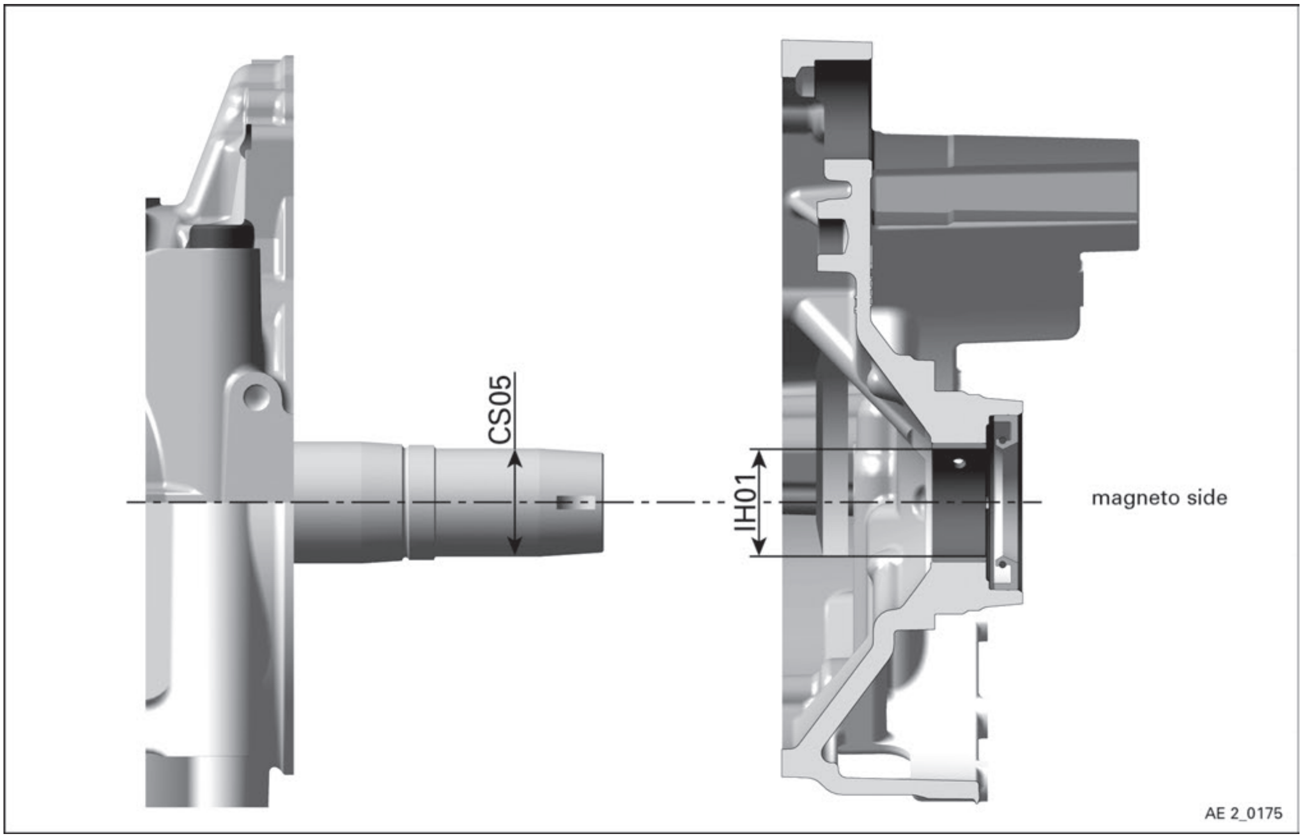

Figure 2.15: Ignition housing

Descrip-tion	Code	Reading new		Wear limit		Readings	
		min.	max.	100 %	50 %		
Bearing bushing in ignition housing	IH01	32.03 mm 1.2610 in	32.04 mm 1.2614 in	32.10 mm 1.2638 in	32.07 mm 1.2626 in	actual	
						renewed	
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	actual	
						renewed	
Journal at magneto side (S2)	CS05	31.990 mm 1.2594 in	32.000 mm 1.2598 in	31.950 mm 1.2579 in	31.970 mm 1.2587 in	actual	
						renewed	

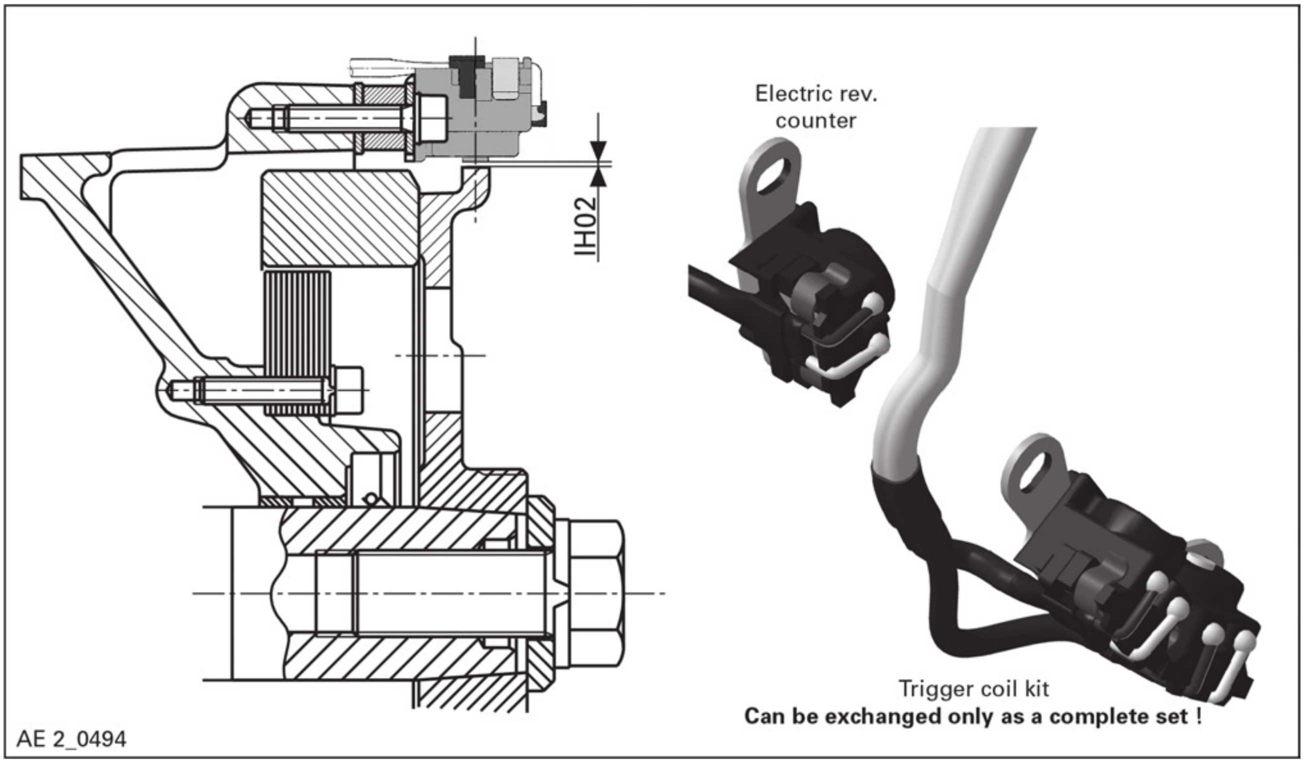

Figure 2.16: Gap trigger coil

Description	**Code**	**Reading new**		**Wear limit**		**Readings**				
		min.	**max.**	**100 %**	**50 %**					
							A1/2	A3/4	B1/2	B3/4
trigger coil gap “old type”	IH02	0.4 mm 0.016 in	0.5 mm 0.020 in			actual				
						renewed				
trigger coil gap (with clamps)	IH02	0.3 mm 0.012 in	0.4 mm 0.016 in			actual				
						renewed				

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	Install water pump. See Chapter 75–00–00.
2	Install bracket using Allen screw M6x16 and washer A6. Tightening torque 10 Nm (89 in. lb)

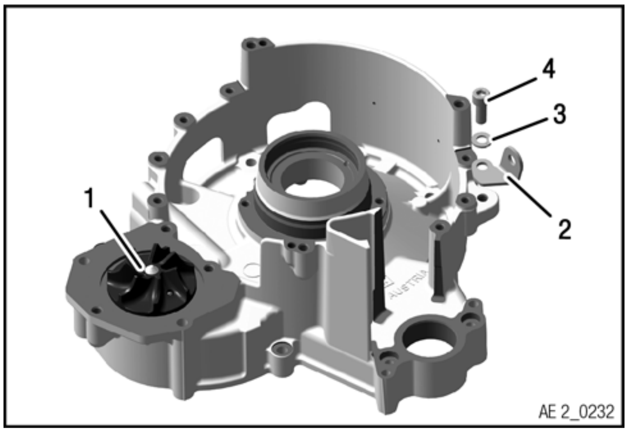

Figure 2.17

1 Water pump
2 Bracket
3 Washer A6
4 Allen screw M6x16

Step	Procedure
3	Polish and then clean the contact surface for the oil seal.
4	Apply LOCTITE 5910 sparingly to outer surface of the oil seal 32/52/7.
5	Press the new oil seal into the block with an insertion jig, part no. 877270.

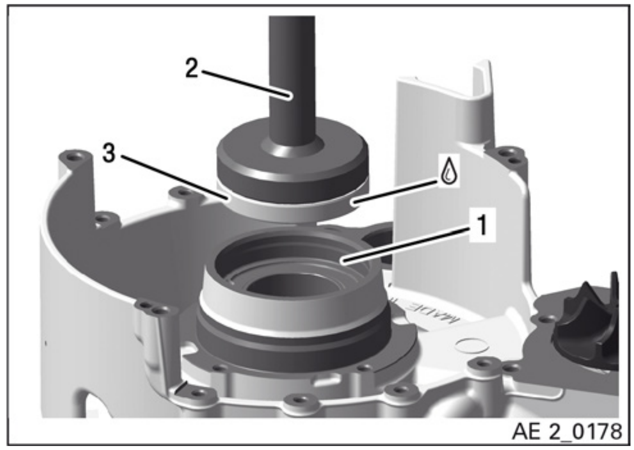

Figure 2.18

1 Contact surface
2 Insertion jig 877270
3 Oil seal 32/52/7

STATOR ASSY. — INSTALLATION

NOTE

When replacing the stator, pay attention to correct routing of the cable assembly.

Step	Procedure
1	One each charging coil grounding cable is screwed with the stator fixation.
2	At assembly, apply LITHIUM–BASE GREASE to the contact areas of the stator, screw heads and lock washer. Tighten torque 5 Nm (44 in. lb).

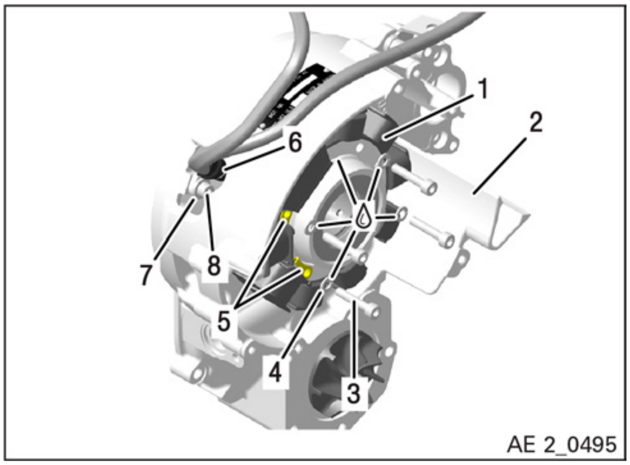

Figure 2.19

1	*Stator assy.*	2	*Ignition housing*
3	*Allen screw M5x25*	4	*Lock washer A5*
5	*Grounding cable*	6	*Cable clamp 15/M5*
7	*Lock washer A5*	8	*Allen screw M5x16*

Step	Procedure
3	Fix stator cable using cable clamp 15/M5 with lock washer A5 and Allen screw M5x16. Tightening torque 5 Nm (44 in. lb).

TRIGGER COIL KIT AND ELECTRONIC REV COUNTER — INSTALLATION

NOTE

Because of the shielding, the trigger coil kit can be exchanged only as a complete set.

NOTE

The trigger coil kit for older engine versions is no longer available. However, there is a new trigger coil kit with new trigger coils which will fit older engines.

NOTE

For easier adjustment, on the new trigger coils ("clip on pick up"), the attachment has been changed from a cylindrical hole with centering to a elongated hole.

Step	Procedure
1	Route cables from trigger coil assy. and electronic rev counter. Install cable clamps onto the cables.
2	Install Trigger coils with Allen screws M5 lock washers A5, washers A5.5, spacers and cable clamps (hand tight).
3	For adjustment and tighten see fly wheel hub assy. - installation.

NOTE

As the trigger coils are no longer centered and the screws has clearance in the oblong hole, during adjustment of the gap (IH02), all trigger coils must be pressed clockwise up to the limit.

NOTICE

Fit the cable clamps in such a way that there is adequate grounding between the shielding and the ignition housing.

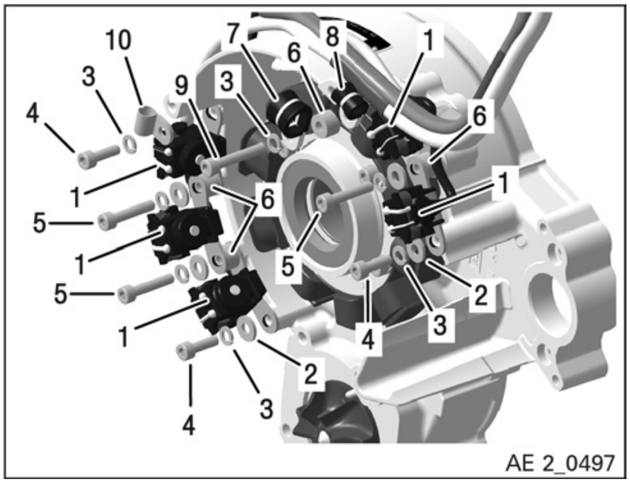

Figure 2.20

1	*Trigger coil*	2	*Washer A5.5*
3	*Lock washer A5*	4	*Allen screw M5x16*
5	*Allen screw M5x25*	6	*Spacer*
7	*Cable clamp 15/M5*	8	*Cable clamp 8/M5*
9	*Allen screw M5x30*	10	*Cable clamp 7/M5*

INSTALLATION

IGNITION HOUSING ASSY. — INSTALLATION

Preparation

- Install the intermediate gear.

See Chapter 80–00–00 Electric starter.

Step	Procedure
1	Place the O-ring 5x2 into the crankcase and fit guide sleeve, part no. 877360, for oil seal onto the crankshaft. The thrust washer of the intermediate starter gear is installed.

NOTE

If the guide sleeve, part no. 877360, is not used, the oil seal will be damaged by the sharp edge of the keyway in the crankshaft.

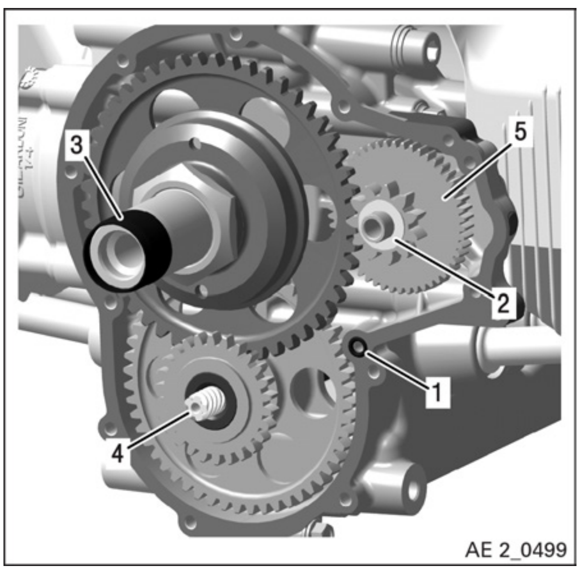

Figure 2.21

1	*O-ring 5x2*	2	*Thrust washer 12.5/21.5/1*
3	*Guide sleeve 877360*	4	*Drive shaft for mechanical rev counter*
5	*Intermediate gear*		

Step	Procedure
2	Apply engine oil to the oil seal.
3	Apply LOCTITE 5910 surface sealing compound to the sealing surface of the pre-assembled ignition housing.
4	Turn the water pump shaft to engage it in the gear tooth system.
5	Tighten ignition cover with 7 Allen screws M6x30 and lock washers evenly to 10 Nm (89 in. lb).

NOTICE

Risk of leakage.
The 9 o'clock Allen screw must be sealed with LOCTITE 243.

NOTICE

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

Step	Procedure
6	(HD electric starter only) Install the two Allen screws M5x45 with cap nut M5 or hex nut M5 with lock washer A5. Tightening torque: 6 Nm (53 in. lb.).
7	Install electric starter. (see Chapter 80–00–00 section Installation). **NOTE** *If SD starter is used, install immediately.*
8	Install water pump housing with new gasket, see Chapter 75-00-00 section Water pump housing installation.

NOTICE

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.

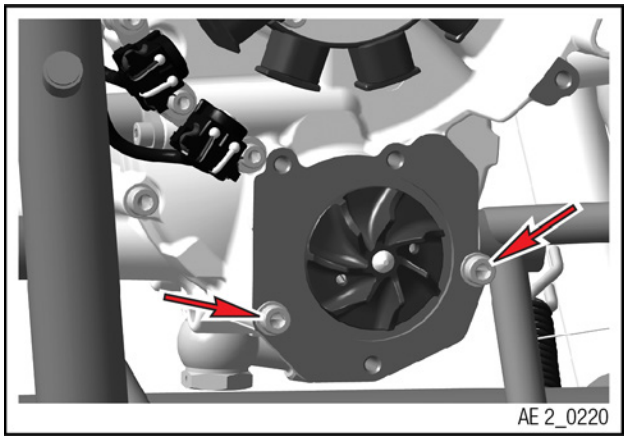

Figure 2.22

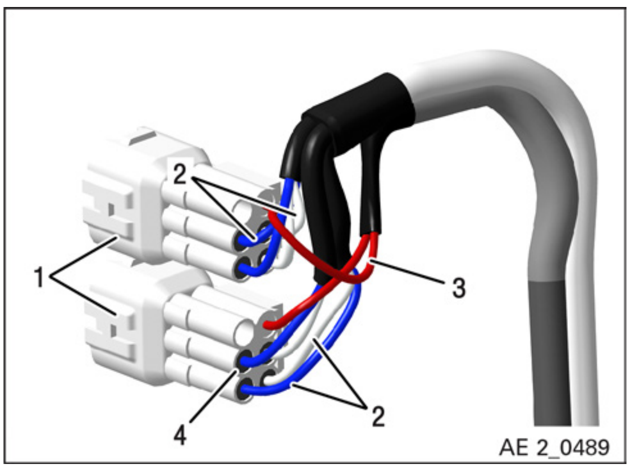

Figure 2.23

1	*Connector housing*	2	*Trigger coil cables (blue/white)*
3	*Charging cables (red)*	4	*Pins*

Step	Procedure
9	Install pins of the two trigger coil cables (blue / white) and pins of the charging cable (red) into the connector housings. See Wiring Harness Chapter 74-00-00 Ignition unit .
10	Connect the plug connectors of the two trigger coil cables and the charging cable with connectors of the SMD electronic module. Apply Lithium–base greaseon connectors. **NOTE** *Ensure that the connectors are refitted in the right position.*
11	Install connectors on connector bracket.
12	Install spacer on the rubber buffer of the electric module and install it on the bracket with hex. nut M6. Tightening torque 10 Nm (89 in. lb)
13	Install cable clamp on the SMD electronic module with grounding cable, secure with Allen screw M5x25 and LOCTITE 243. Tightening torque 2.5 Nm (22 in. lb).
14	Install cable ties.

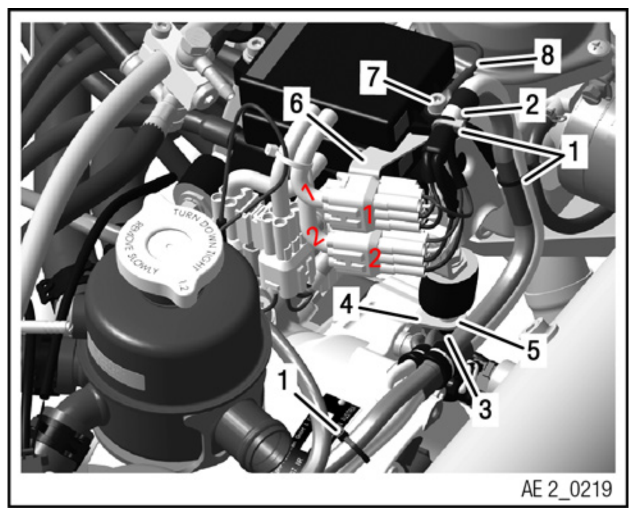

Figure 2.24

1	*Cable tie*	2	*Cable clamp 11.3/M5*
3	*Hex. nut M6*	4	*Bracket*
5	*Spacer 6.5/10/11*	6	*Connector bracket*
7	*Allen screw M5x25*	8	*Grounding cable*

Step	Procedure
15	Connect both plug connectors of the generator cable and the yellow control wiring for the electronic rev counter.

FLY WHEEL HUB ASSY. — INSTALLATION

Preparation
Under normal circumstances, dismantling of fly wheel hub is not necessary.
If it has been dismantled, clean the contact faces. Apply LOCTITE 243 to all 10 screws (alternating 5 screws M6x30 and 5 screws M6x25) with lock washers A6 and screw together. Tightening torque 10 Nm (89 in.lb)

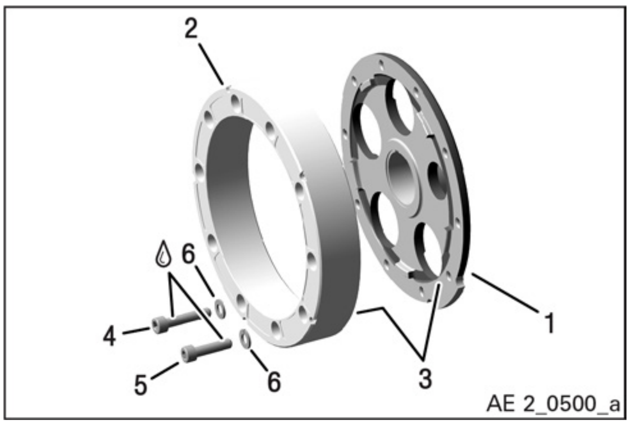

Figure 2.25

1	*Fly wheel hub*	*2*	*Magneto ring*
3	*Contact faces*	*4*	*Allen screw M6x30*
5	*Allen screw M6x25*	*6*	*Lock washer A6*

NOTE

The hole pattern in the magneto ring is symmetrical and therefore it can be assembled in any position.

Lock crankshaft.
See current Maintenance Manual Line (MML) for the respective engine type.

NOTICE

The woodruff key must remain in the groove.

Step	Procedure
1	Check woodruff key in crankshaft for tight fit.
2	Degrease tapers of crankshaft and fly wheel hub and apply LOCTITE 243 sparingly.
3	Fit fly wheel on crankshaft.
4	Apply lithium base grease on the contact face of the washer 17/36/5 and of the lock washer 16.
5	Screw in hex. screw M16x1.5 with washer 17/36/5 and lock washer 16 and immediately tighten to 45 Nm (33 ft lb) + 180°.

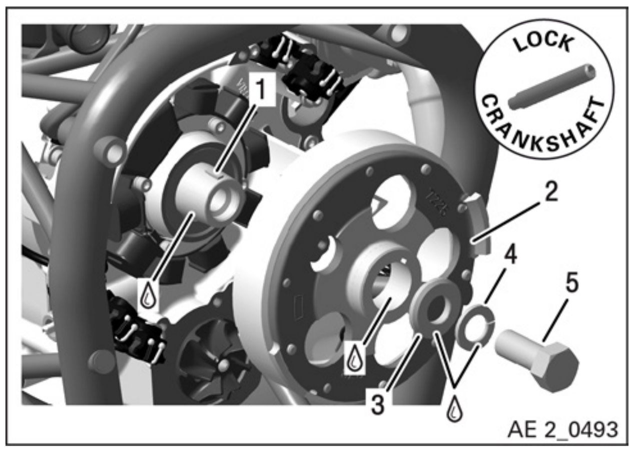

Figure 2.26

1	*Woodruff key*	*2*	*Fly wheel hub assy.*
3	*Washer 17/36/5*	*4*	*Lock washer 16*
5	*Hex. screw M6x1.5*		

Step	Procedure
6	Release crankshaft. See current Maintenance Manual Line (MML) for the respective engine type.

NOTE

The trigger coils are only adjustable to a limited extent. The gap between trigger coil and trigger cam is equal to dimension IH02.

NOTE

As the trigger coils are no longer centered and the screws has clearance in the oblong hole, during adjustment of the gap (IH02), all trigger coils must be pressed clockwise up to the limit.

Step	Procedure
7	Adjust the air gap of the external triggers with feeler gauge to dimension IH02.
8	Check external trigger coils for correct axial position with reference to the trigger cam of the fly wheel hub.
9	Tighten all Allen screws with 5 Nm (44 in. lb.).

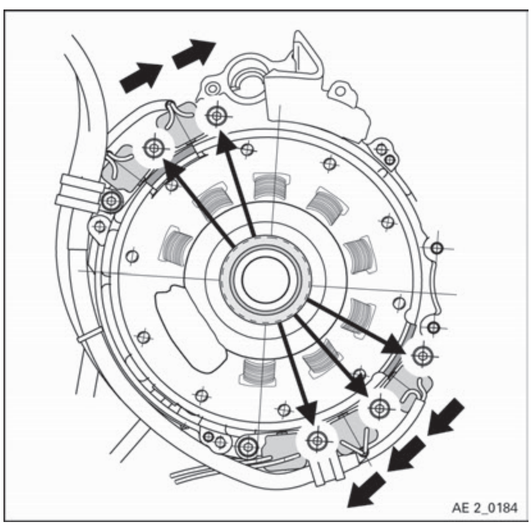

Figure 2.27: Alignment of trigger coils

IGNITION COVER — INSTALLATION

Step	Procedure
1	Fix the ignition cover with 3 hex. screw M6x16 and LOCTITE 243. Tightening torque 5 Nm (44 in. lb)

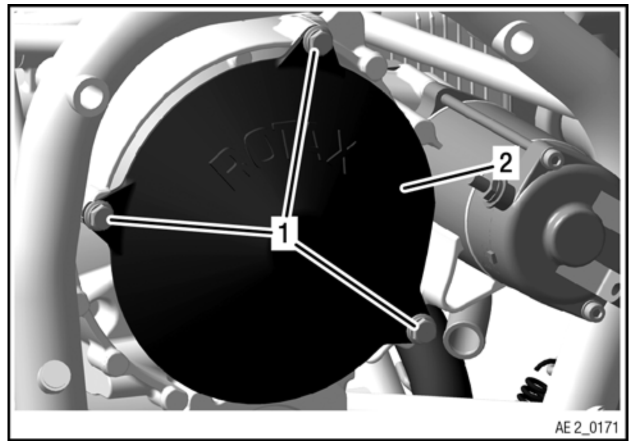

Figure 2.28

1 Hex screw M6x16 *2 Ignition cover*

FINISHING WORK

- Install water pump housing and coolant hoses from cylinder head and water inlet elbow. See Chapter 75-00-00 section Water pump housing installation.
- Install mechanical rev counter assy.
  See Chapter 75-20-00 Mechanical rev counter – installation.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

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Chapter: 24–30–00
EXTERNAL ALTERNATOR

TOPICS IN THIS CHAPTER

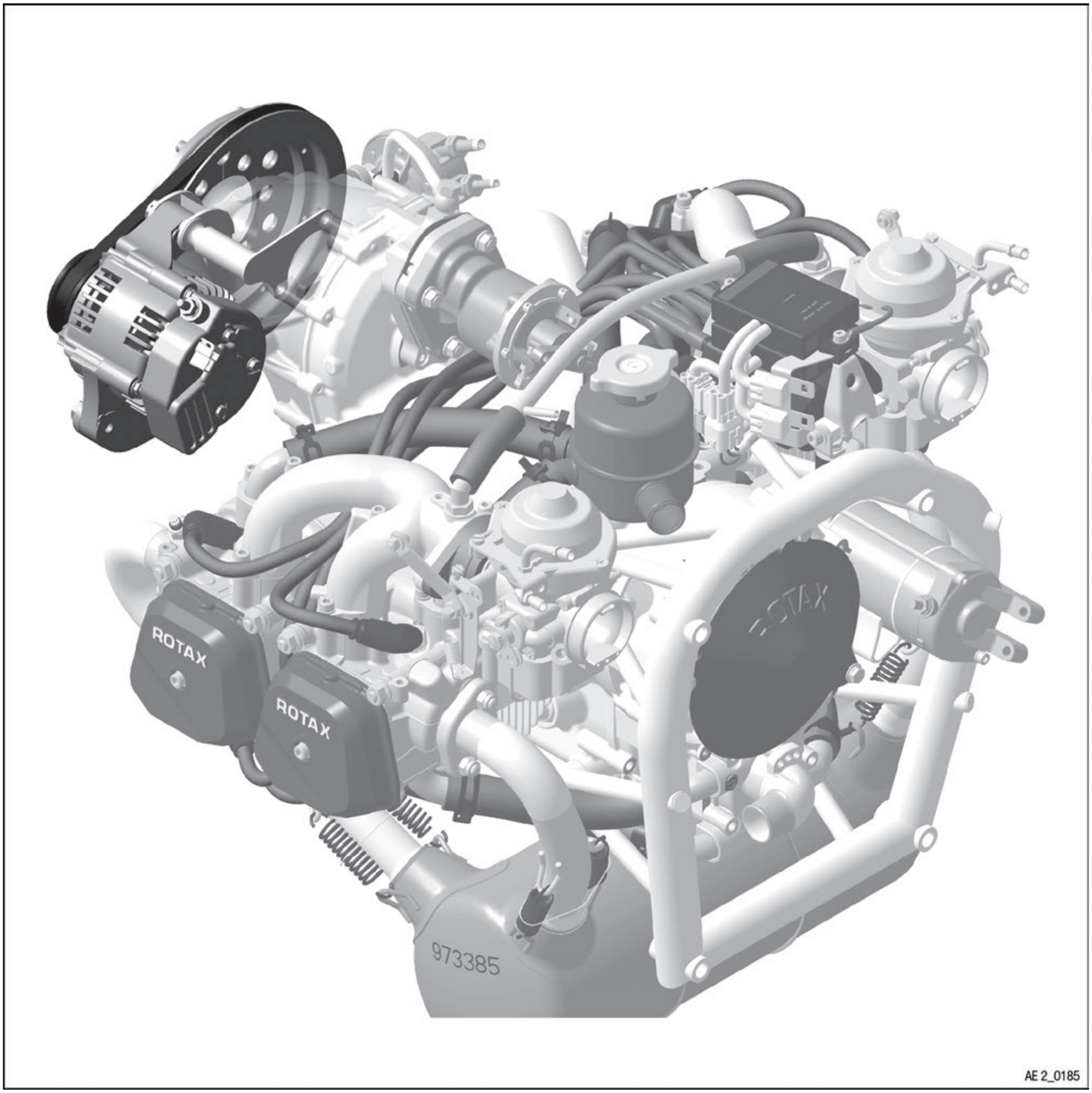

Figure 3.1: Location on the engine

TIGHTENING TORQUE

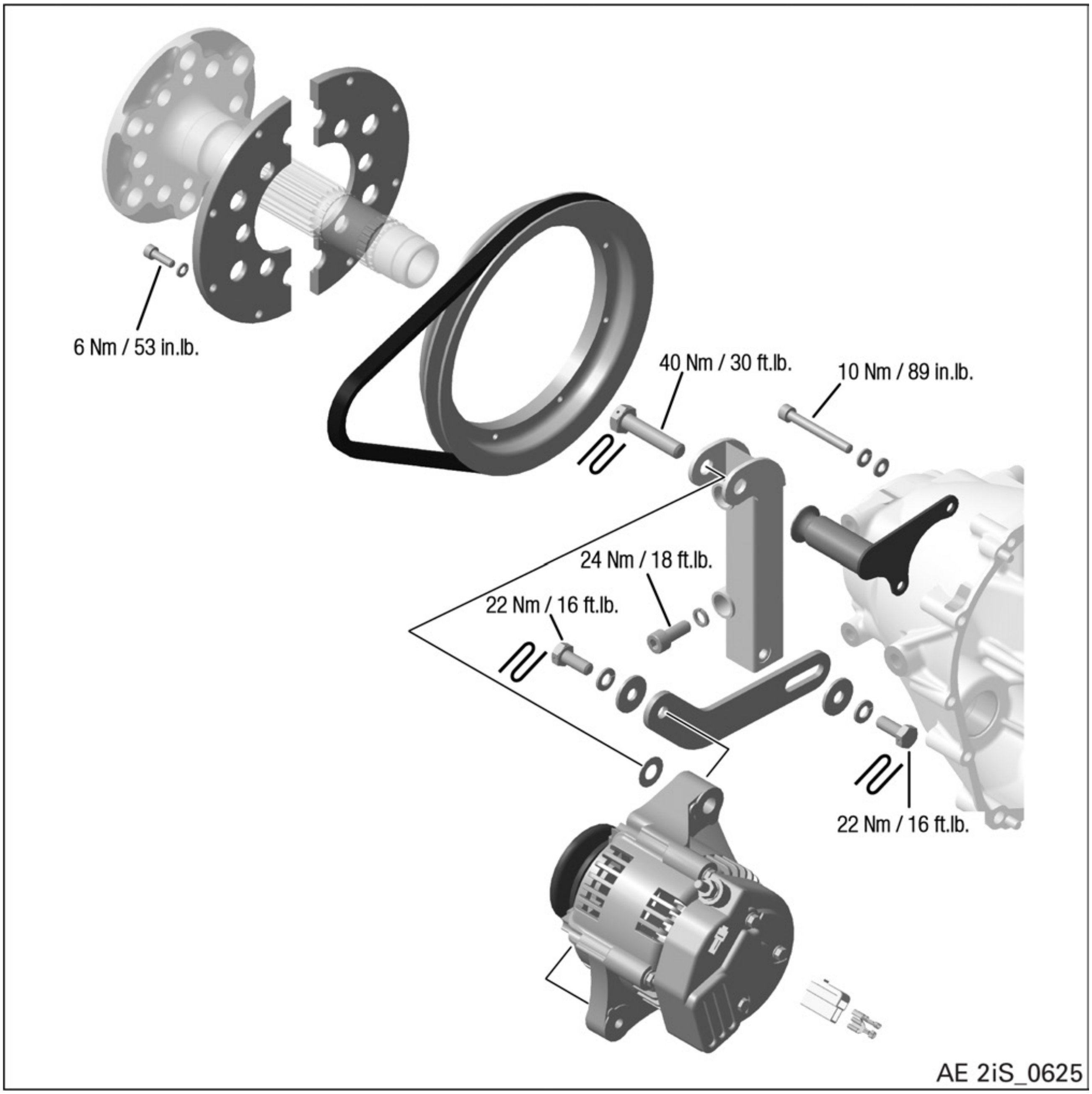

Figure 3.2: Tightening torque

SYSTEM DESCRIPTION

The ROTAX® 912 or 914 Series can optionally be equipped with an external alternator. This is a state-of-the-art, electromechanical three-phase generator (compact generator) with small outer dimensions. It has the task of supplying the electric consumers with energy and charging the starter battery with the least possible fuel consumption and low noise levels during operation of the aircraft.

DRIVE

Drive is provided by the engine by means of a V-belt.

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 switches must be "OFF"!

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

BEFORE THE EXTERNAL ALTERNATOR IS REMOVED:

NOTICE
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 current Maintenance Manual Line (MML) for the respective engine type.

Carry out a generator inspection during an engine test run. See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12–20–00 section Planned maintenance.

Output voltage check. See “Documentation of aircraft manufacturer”.

REMOVAL

Preparation

Loosen pulley tension. See current Maintenance Manual Line (MML) for the respective engine type.

Remove the propeller. See "Documentation of aircraft manufacturer".

V-BELT PULLEY — REMOVAL

Step	Procedure
1	Loosen 8 Allen screws with lock washers.
2	Remove pulley carriers, V-belt pulley and V-belt.

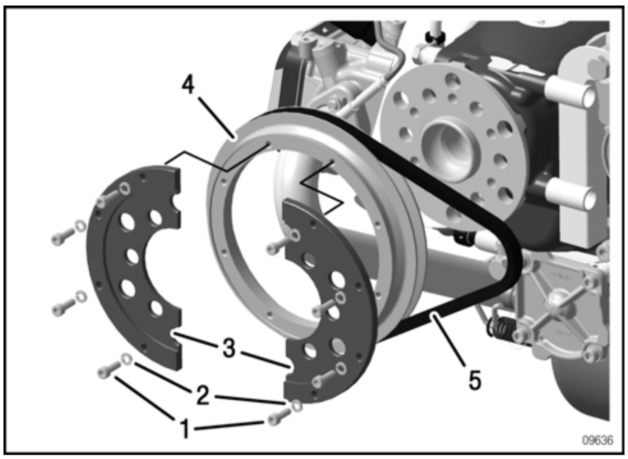

Figure 3.3: Typical

1 Allen screws *2 Lock washers*
3 Pulley carrier *4 V-belt pulley*
5 V-belt

ALTERNATOR — REMOVAL

Step	Procedure
1	Loosen 2 hex. screws along with lock washers and washers.
2	Remove the tension bar underneath the external generator.

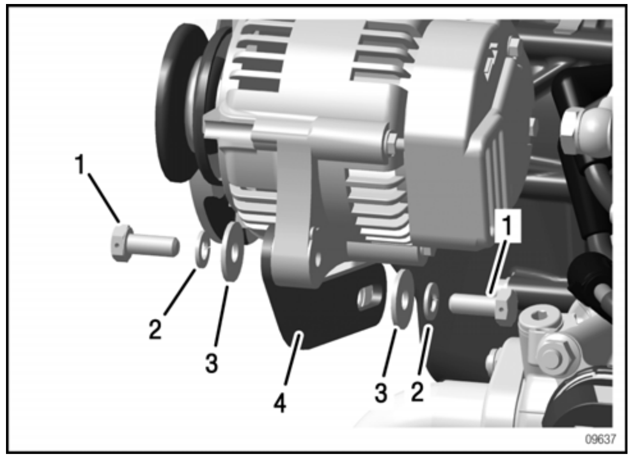

Figure 3.4: Typical

1 Hex. screws *2 Lock washers*
3 Washers *4 Tension bar*

Step	Procedure
3	Loosen hex. screw and remove the alternator and thrust washer.

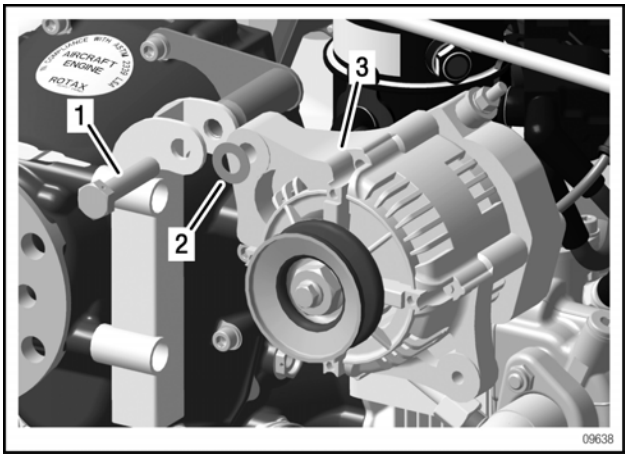

Figure 3.5: Typical

1	*Hex. screw*	2	*Thrust washer*
3	*External alternator*		

Step	Procedure
4	Loosen 2 Allen screws along with lock washers and remove the alternator bracket.

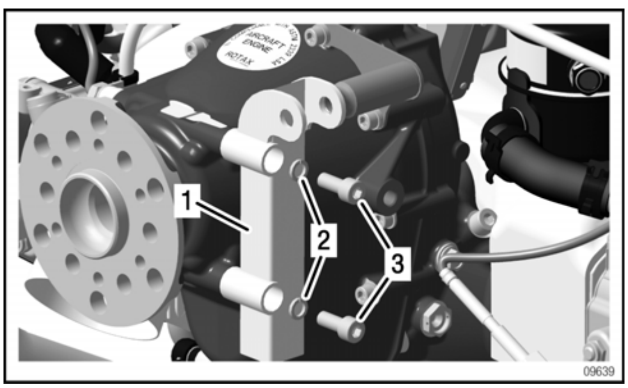

Figure 3.6: Typical

1	*Alternator bracket*	2	*Lock washer*
3	*Allen screws*		

Step	Procedure
5	Remove 2 Allen screws along with lock washers and washers from the gearbox housing and alternator support.

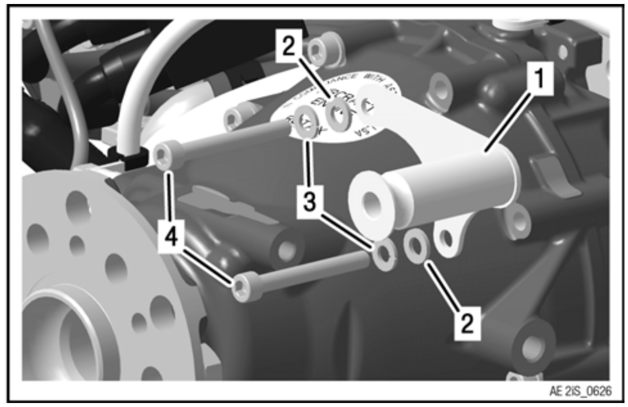

Figure 3.7: Typical

1	*Alternator support assy.*	2	*Washers*
3	*Lock washers*	4	*Allen screws*

INSTALLATION

V-BELT PULLEY — INSTALLATION

Step	Procedure
1	Push the V-belt pulley completely over the propeller flange and insert the V-belt 9.5x675 loosely into the V-belt pulley.

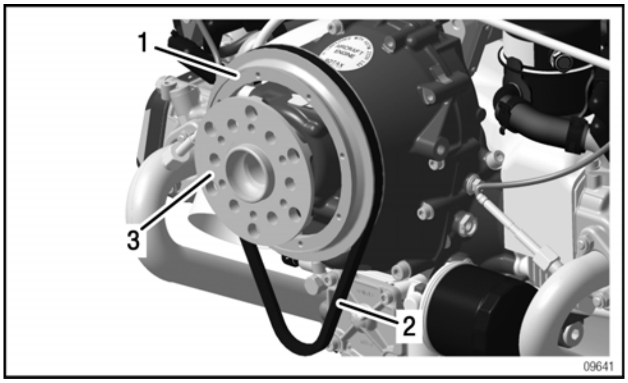

Figure 3.8: Typical

1 *V-belt pulley* 2 *V-belt 9.5x675*
3 *Propeller flange*

NOTICE

The two pulley carriers must sit with the centring exactly on the inner side of the propeller flange.

Step	Procedure
2	Insert both pulley carriers with the centring towards the inner side of the propeller flange.
3	Push the V-belt pulley onto the two pulley carriers and tighten with 8 Allen screws M5x16 and lock washers A5. Tightening torque 6 Nm (53 in. lb.)

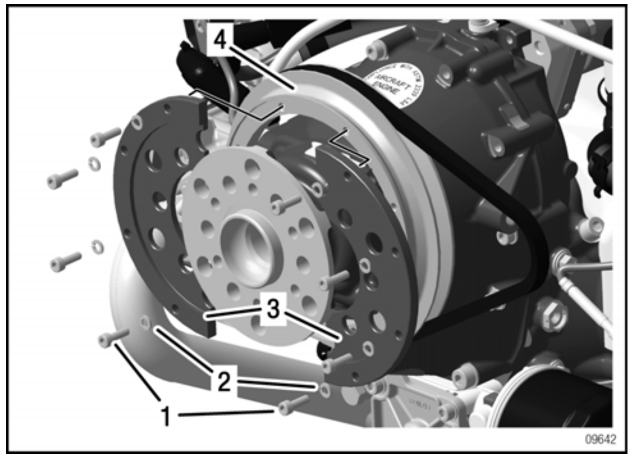

Figure 3.9: Typical

1 *Allen screws M5x16* 2 *Lock washers A5*
3 *Pulley carrier* 4 *V-belt pulley*

ALTERNATOR — INSTALLATION

Step	Procedure
1	Fix the alternator support finger-tight by means of 2 Allen screws M6x50, lock washers A6 and washers 6.4.

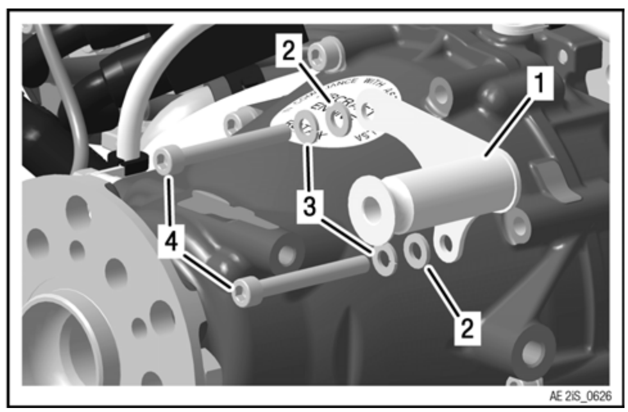

Figure 3.10: Typical

1 *Generator support* 2 *Washer 6.4*
3 *Lock washers A6* 4 *Allen screws M6x50*

Step	Procedure
2	Attach the alternator bracket finger-tight to the gearbox housing using the 2 Allen screws M8x20 and lock washers VHZ8.

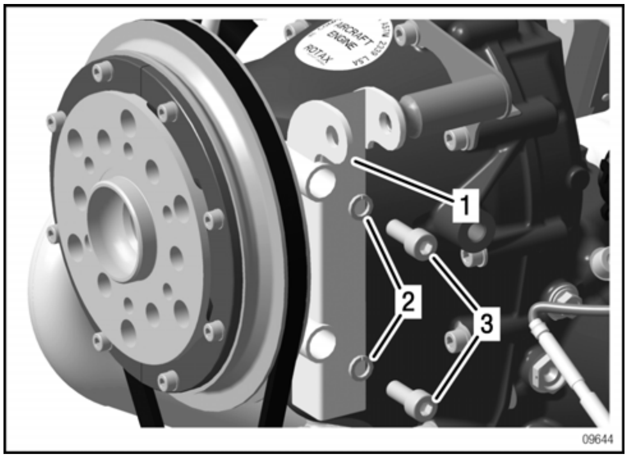

Figure 3.11: Typical

1	*Alternator bracket*	2	*Lock washers VHZ 8*
3	*Allen screw M8x20*		

Step	Procedure
3	Push the alternator into the lug of the al-ternator bracket and fix initially finger-tight with hex. screw M10x45 and thrust wash-er 10.1/20/0.5 (inside the lug).

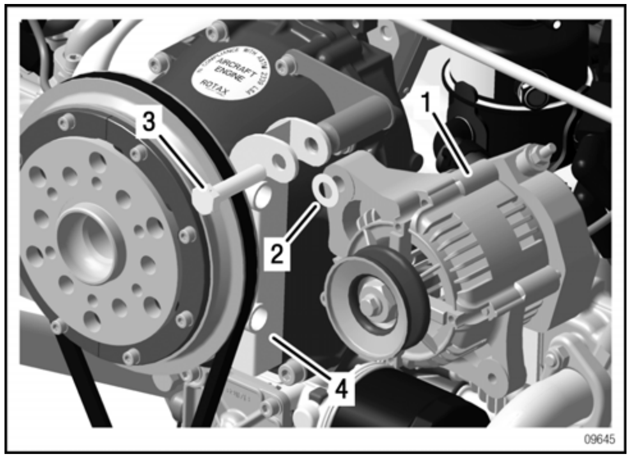

Figure 3.12: Typical

1	*Alternator*	2	*Thrust washer 10.1/20/ 0.5*
3	*Hex. screw M10x45*	4	*Alternator bracket*

Step	Procedure
4	Tighten the pre-mounted Allen screws M6 and M8. Tightening torque Allen screw M6 10 Nm (89 in. lb.). Tightening torque Allen screw M8 24 Nm (18 ft. lb).
5	Place the V-belt in the V-belt pulley of the alternator.

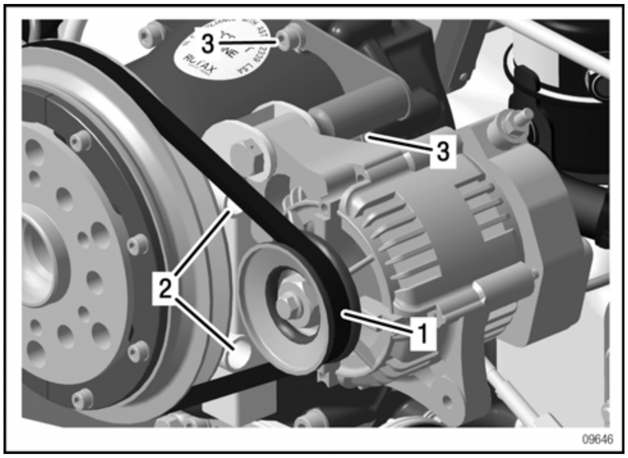

Figure 3.13: Typical

1 *V-belt*	2 *Allen screw M8x20*
3 *Allen screw M6x50*	

Step	Procedure
6	Attach the tension bar finger-tight to the alternator bracket using 2 hex. screws M8x20 with a lock washer A8 and a washer 8.4.

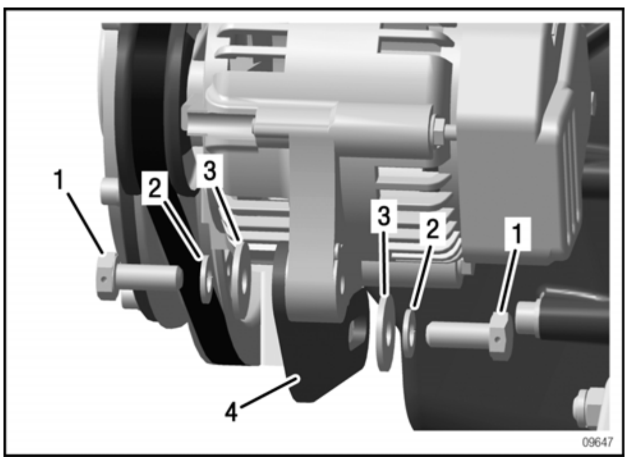

Figure 3.14: Typical

1 *Hex. screws M8x20*	2 *Lock washer A8*
3 *Washer 8.4*	

Step	Procedure
7	Adjust the pulley tension and tighten hex. screws M10 and M8. Tightening torque hex. screws M10: 40 Nm (30 ft. lb.) Tightening torque hex. screws M8: 22 Nm (16 ft. lb.). See relevant Maintenance Manual Line (MML) for the respective engine type.
8	Attach the safety wires.

V-BELT TENSION

See current Maintenance Manual Line (MML) for the respective engine type.

FINISHING WORK

Install the propeller. See "Documentation of aircraft manufacturer".

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Chapter: 37–10–00
VACUUM PUMP

TOPICS IN THIS CHAPTER

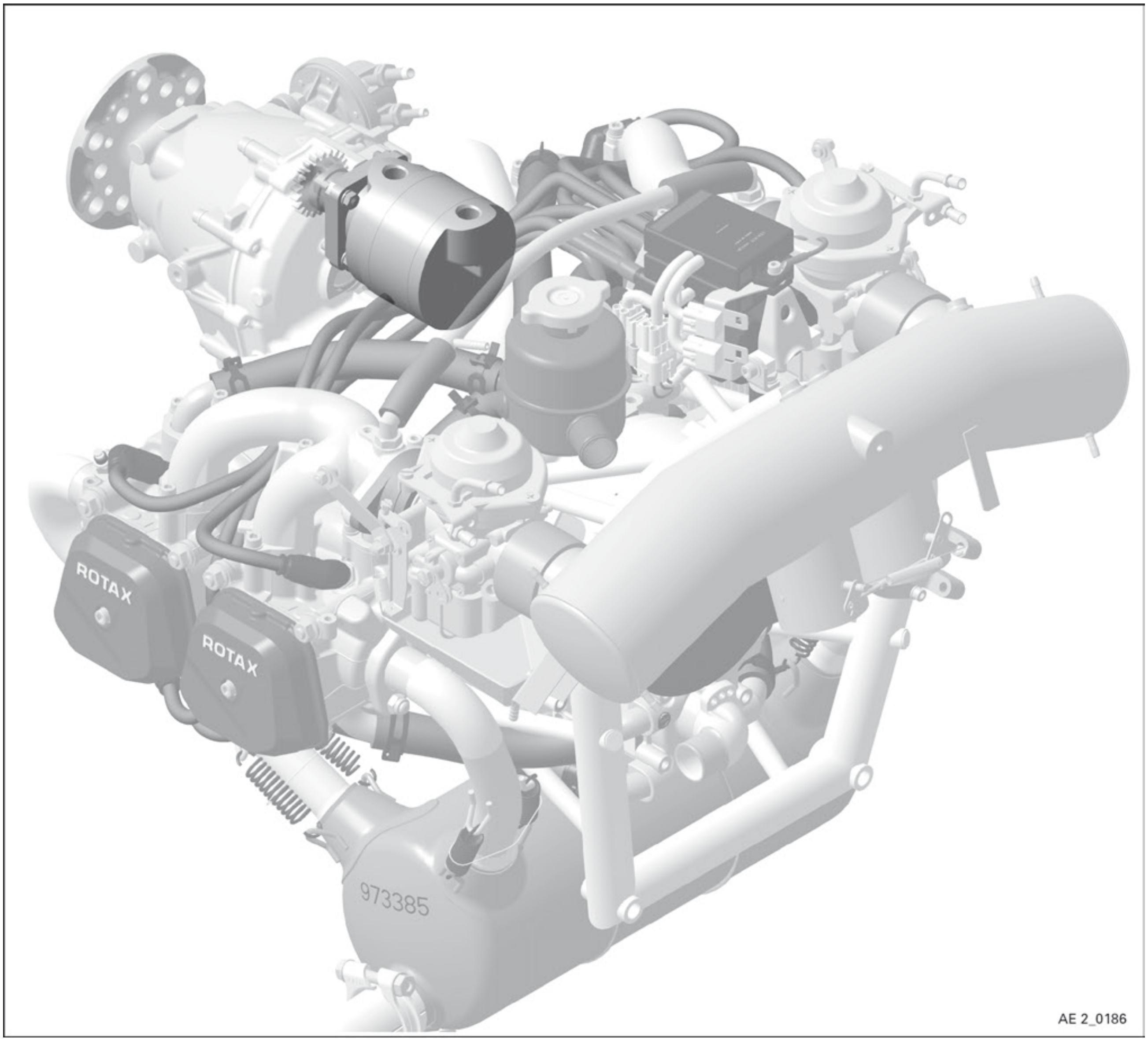

Figure 4.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Insertion jig assy.	276332
Retaining tool	242661
Ring spanner a/f 10/13	876470
Puller assy.	876489
Press-in mushroom	877597
Press-in mushroom	877595
Insertion jig assy.	877276

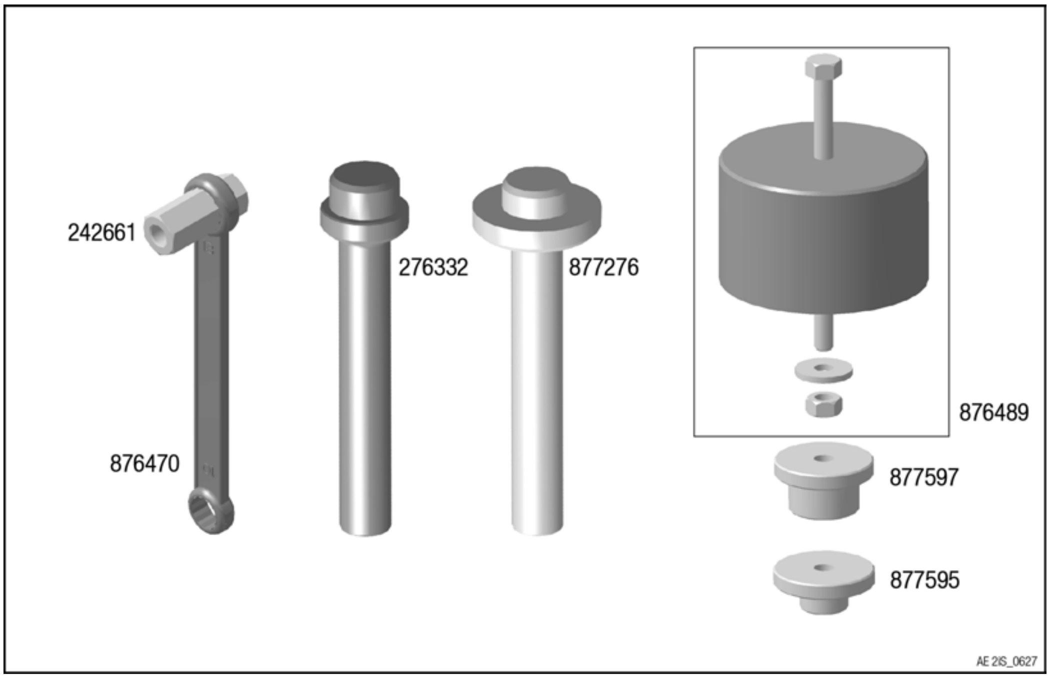

Figure 4.2

SERVICE PRODUCTS

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

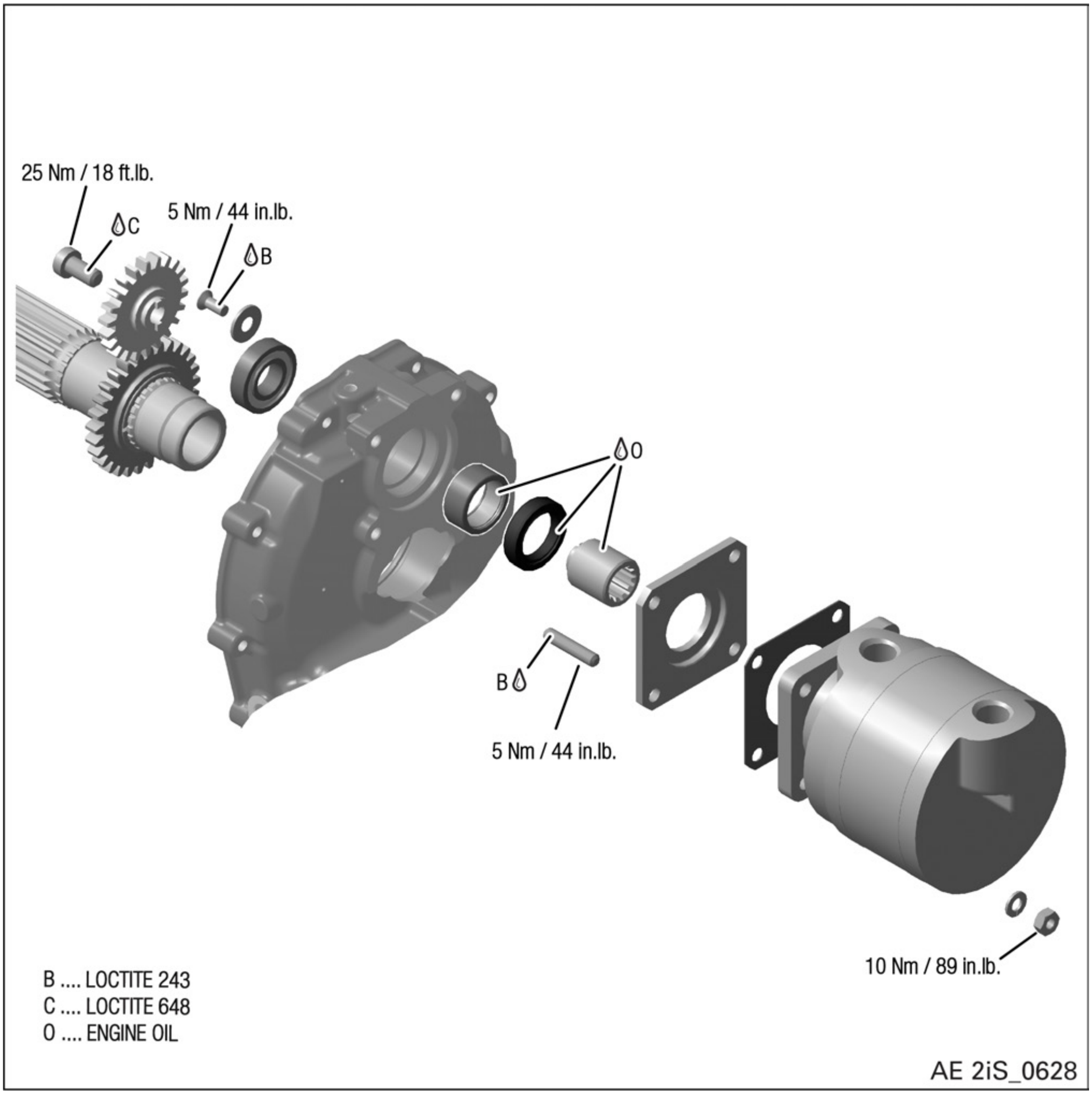

Figure 4.3: Vacuum pump

SYSTEM DESCRIPTION

There is the option of installing a vacuum pump. To do this, the drive for the vacuum pump must be retrofitted in the propeller gearbox.

NOTE

Simultaneous use of the vacuum pump and governor is not possible.

Gear ratio
The vacuum pump and the governor have the same drive and therefore an equal gear ratio, see Chapter 61-20-00 Governor.

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 current Maintenance Manual Line (MML) for the respective engine type.

VACUUM PUMP

VACUUM PUMP — REMOVAL

Preparation

General visual inspection. See current Maintenance Manual Line (MML) for the respective engine type.

Carry out a functional test run to identify any damage. See "Documentation of aircraft manufacturer".

Remove the propeller gearbox so that the governor drive can be removed. See current Maintenance Manual Line (MML) for the respective engine type

Step	Procedure
1	Loosen the 4 hex. nuts with lock washers (or washers).

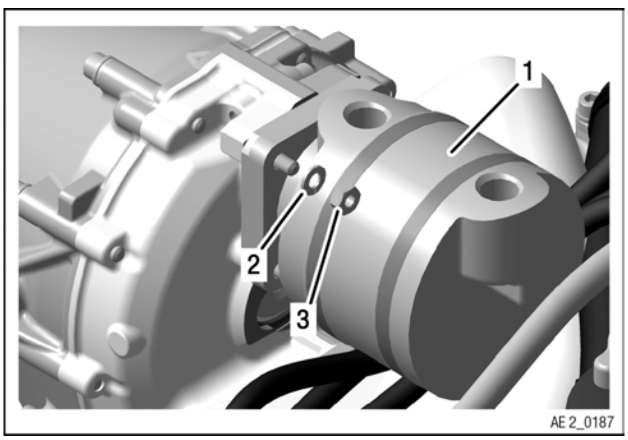

Figure 4.4

1 Vacuum pump
2 Lock washer
3 Hex. nut

Step	Procedure
2	Remove the vacuum pump including the gasket and the attachment flange from the crankcase.

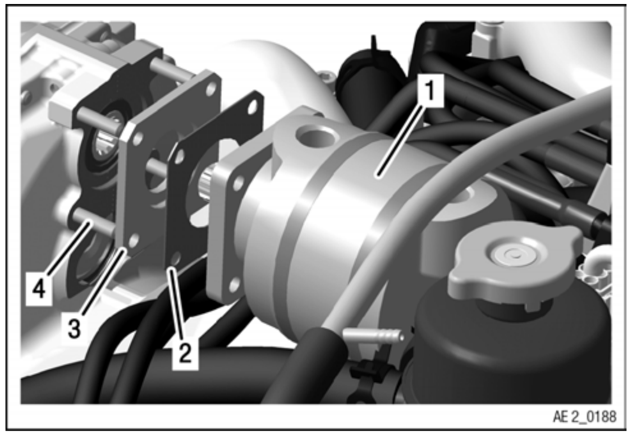

Figure 4.5

1 Vacuum pump
2 Gasket
3 Attachment flange
4 Studs

NOTE

Various screws or studs with nuts are required, depending on the manufacturer of the vacuum pump.

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

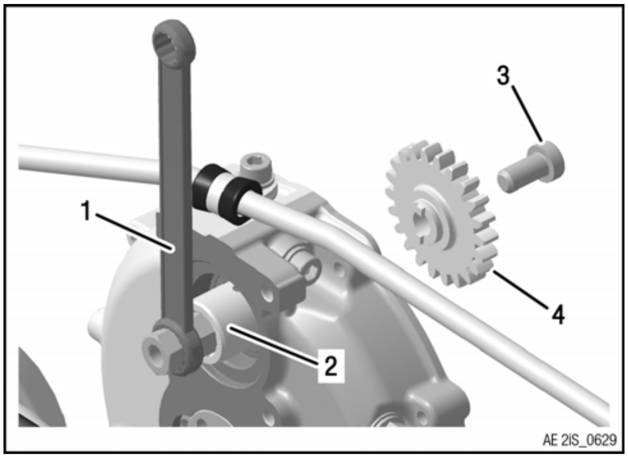

Figure 4.6: Typical

1	*Retaining tool 242660 and 876470*	2	*Drive sleeve*
3	*Allen screw M8x14*	4	*Vacuum pump gear 22T*

Step	Procedure
5	Loosen the countersunk screw with thrust washer for the ball bearing fastening.

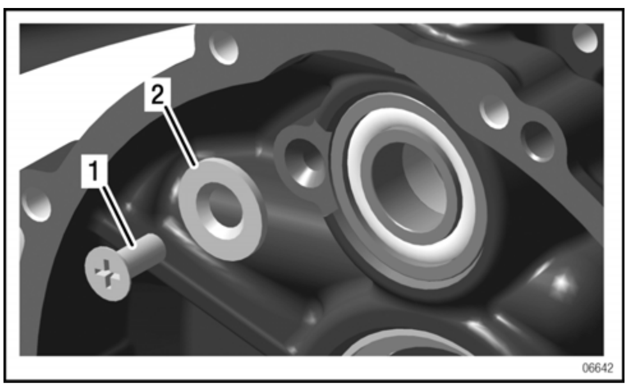

Figure 4.7

1	*Countersunk screw*	2	*Thrust washer*

Step	Procedure
6	Lift out the oil seal and press the needle sleeve along with the ball bearing towards the gearbox with a suitable insertion jig part no. 276332.

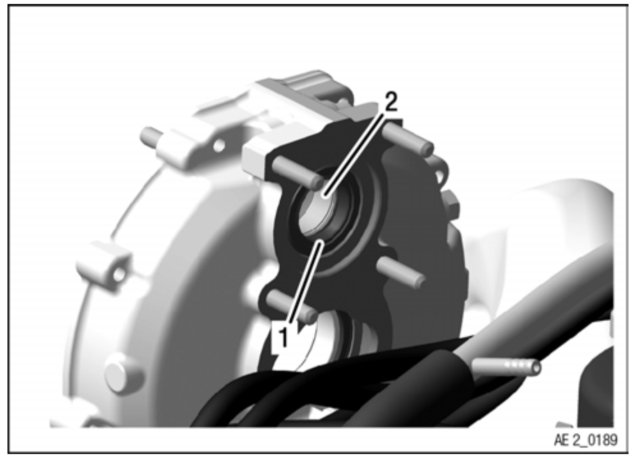

Figure 4.8

1	*Oil seal*	2	*Needle sleeve*

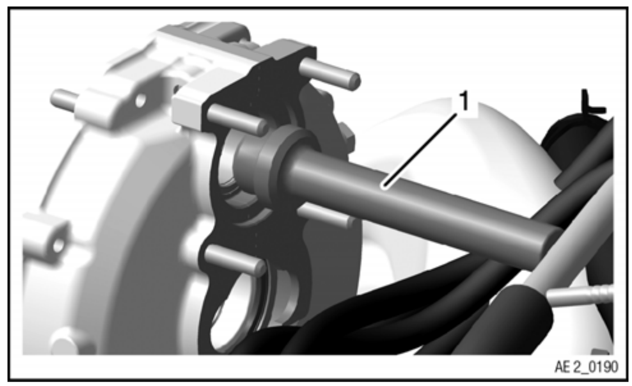

Figure 4.9

1 *Insertion jig 276332*

NOTE

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

INSPECTION

Preparation

Clean all parts carefully. See current Maintenance Manual Line (MML) for the respective engine type.

General visual inspection. See current Maintenance Manual Line (MML) for the respective engine type.

DRIVE SLEEVE — INSPECTION

Step	Procedure
1	Check the gear-tooth system of the drive sleeve.

NOTE

Wear usually appears as a flattened area on the journal.

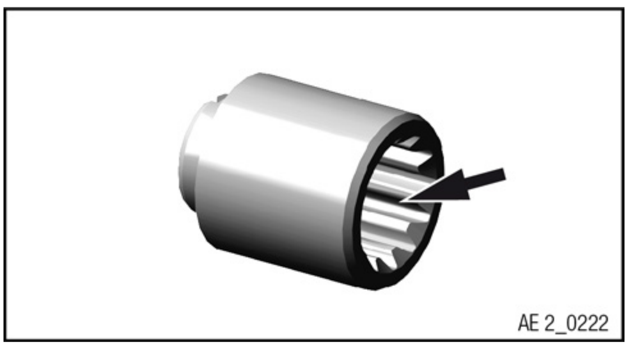

Figure 4.10

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

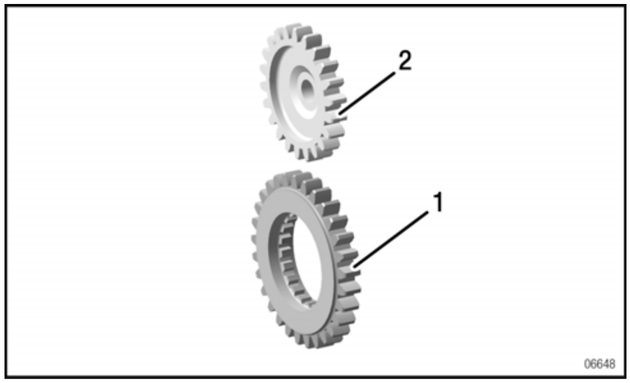

Figure 4.11

1 *Drive gear* 2 *Vacuum pump gear*

VACUUM PUMP — INSPECTION

NOTICE
Follow the vacuum pump manufacturer's instructions for maintenance, inspection and repair.

INSTALLATION

For installation of needle sleeve and ball bearing see Chapter 61–20–00.

OIL SEAL — INSTALLATION

Step	Procedure
1	Press in a new oil seal with insertion jig part no. 877276 and lubricate with engine oil.

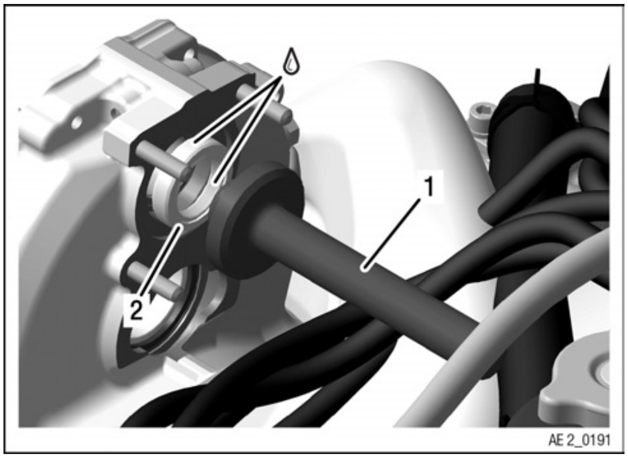

Figure 4.12

1 Insertion jig 877276 *2 Oil seal AS 22x32x7*

VACUUM PUMP GEAR – INSTALLATION

Step	Procedure
1	Insert the lubricated drive sleeve. Hold with the retaining tool part no. 242661 and 876470. Then align slots of drive sleeve with gear.
2	Secure Allen screw M8x14 with LOCTITE 648 and tighten it. Tightening torque 25 Nm (18 ft.lb.)

NOTICE

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 vacuum pump drive.

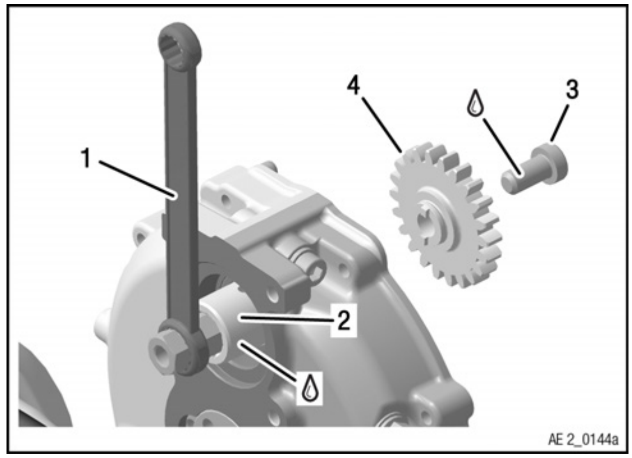

Figure 4.13: Typical

1	*Retaining tool 242661 and 876470*	2	*Drive sleeve*
3	*Allen screw M8x14*	4	*Vacuum pump gear*

VACUUM PUMP — INSTALLATION

Follow the instructions of the aircraft manufacturer.

Step	Procedure
1	Check that the studs are firmly in place. If necessary, apply LOCTITE 243 and tighten. Tightening torque 5 Nm (44 in.lb.).

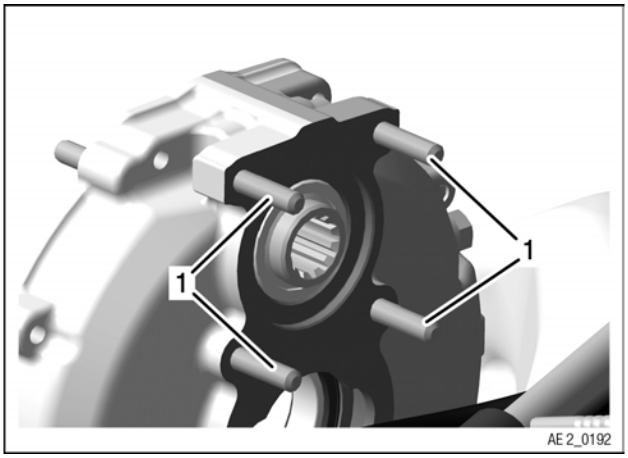

Figure 4.14

1 Studs M6

NOTICE

The gear-tooth system of the governor must match when installed!

NOTICE

No hammering or pressing!
The drive gear must only be pushed on manually.

NOTE

Make sure that the toothing is engaged and the drive gear of the vacuum pump move easily into the drive sleeve.

Step	Procedure
2	Position the vacuum pump including the gasket and the attachment flange on the crankcase.
3	Screw 4 hex. nuts M6 including lock washers onto studs M6 and tighten them. Tightening torque 10 Nm (89 in.lb.).

NOTE

Various screws or studs and nuts are required, depending on the manufacturer of the vacuum pump.

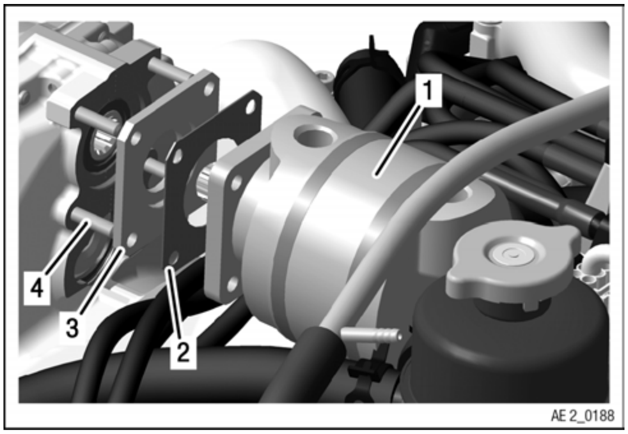

Figure 4.15

1 Vacuum pump
2 Gasket
3 Attachment flange
4 Studs M6

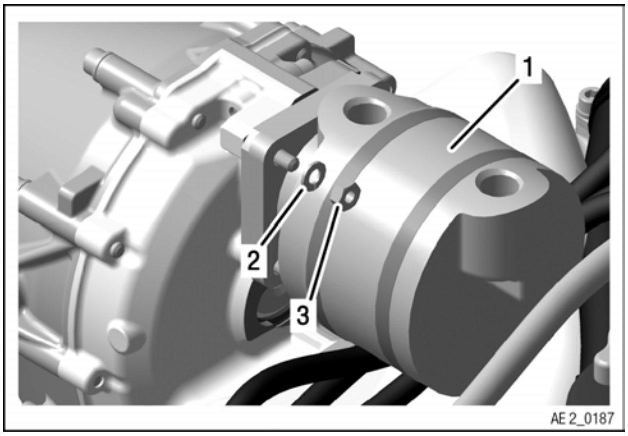

Figure 4.16

1 Vacuum pump

2 Lock washer A6

3 Hex. nut M6

FINISHING WORK

Install the propeller gearbox.
See current Maintenance Manual Line (MML) for the respective engine type.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance..

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Chapter: 61–20–00
GOVERNOR

TOPICS IN THIS CHAPTER

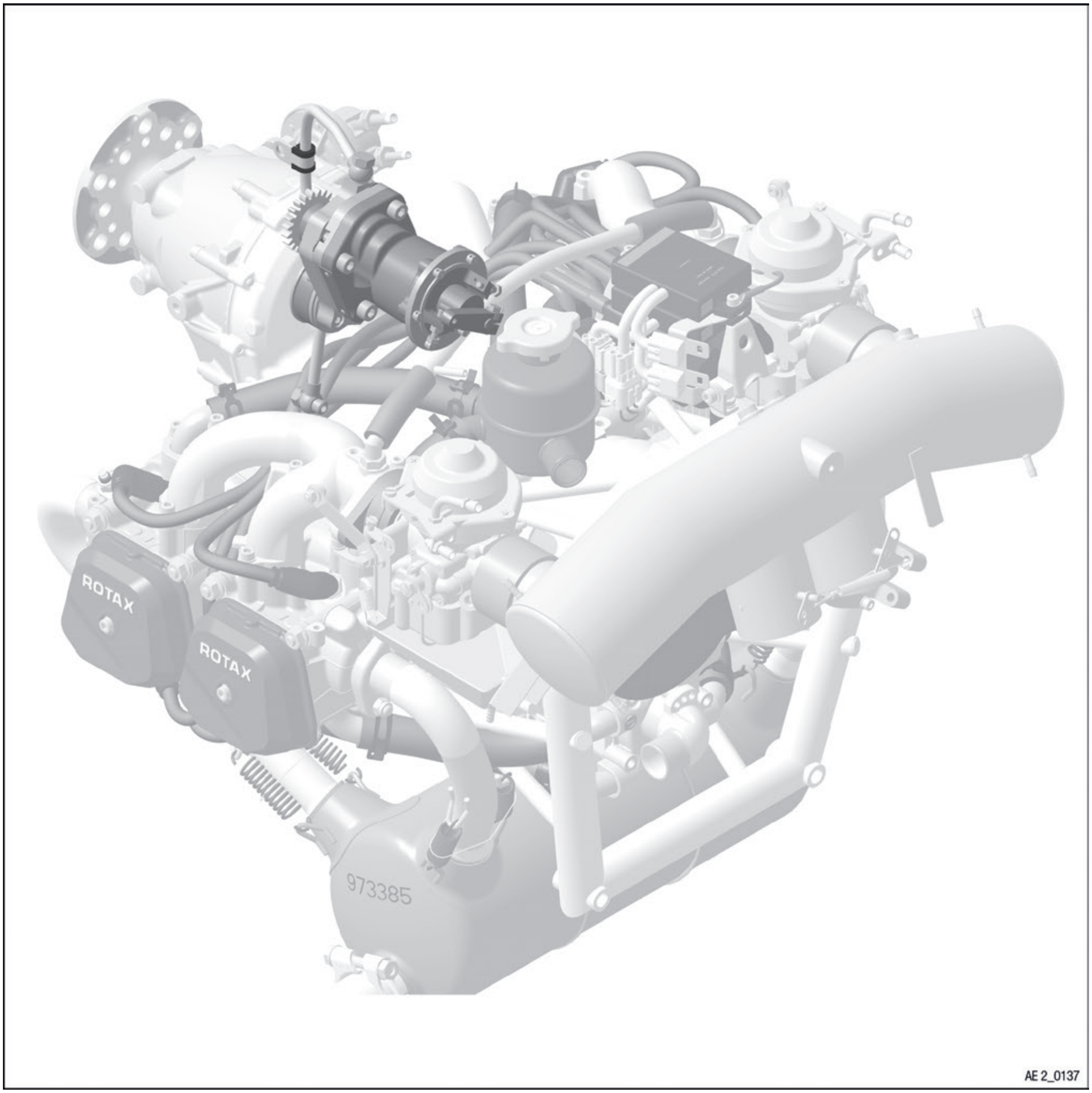

Figure 5.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Puller	876489
Extractor	877615
Press-in mushroom	877590
Press-in mushroom	877595
Press-in mushroom	877597
Insertion jig assy.	276332
Retaining device	242661
Ring spanner a/f 10/13	876470

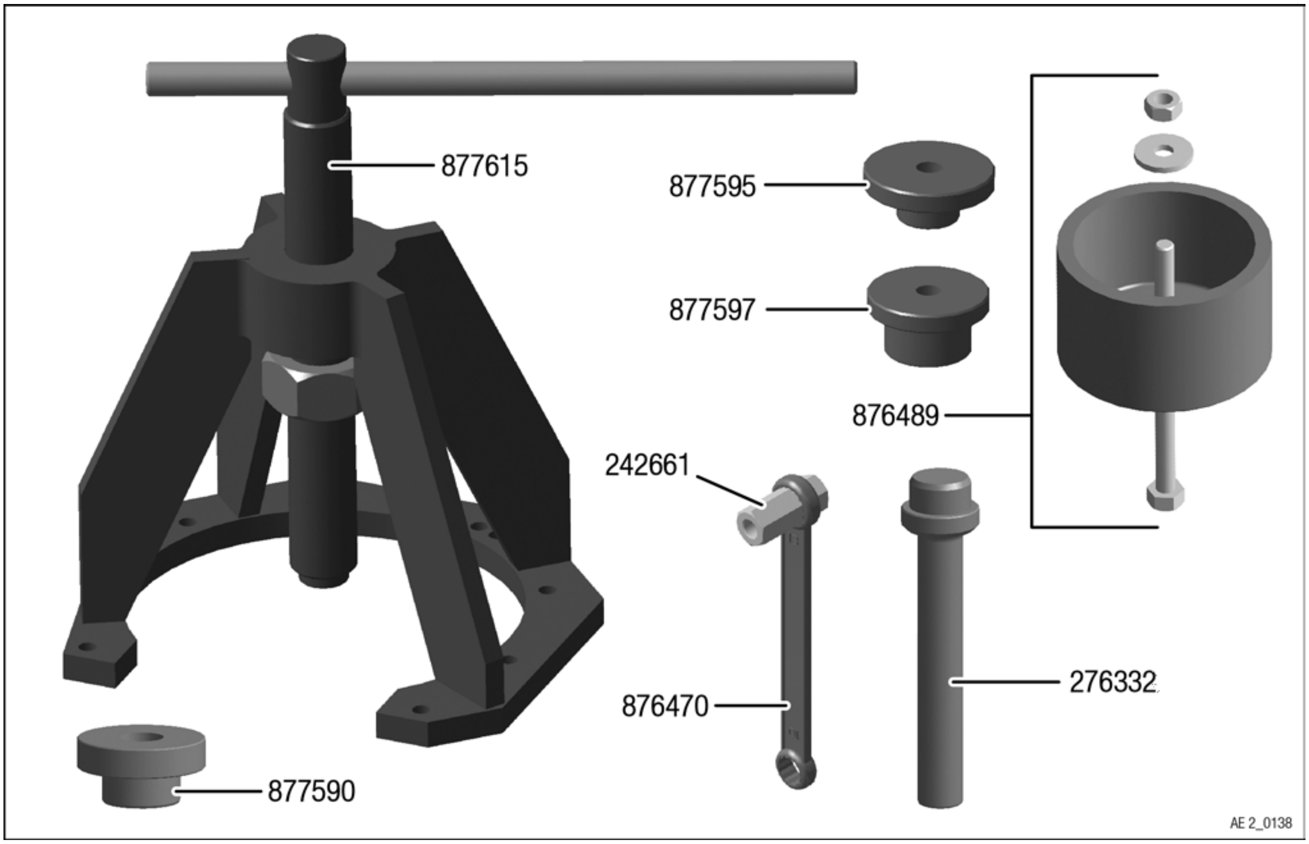

Figure 5.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 648	899788
LOCTITE ANTI SEIZE	297434
Engine oil	n.a.

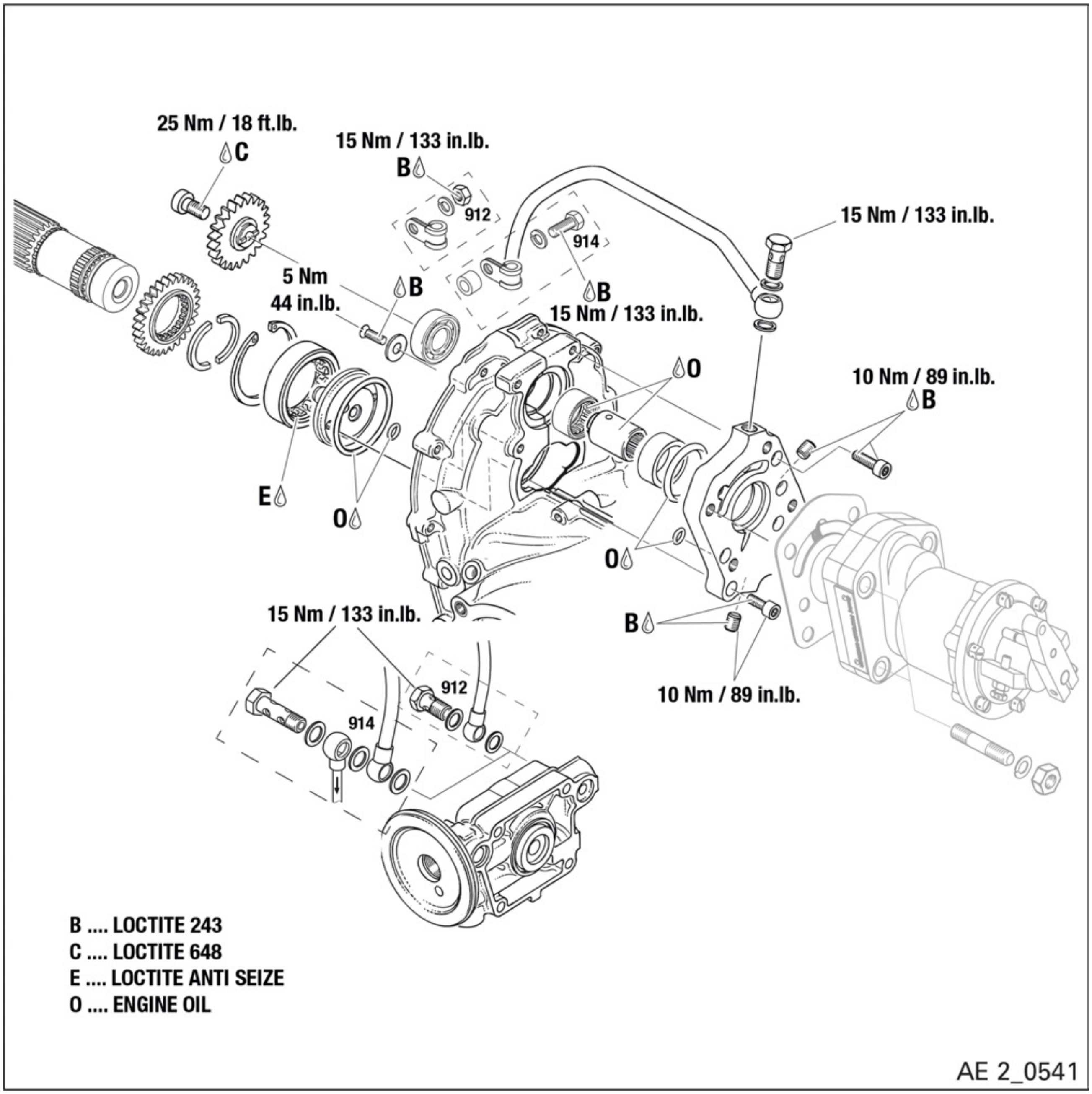

Figure 5.3: Hydraulic governor

SYSTEM DESCRIPTION

For operation with a hydraulic constant-speed propeller on version 3 of the engine type 912 / 914 Series, a hydraulic governor can be attached to control the propeller.
Version 2 can be retrofitted for this purpose, i.e. the drive for the governor in the propeller gearbox, the oil feed line to the propeller shaft and the propeller shaft must be retrofitted.

Gear ratio (i)	912 A/F/UL		912 S/ULS/ ULSFR 914 Series	
Crankshaft: Propeller shaft	50: 22	2.273[1]	51: 21	2.429
Propeller shaft: Governor	22: 29	0.759	22: 29	0.759
Total	1.722		1.842	

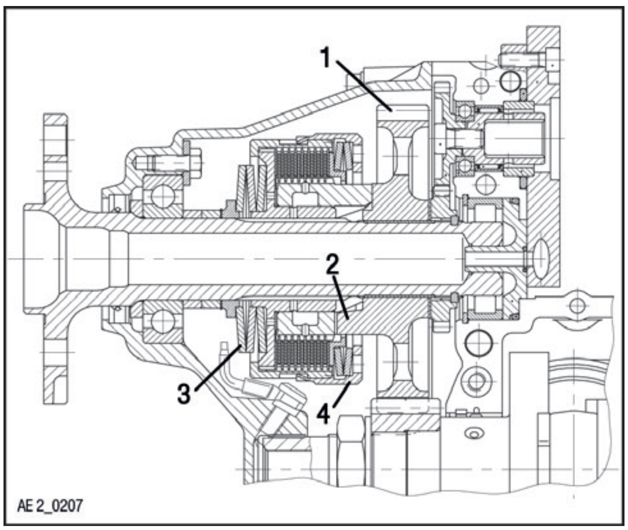

Figure 5.4: Configuration 3, with overload clutch

1 *Straight toothed spur gear*
2 *Dogs*
3 *Disc springs*
4 *Overload clutch*

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 current Maintenance Manual Line (MML) for the respective engine type.

1. optional 2.429 possible

REMOVAL

GOVERNOR – REMOVAL

Preparation

General visual inspection. See current Maintenance Manual Line (MML) for the respective engine type.

Carry out engine test run to check proper functioning of the governor. See current Maintenance Manual Line (MML) for the respective engine type.

Drain oil. See current Maintenance Manual Line (MML) for the respective engine type.

NOTICE

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

Step	Procedure
1	Loosen the hex. nut on the governor and remove the governor along with the gasket and lock washer.

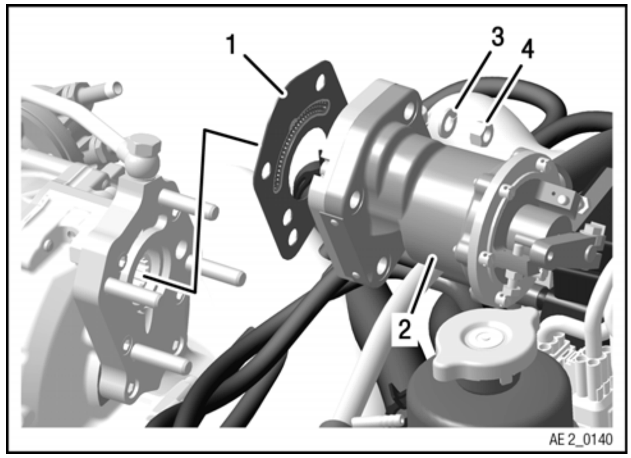

Figure 5.5

1	*Gasket*	*2*	*Governor*
3	*Lock washer*	*4*	*Hex. nut*

Various screws, studs and nuts are required, depending on the manufacturer of the governor. See the current edition of SB-912-052 and / or SB-914-035 "Installation/use of governors”.

GOVERNOR FLANGE — REMOVAL

Step	Procedure
1	Loosen the hex. nut (912) or hex. screw (914) with the washer and remove the cable clamp and distance sleeve (914).

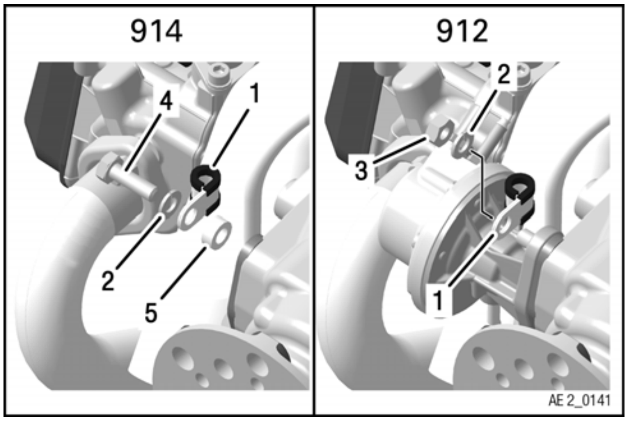

Figure 5.6

1	*Cable clamp*	*2*	*Lock washer*
3	*Hex. nut*	*4*	*Hex. screw M8x25*
5	*Distance sleeve*		

Step	Procedure
2	912 Series: Loosen banjo bolts M10x1x23 with sealing rings on both sides of the governor flange and oil pump housing. Remove the governor pressure oil line. 914 Series: Loosen banjo bolt M10x1x23 with sealing rings A10x14 on the governor flange and banjo bolt M10x1x34 with sealing rings on oil pump housing. Remove the governor pressure oil line.

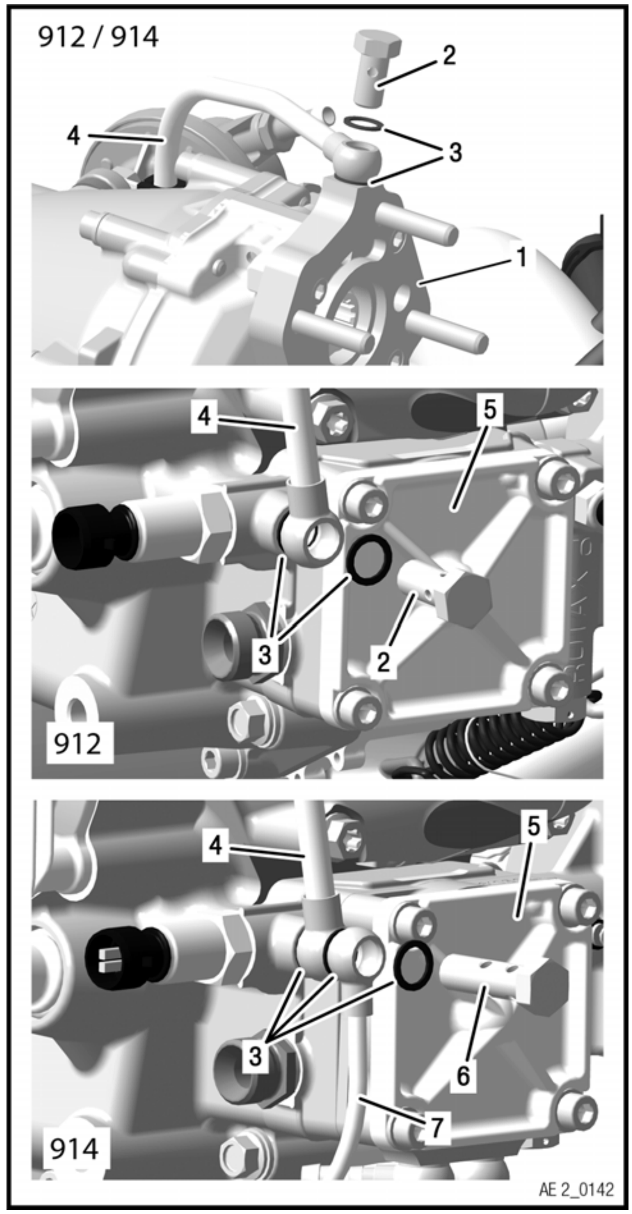

Figure 5.7

1	*Governor flange*	*2*	*Banjo bolt M10x1x23*
3	*Sealing rings*	*4*	*Governor pressure oil line assy.*
5	*Oil pump housing*	*6*	*Banjo bolt M10x1x34*
7	*Turbo pressure oil line*		

Step	Procedure
3	Loosen 4 Allen screws M6x20 and 2 Allen screws M6x16 for the governor flange fastening of the oil feed line.
4	Remove the governor flange with the O-rings and spacer behind it.

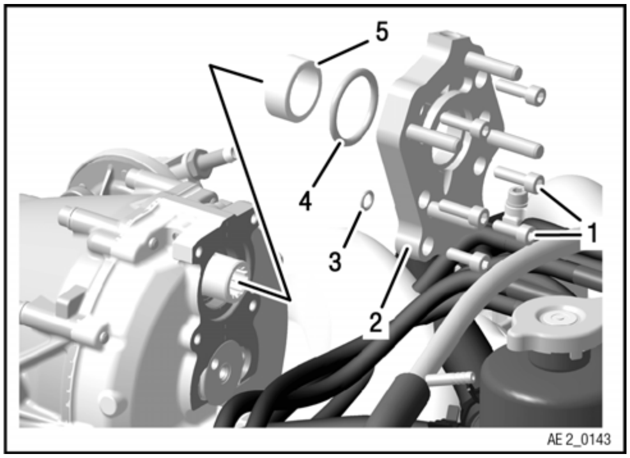

Figure 5.8

1	*Allen screws M6x20, M6x16*	2	*Governor flange*
3	*O-ring*	4	*O-ring*
5	*Spacer*		

GOVERNOR DRIVE — REMOVAL

Preparation

- The propeller gearbox must be removed so that the governor drive can be removed. See current Maintenance Manual Line (MML) of the respective engine type.

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

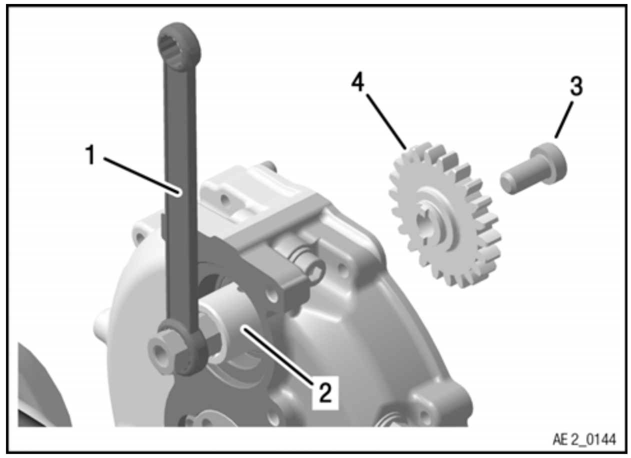

Figure 5.9

1	*Retaining tool 242661 and 876470*	2	*Drive sleeve*
3	*Allen screw*	4	*Vacuum pump gear*

Step	Procedure
3	Loosen the countersunk screw with thrust 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.

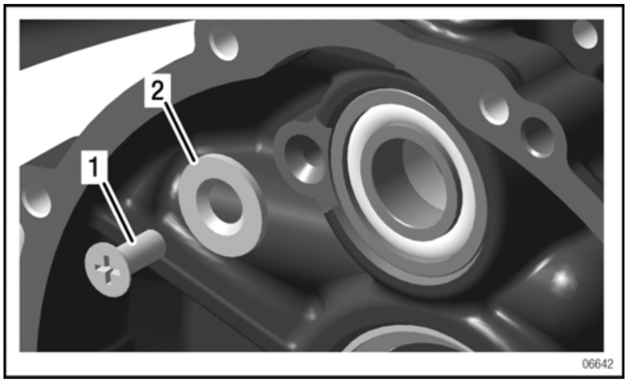

Figure 5.10

1 Countersunk screw *2 Thrust washer*

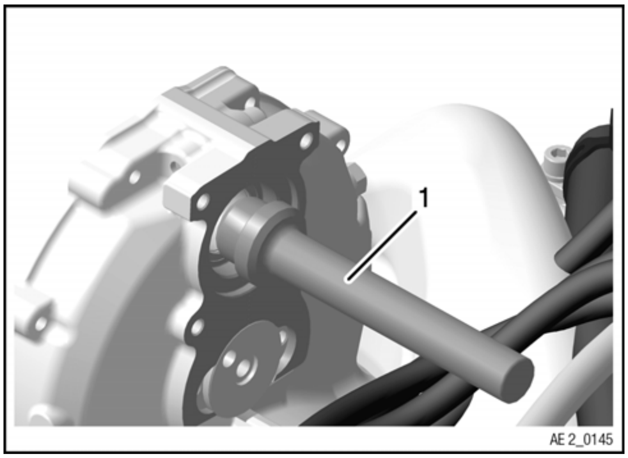

Figure 5.11

1 Insertion jig 276332

ROLLER BEARING VERSION 3 — REMOVAL

See 72–10–00 section Propeller gearbox.

INSPECTION

GOVERNOR - INSPECTION

NOTICE

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

GOVERNOR DRIVE - INSPECTION

Preparation

Clean all parts carefully. See current Maintenance Manual Line (MML) for the respective engine type.

General visual inspection.
See current Maintenance Manual Line (MML) for the respective engine type.

Step	Procedure
1	Measure the inner diameter of the propeller shaft. See section Wear limits (GB05).
2	Measure the journal of the oil inlet flange. See section Wear limits (GB06).

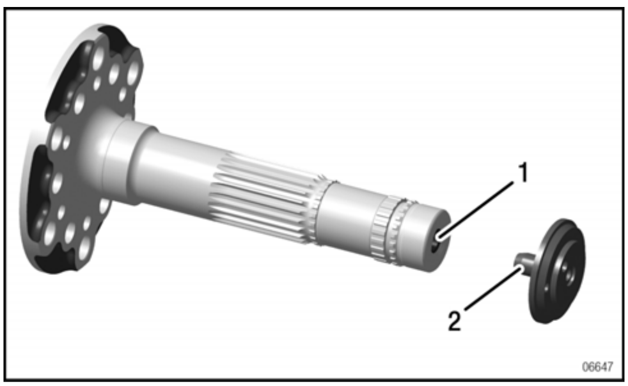

Figure 5.12

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

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.

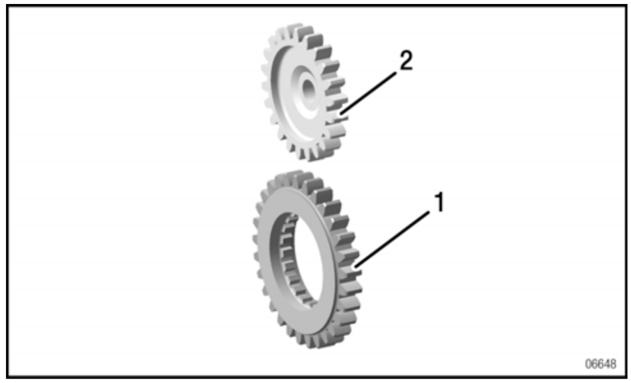

Figure 5.13

1 *Drive gear* 2 *Vacuum pump gear*

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

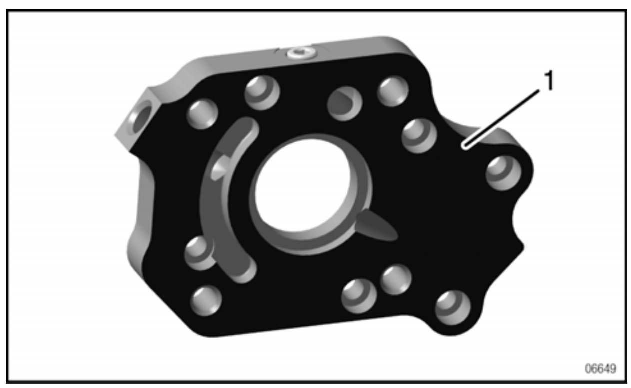

Figure 5.14: Typical

1 *Governor flange*

Step	Procedure
5	Check the toothing of the drive sleeve for damage..

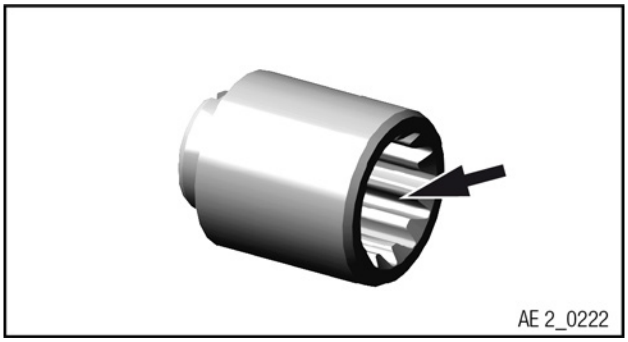

Figure 5.15

WEAR LIMITS

For detailed information and measurements, see
Chapter 72-10-00 section Wear limits (Gearbox).

INSTALLATION

NOTICE

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

NEEDLE SLEEVE – INSTALLATION

Step	Procedure
1	Lubricate the new needle sleeve.
2	Apply 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 and washer.

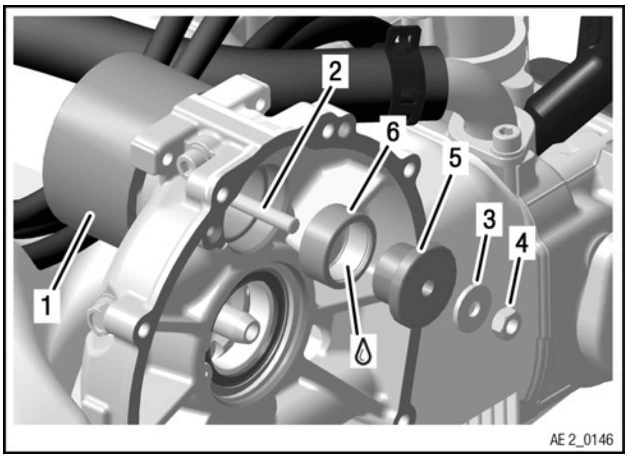

Figure 5.16: Typical

1	*Puller 876489*	*2*	*Hex. screw*
3	*Washer*	*4*	*Hex. nut*
5	*Press-in mushroom part 877597*	*6*	*Needle sleeve 22x18x12*

Step	Procedure
4	The needle sleeve is pressed in as far until seated by turning the hex. screw clockwise.

BALL BEARING — INSTALLATION

Step	Procedure
1	Apply 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 and washer.
3	The new ball bearing is pressed in until seated by turning the hex. screw clockwise.

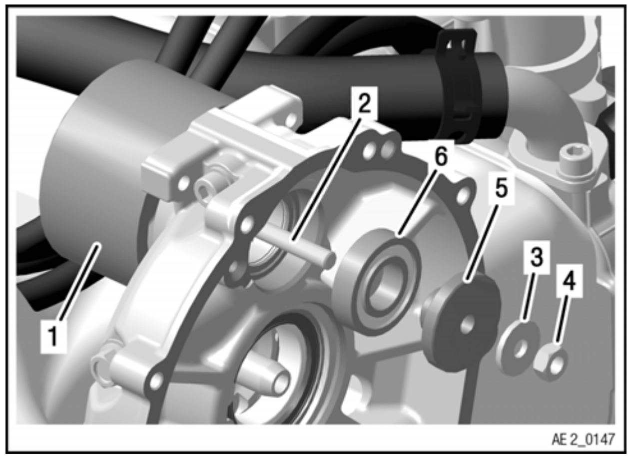

Figure 5.17: Typical

1	*Puller 876489*	*2*	*Hex. screw*
3	*Washer*	*4*	*Hex. nut*
5	*Press-in mushroom 877595*	*6*	*Ball bearing*

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

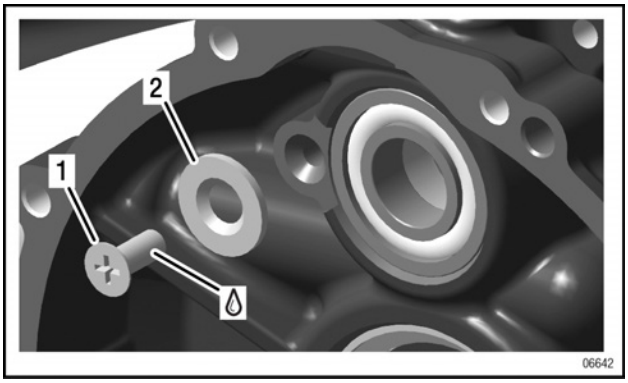

Figure 5.18

1	*Countersunk screw M5x12*	2	*Thrust washer*

ROLLER BEARING — INSTALLATION — VERSION 3

See Chapter 72-10-00 section Propeller gearbox.

GOVERNOR DRIVE — INSTALLATION

CONFIGURATION 3

Step	Procedure
1	Insert the lubricated drive sleeve. Hold with the retaining tool part no. 242661 and 876470. Then align slots of drive sleeve with gear.
2	Secure Allen screw M8x16 with LOCTITE 648 and tighten it. Tightening torque 25 Nm (18 ft.lb.)

NOTICE

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 vacuum pump drive.

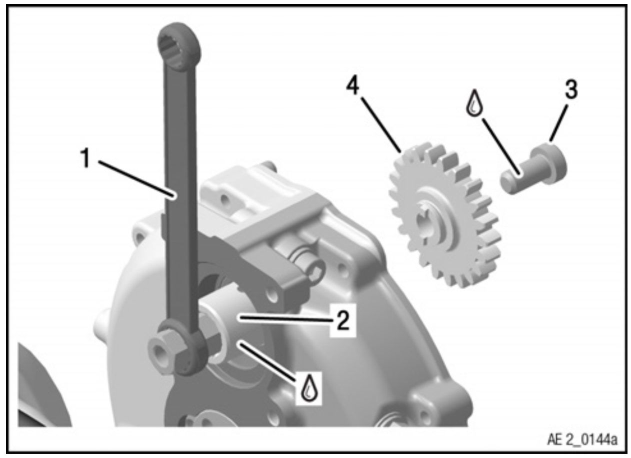

Figure 5.19: Typical

1	*Retaining tool 242660 and 876470*	2	*Drive sleeve*
3	*Allen screw M8x16*	4	*Vacuum pump gear*

GOVERNOR FLANGE — INSTALLATION — CONFIGURATION 3

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

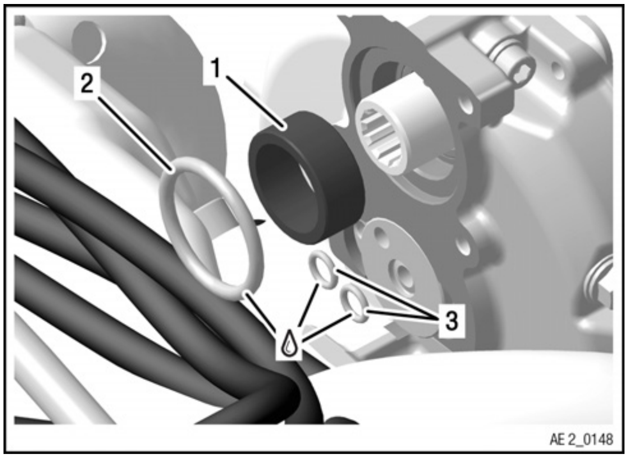

Figure 5.20

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

NOTICE
Leakage may occur, if LOCTITE 243 sticks the small O-rings. Avoid too much LOCTITE 243!

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 flange (oil feed line), and tighten the screws. Tightening torque 10 Nm (89 in. lb.). **NOTE** *Put LOCTITE 243 onto the thread and the head of the Allen screws.*

NOTE

LOCTITE 5910 can be used on the sealing surface of the governor flange.

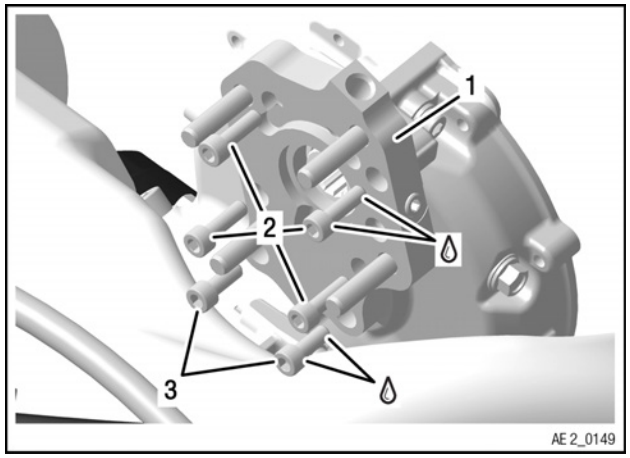

Figure 5.21

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

NOTICE
Longer screws may destroy the oil inlet flange and ball bearing. Observe the length of the screws.

Step	Procedure
4	Install the propeller gearbox. See latest Maintenance Manual Line (MML) of the respective engine type.
5	912 Series: Install the governor pressure oil line on the governor flange and on oil pump housing using banjo bolt M10x1x23 with sealing rings A10x14. Tightening torque 15 Nm (133 in.lb.) 914 Series: Install the governor pressure oil line on the governor flange using banjo bolt M10x1x23 with sealing rings A10x14 and on oil pump housing using banjo bolt M10x1x34 with sealing rings A10x14. Tightening torque 15 Nm (133 in.lb.)

NOTICE
Banjo bolt M10 is of different lengths on newer engines. M10x1x23 on 912 Series and M10x1x34 on 914 Series.

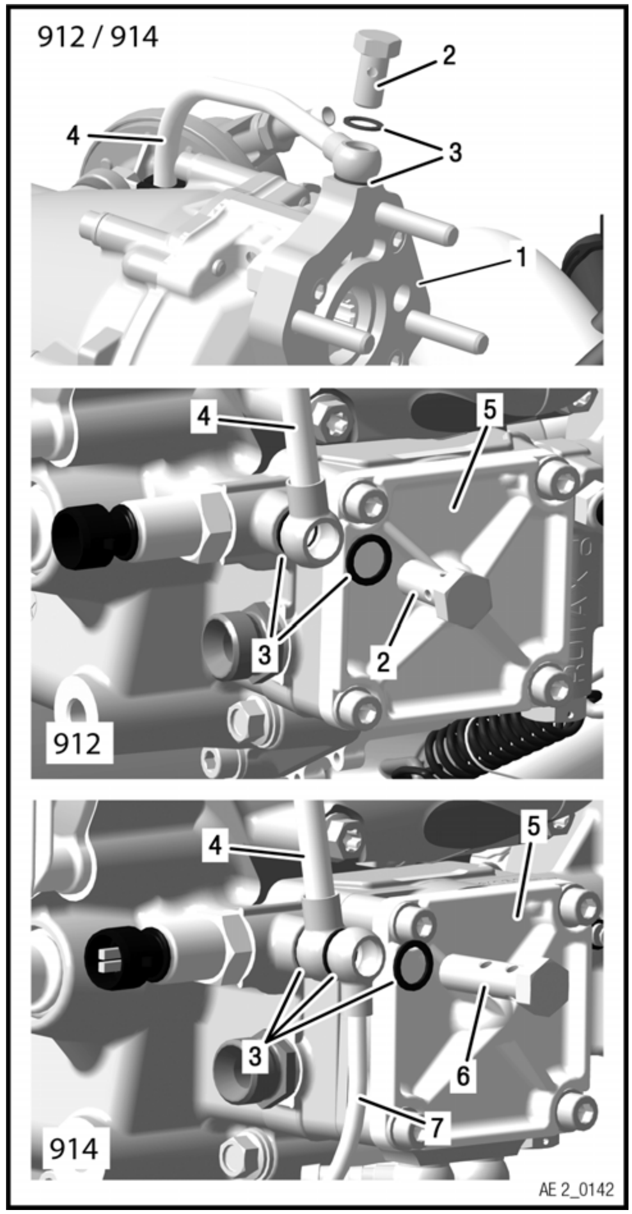

Figure 5.22

1	*Governor flange*	2	*Banjo bolt M10x1x23*
3	*Sealing rings A10x14*	4	*Governor pressure oil line assy.*
5	*Oil pump housing*	6	*Banjo bolt M10x1x34*
7	*Turbo pressure oil line*		

Step	Procedure
6	912 Series: Fasten governor pressure oil line with the cable clamp using lock washer A8, hex. nut M8 and LOCTITE 243. Tightening torque 15 Nm (133 in.lb.). 914 Series: Fasten governor pressure oil line with the cable clamp and the distance sleeve using lock washer A8, hex. screw M8x25 and LOCTITE 243. Tightening torque 15 Nm (133 in.lb.).

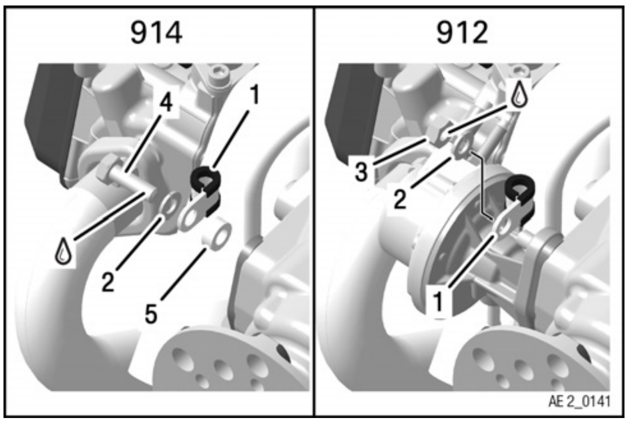

Figure 5.23

1	*Cable clamp*	2	*Lock washer A8*
3	*Hex. nut M8*	4	*Hex. screw M8x25.*
5	*Distance sleeve 8.4/ 15/6*		

Step	Procedure
7	The plug screws are usually not removed. If necessary, a manometer can be connected to check the governor pressure.
8	Secure the plug screw M8x1 with LOCTITE 243. Tightening torque 10 Nm (89 in.lb.)
9	Check that the studs are firmly in place. If necessary, apply LOCTITE 243 and tighten. Tightening torque 15 Nm (133 in.lb.).

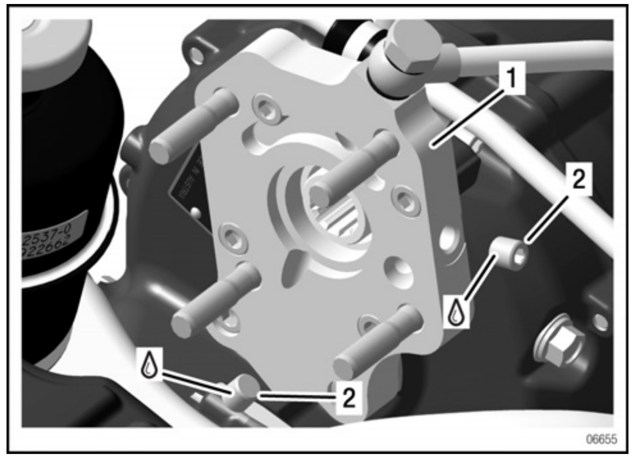

Figure 5.24: Typical

1	*Governor flange*	2	*Plug screw M8x1*

GOVERNOR INSTALLATION

Follow the instructions of the aircraft manufacturer.

Various screws or studs with nuts are required, depending on the manufacturer of the governor. See the current edition of SB-912-052 and SB-914–035 "Installation/use of governors".

NOTICE

The gear-tooth system of the governor must match when installed!

NOTE

Make sure that the toothing is engaged and the toothed shaft of the governor move easily into the drive sleeve.

NOTICE

No hammering or pressing!
The drive gear must only be pushed on manually.

FINISHING WORK

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

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Chapter: 71–00–00
POWER PLANT

TOPICS IN THIS CHAPTER

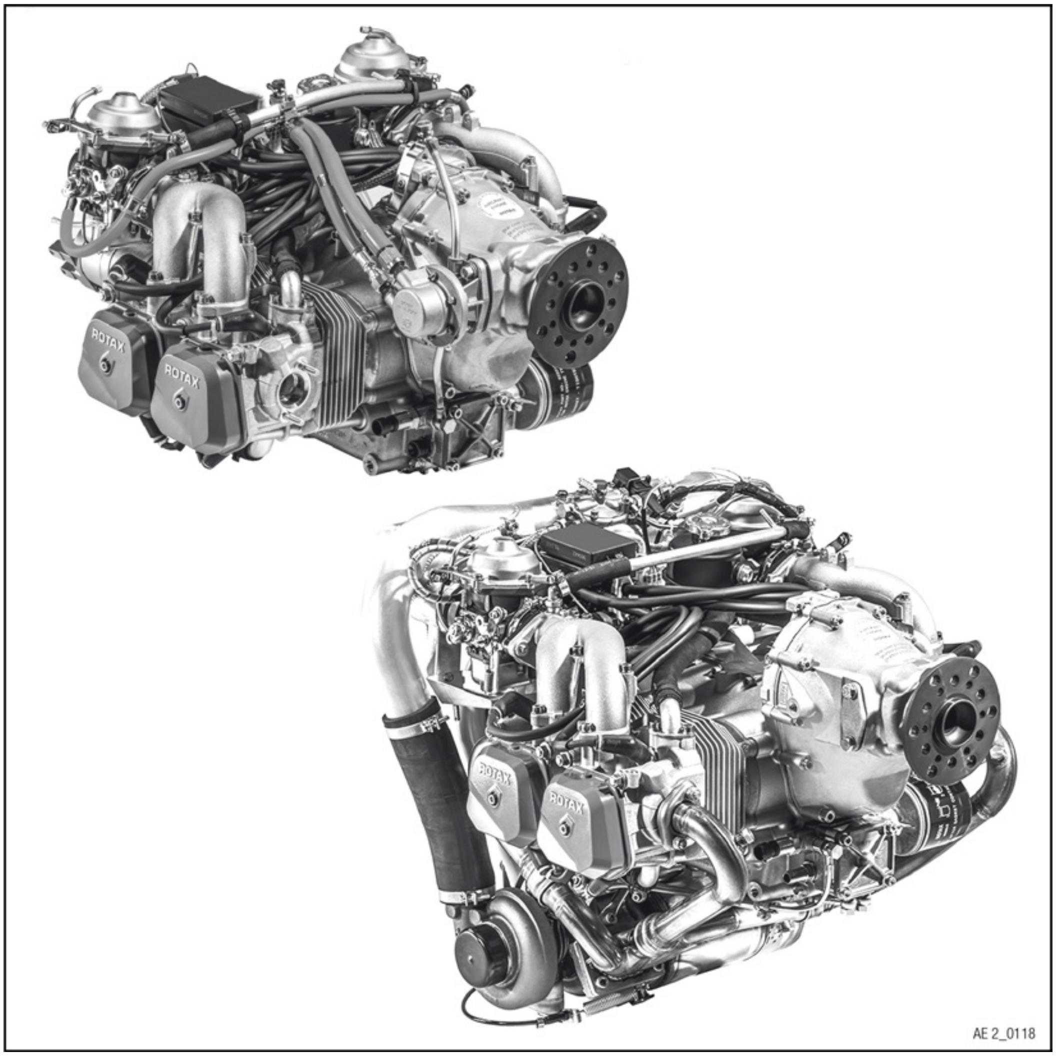

Figure 6.1: Power plant

GENERAL NOTE

DELIVERY OF THE ENGINE

Delivery and handling of the engine and assemblies

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

Unpacking the engine
To unpack a new engine, proceed as follows:

Step	Procedure
1	Remove the wooden lid.
2	Remove the protective packaging.

Removal of protective coverings and preservation

Step	Procedure
1	Remove protective coverings, waxed paper or something similar.
2	The protective coverings attached for transport or preservation must be removed.

ENGINE PRESERVATION

If limit is exceeded or preservation was not performed annually - this section is valid for:
Storage and preservation requirements for a new engine or an engine which has been in operation.
Following steps need to be checked before return to operation:

- Removal of the gearbox and one cylinder.
- Visual inspection for possible corrosion on gear set, propeller shaft, clutch, crankshaft, camshaft, con rod, piston rings and valves.

NOTE

If there is any corrosion of the components, the engine must be sent to an ROTAX® Authorized overhaul facility.

NOTICE

The preservation is in the responsibility of the engine owner or any other service contracted partner of him or her. The relevant documentation to approve that the preservation was done correctly also is in the responsibility of the previous named parties. BRP-Rotax can not approve, if a preservation was done correctly or not.If no documentation of preservation is available, BRP-Rotax recommends to perform the checks according to part “Following steps need to be checked before return to operation”.

⚠ 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.

Finishing work:

- 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.

NOTICE

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

NOTE

In the event of longer out of service periods repeat the whole preservation procedure annually.

Carry out oil change.
See current Maintenance Manual Line (MML) for the respective engine type.

- On 912 Series: Run the engine to allow it to warm up, leave it running at increased idle speed, remove the air filters and inject approx. 30 cm3 of preservation oil into the carburetors, shut down the engine.
- On 914 Series: Remove the top spark plugs from all four cylinders and spray preservation oil into the cylinders through the spark plug bores.
  Turn the crankshaft several times.
  Fit spark plugs and spark plug connectors.
- Drain carburetor float chambers.
- Apply engine oil to all linkages on carburetors.
- 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 current Maintenance Manual Line (MML) for the respective engine type.

⚠ 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

CORROSION

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

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

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® 912 or 914 Series engine consists basically of several main components and add-on assemblies, which are described in more detail in the Operators Manual (OM) (Chapter 1).

TECHNICAL DATA

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

OPERATING LIMITS

See the current 912 or 914 Series Operators Manual (OM), “Operating instructions”.

OPERATING FLUIDS/CAPACITIES

See the current 912 or 914 Series Operators Manual(OM), “Operating media”.

WEIGHTS

See the current 912 or 914 Series Operators Manual (OM), “Technical data”.

SERIAL AND PART NO.

The parts are labelled with serial and part numbers. The following description explains the main two versions of 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.

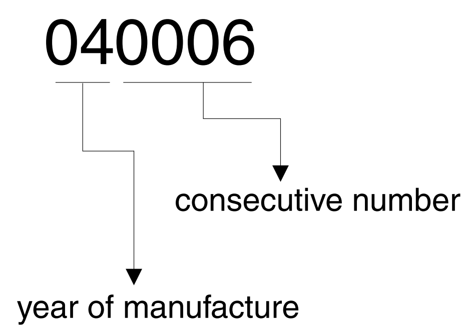

Figure 6.2: e.g. serial number

PART NO.

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

This number block is a consecutive number.

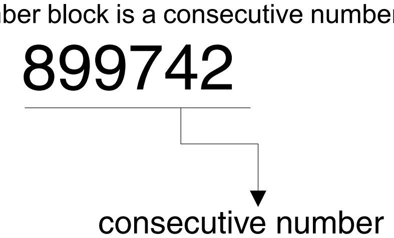

Figure 6.3: e.g. part no.

ENGINE/COMPONENTS, GENERAL

Engine 912:

	912 A, F, UL		**912 S, ULS, ULSFR**	
Design	4–cylinder horizontally opposed 4-stroke-engine			
Bore	79.5 mm (3.13 in)		84 mm (3.31 in)	
Stroke	61.0 mm (2.40 in)			
Displacement	1211 cm³		1352 cm³	
Cylinders	Lightweight metal cylinder with Nikasil coated running surface			
Pistons	Lightweight cast metal piston with 3 piston rings			
Cylinder head	4 individual cylinder heads			
Compression	9 : 1		10.8 : 1	
Intake valve	38 mm (1.49 in), valve seat surfaced hardened			
Exhaust valve	32 mm (1.26 in) NIMONIC, armor welding at valve seat			
Valve clearance	Automatic valve clearance compensation by means of hydraulic valve tappet			
Valve train	OHV, hydraulic valve tappet, push-rods and rocker arms			
Camshaft	Steel, heat- and surface-treated			
Control time (at 1 mm valve stroke)	Io. 0° T.D.C Ic. 48° after B.D.C.	Oo. 48° before B.D.C Oc. 0° T.D.C.	Io. 2° before T.D.C. Ic. 48° after B.D.C.	Oo. 48° before B.D.C. Oc. 2° after T.D.C.
Crankshaft	Supported in 5 plain bearings, case hardened			
Cooling	Liquid-cooled cylinder heads, ram air cooled cylinders			
Lubrication	**Main oil pump circuit:** Dry sump forced lubrication system, trochoid pump driven by the camshaft, oil return by the blow-by			
Oil delivery rate	**Main oil pump:** approx. 16 l/min at 5500 rpm			
Ignition unit	ROTAX® DCDI, interference suppressed			
Ignition point	**Differences between electronic module**		without advanced start	with advanced start
		fly wheel hub		
	ignition point at start	old: 966871 new: 966872	4° before T.D.C. 3° after T.D.C.	4° before T.D.C. 3° after T.D.C.
	time delay for ignition at start		none	3 – 8 sec.

	912 A, F, UL	912 S, ULS, ULSFR	
	switching to advanced ignition	from 650 to 1000 RPM depending on trigger gap	after the expiration of the time delay (3-8 sec.)
	ignition timing in normal operation	**912 A, F, UL** Circuit A: 26° before T. D.C. Circuit B: 26° before T. D.C.	**912 S, ULS, ULSFR** Circuit A: 26° before T.D.C. Circuit B: 26° before T.D.C.
Firing order	1–4–2–3		
Spark plugs	12 mm (0.47 in), GENUINE RO-TAX® Spark plug part no. 297656	12 mm (0.47 in), GENUINE ROTAX® Spark plug part no. 297656	
Electrode gap	See Maintenance Manual Line (MML)		
Integrated generator	Permanent magnet single-phase generator approx. 250 W AC		
Rectifier regulator	12 V 20 A DC		
External gener-ator (optional)	12 V 40 A DC serial regulator with full-wave rectifier-regulator		
Carburetor	2 Bing-constant depression carburetors 32 mm (1.26 in), Type 64		
Fuel pumps	1 mechanically driven fuel pump		
Starter	Electric starter, 12 V/0.6 kW, optionally 0.9 kW (at 912 ULS standard)		
Propeller gearbox	Integrated gearbox with mechanical vibration damping and overload clutch on UL optionally without overload clutch		
Gear transmission	2.27	2.43	
Direction of rotation	counterclockwise, seen from the front in the direction of the propeller flange		
Overload clutch	Multi-disk clutch		
Vacuum pump (optional)	Drive via the gearbox		
Propeller pitch governor (optional)	Drive via the gearbox		
Certification	912 A: in accordance with JAR 22 (Type Certificate No. EASA.E.121) 912 F in accordance with FAR 33 and JAR-E (Type Certificate No. EASA.E.121) 912 F in accordance with FAR 33 and JAR-E (Type Certificate No. EASA.E.121)		

Engine 914

<table>
<tr><th></th><th colspan="4">914 F, UL</th></tr>
<tr><td>Design</td><td colspan="4">4–cylinder horizontally opposed 4-stroke-engine</td></tr>
<tr><td>Bore</td><td colspan="4">79.5 mm (3.13 in)</td></tr>
<tr><td>Stroke</td><td colspan="4">61.0 mm (2.40 in)</td></tr>
<tr><td>Displacement</td><td colspan="4">1211 cm³</td></tr>
<tr><td>Cylinders</td><td colspan="4">Lightweight metal cylinder with Nikasil coated running surface</td></tr>
<tr><td>Pistons</td><td colspan="4">Lightweight cast metal piston with 3 piston rings</td></tr>
<tr><td>Cylinder head</td><td colspan="4">4 individual cylinder heads</td></tr>
<tr><td>Compression</td><td colspan="4">9 : 1</td></tr>
<tr><td>Intake valve</td><td colspan="4">38 mm (1.49 in), valve seat surfaced hardened</td></tr>
<tr><td>Exhaust valve</td><td colspan="4">32 mm (1.26 in) NIMONIC, armor welding at valve seat</td></tr>
<tr><td>Valve clearance</td><td colspan="4">Automatic compensation of clearance by hydraulic valve tappet</td></tr>
<tr><td>Valve train</td><td colspan="4">OHV, hydraulic valve tappet, push-rods and rocker arms</td></tr>
<tr><td>Camshaft</td><td colspan="4">Steel, annealed, liquid nitriding</td></tr>
<tr><td>Control time
(at 1 mm valve stroke)</td><td colspan="2">Io. 0° T.D.C
Ic. 48° after B.D.C.</td><td colspan="2">Oo. 48° before B.D.C
Oc. 0° T.D.C.</td></tr>
<tr><td>Crankshaft</td><td colspan="4">Supported in 5 plain bearings, case hardened</td></tr>
<tr><td>Cooling</td><td colspan="4">Liquid-cooled cylinder heads, ram air cooled cylinders</td></tr>
<tr><td>Lubrication</td><td colspan="4">Main oil pump circuit:
Dry sump forced lubrication with trochoid pump, drive from the camshaft, blow-by oil return
Suction pump circuit:
Extra trochoid pump driven by the camshaft returns oil from the lower oil sump of the turbo-charger to the oil tank</td></tr>
<tr><td>Oil delivery rate</td><td colspan="4">Main oil pump:
approx. 16 l/min at 5500 rpm
Suction pump:
approx. 4 l/min at 5500 rpm</td></tr>
<tr><td>Ignition unit</td><td colspan="4">ROTAX® DCDI, interference suppressed</td></tr>
<tr><td rowspan="3">Ignition point</td><td colspan="2">Differences between electronic module part no. 966726 and part no. 966727:</td><td>without advanced start</td><td>with advanced start</td></tr>
<tr><td></td><td>fly wheel hub</td><td></td><td></td></tr>
<tr><td>ignition point at start</td><td></td><td>4° before T.D.C.</td><td>4° before T.D.C.</td></tr>
</table>

	914 F, UL		
	time delay for ignition at start	none	3 – 8 sec.
	switching to advanced ignition	from 650 to 1000 RPM depending on trigger gap	after the expiration of the time delay (3-8 sec.)
	ignition timing in normal operation	**914 F, UL** Circuit A: 26° before T.D.C. Circuit B: 22° before T.D.C.	**914 F, UL** Circuit A: 26° before T.D.C. Circuit B: 22° before T.D.C.
Firing order	1–4–2–3		
Spark plugs	12 mm (0.47 in), ROTAX part no. 297656		
Electrode gap	See Maintenance Manual Line (MML)		
Integrated generator	Permanent magnet single-phase generator approx. 250 W AC		
Rectifier regulator	12 V 20 A DC		
External generator (optional)	12 V 40 A DC serial regulator with full-wave rectifier-regulator		
Carburetor	2 Bing-constant depression carburetors 32 mm (1.26 in), Type 64		
Fuel pumps	2 electric fuel pumps		
Starter	Electric starter, 12 V/0.6 kW, optionally 0.9 kW		
Propeller gearbox	Integrated gearbox with mechanical vibration damping and overload clutch on UL optionally without overload clutch		
Gear transmission	2.43		
Direction of rotation	Counterclockwise, seen from the front in the direction of the propeller flange		
Overload clutch	Multi-disk clutch		
Vacuum pump (optional)	Drive via the gearbox		
Propeller pitch governor (optional)	Drive via the gearbox		
Turbocharger	Exhaust gas turbine with wastegate, radial-flow compressor T25		

	914 F, UL
Turbocharger control unit (TCU)	electronic, proportional plus integral plus derivative regulator with 2 external indicating lamps
Certification	914 F in accordance with FAR 33 (TC No. E00058EN) (TC No. EASA 122)

ENGINE COMPONENTS, ENGINE VIEWS, CYLINDER DESIGNATION AND DESCRIPTION OF MAIN AXIS (912 SERIES)

NOTE

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

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

Side view

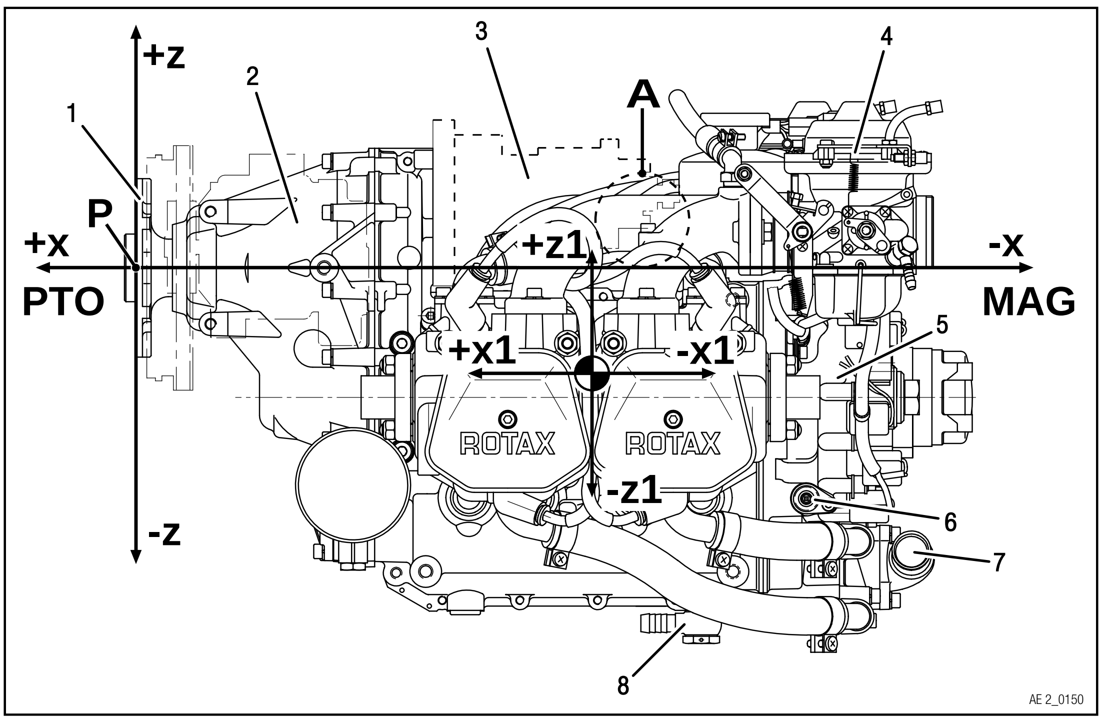

Figure 6.4: Side view engine

1	*Propeller flange*	2	*Propeller gearbox*
3	*Vacuum pump or hydraulic governor for constant speed propeller*	4	*Constant depression carburetor*

5	*Ignition housing*	6	*Connection for mechanical rev counter*
7	*Coolant pump*	8	*Connection for oil return line*

Front view

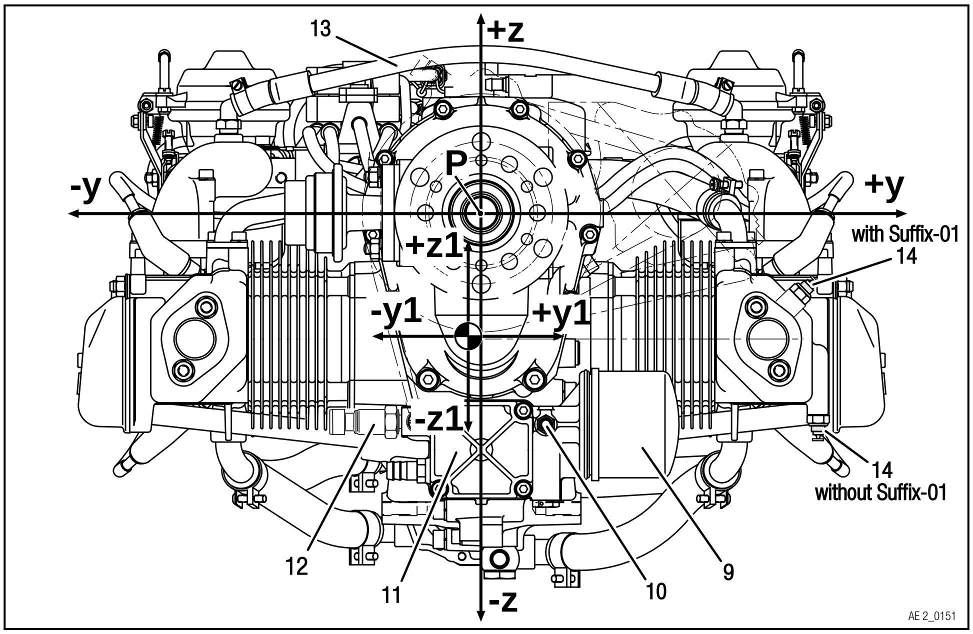

Figure 6.5: Front view engine

9	*Oil filter*	10	*Oil temperature sensor*
11	*Oil pump*	12	*Oil pressure sensor*
13	*Compensation tube*	14	*Cylinder head temperature sensor (without Suffix-01) / Coolant temperature sensor (with Suffix-01)*

Top view

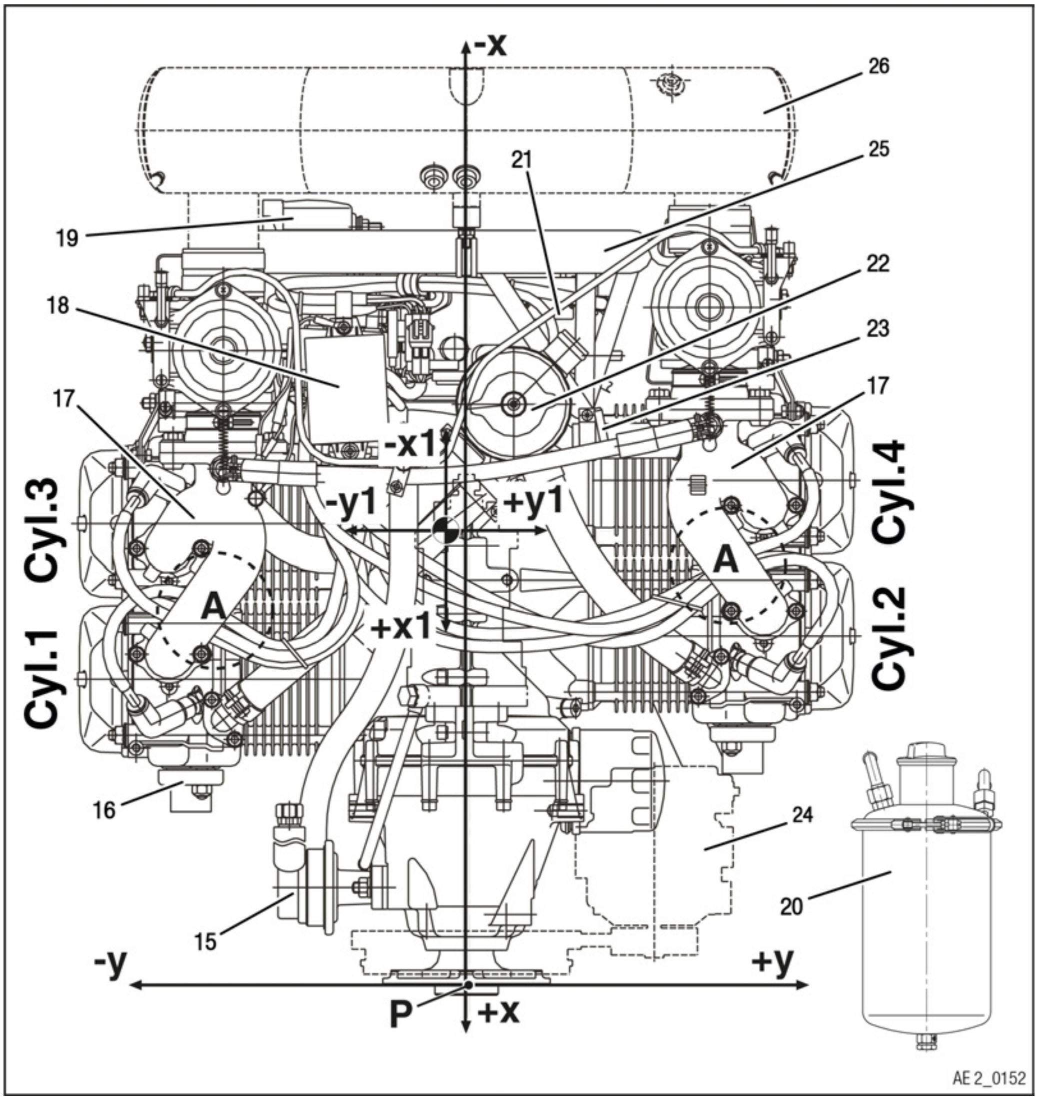

Figure 6.6: Top view engine

15	*Mechanical fuel pump*	16	*Exhaust socket*
17	*Intake manifold*	18	*Electronic module*
19	*Electric starter*	20	*Ignition housing*
21	*Engine number*	22	*Expansion tank*
23	*Connection for manifold pressure*	24	*External alternator (optional)*
25	*Engine suspension frame assy. (optional)*	26	*Airbox assy. (optional)*

ENGINE COMPONENTS, ENGINE VIEWS, CYLINDER DESIGNATION AND DESCRIPTION OF MAIN AXIS (914 SERIES)

NOTE

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

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

Side view

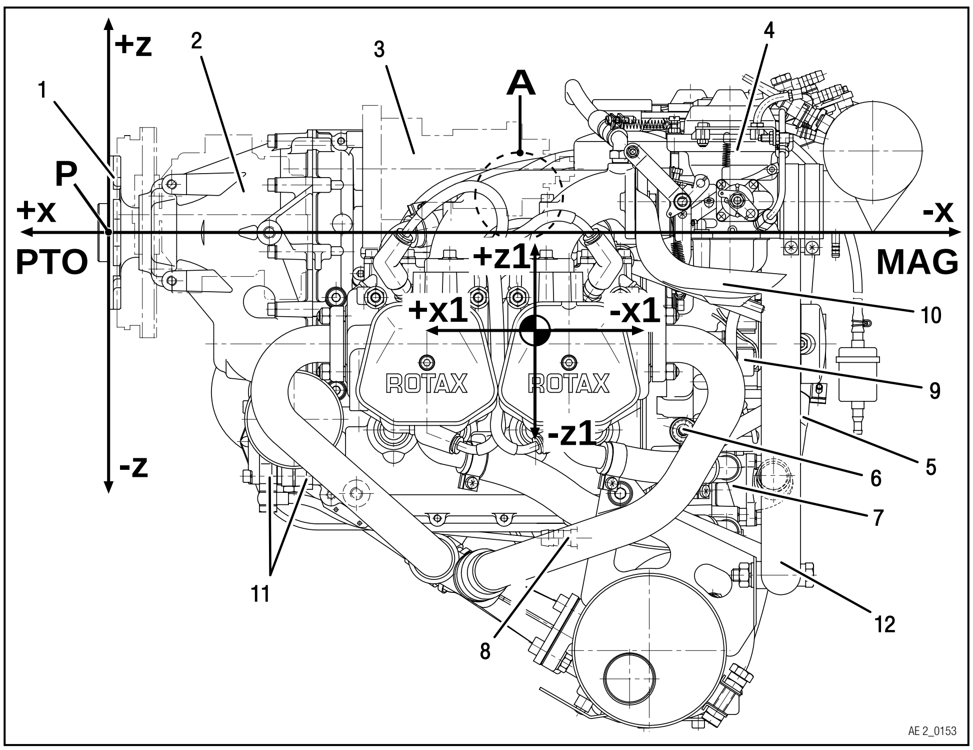

Figure 6.7: Side view engine

1	*Propeller flange*	2	*Propeller gearbox*
3	*Vacuum pump or hydraulic governor for constant speed propeller*	4	*Constant depression carburetor*
5	*Ignition housing*	6	*Connection for mechanical tachometer (optional)*

7	*Coolant pump*	8	*Connection for oil return line*
9	*Ignition housing*	10	*Drip tray*
11	*2 separate oil pumps (pressure & turbo scavenge)*	12	*Engine mount*

Front view

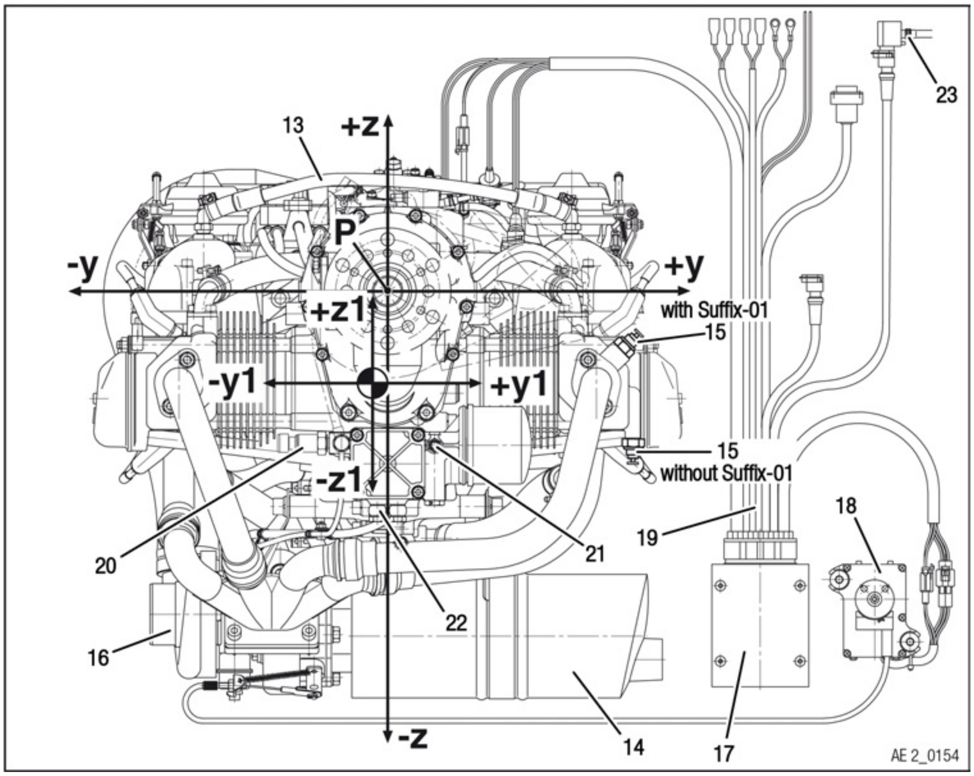

Figure 6.8: Front view engine

13	*Compensation tube*	14	*Stainless steel exhaust system*
15	*Cylinder head temperature sensor (without Suffix-01)/ Coolant temperature sensor (with Suffix-01)*	16	*Turbocharger*
17	*Turbo control unit (TCU)*	18	*Servo motor*
19	*Wiring harness*	20	*Airbox pressure sensor (installed on airbox)*
21	*Oil temperature sensor*	22	*Connection for oil return line (turbo)*
23	*Ambient pressure sensor*		

Top view

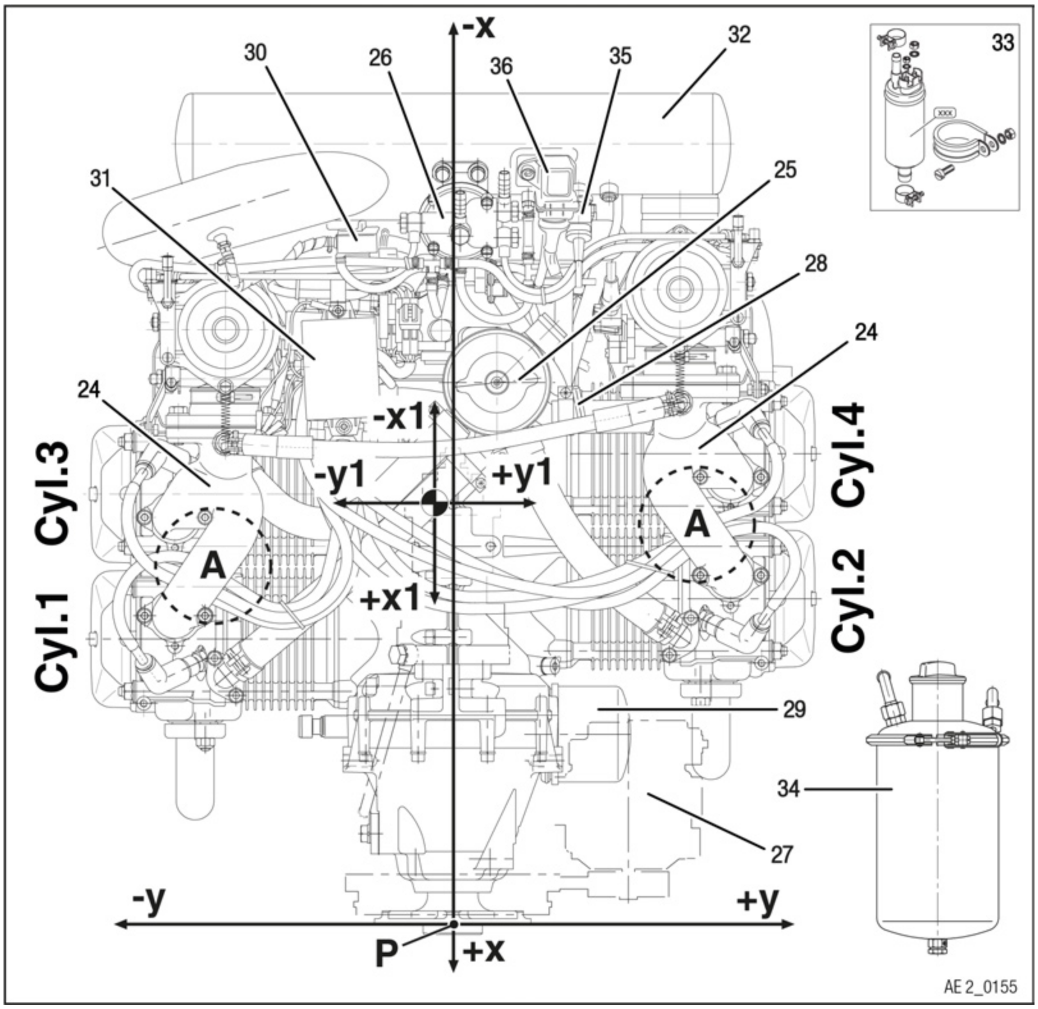

Figure 6.9: Top view engine

24	*Intake manifold*	25	*Expansion tank*
26	*Fuel pressure regulator*	27	*External Alternator*
28	*Connection for manifold pressure*	29	*Oil filter*
30	*Three way solenoid valve*	31	*Electronic modules (2x)*
32	*Airbox assy.*	33	*Fuel pump (2x)*
34	*Oil tank*	35	*Airbox temperature sensor*
36	*Airbox pressure sensor*		

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 75–00–00.
- Engine type 914 Series only: Remove muffler and turbocharger, if necessary. See Chapter 78-10-00 section Muffler assy. — removal (914 Series only) and Chapter 78-20-00 section Turbocharger assy. — removal

Step	Procedure
1	Remove cable clamp from the engine suspension frame.
2	After the Allen screws (1x M10x110 and 3x M10x35) have been removed along with their lock washers, the engine suspension frame can be removed.

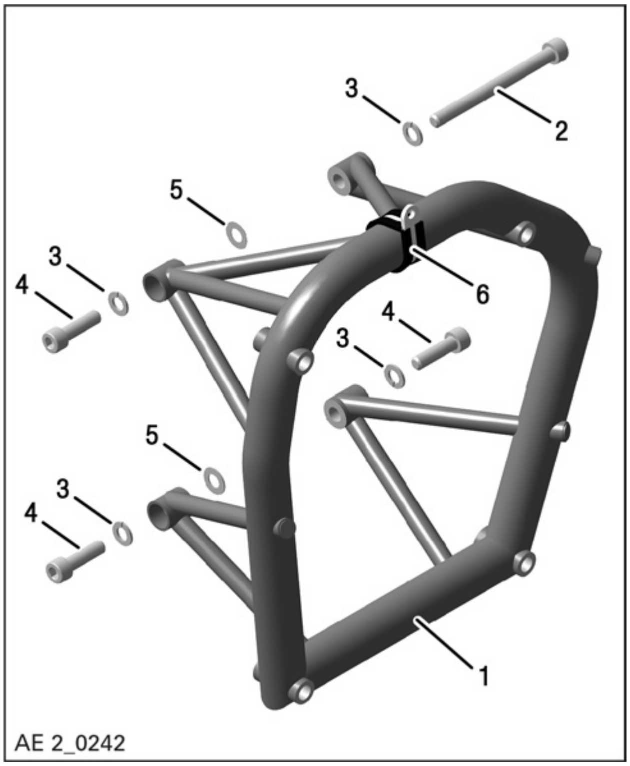

Figure 6.10: for 912 Series shown

1	*Engine suspension frame*	*2*	*Allen screw M10x110*
3	*Lock washer*	*4*	*Allen screw M10x35*
5	*Thrust washer*	*6*	*Cable clamp*

INSPECTION

ENGINE SUSPENSION FRAME CHECK

Step	Procedure
1	All components must be visually inspected.

NOTE

If the engine is fitted with engine suspension frame part no. 886567, inspection in accordance with SB-912-028 or SB-914-016,"Checking or replacement of engine suspension frame", latest issue must be performed.

NOTE

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

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

NOTICE

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, see Service Instruction "Running modifications"..

Step	Procedure
1	Tighten one side of the engine suspension frame with allen screws M10x35/110 including the lock washers A10 with 60 Nm (44 ft.lb.) and secured with LOCTITE 243.
2	Now install thrust washers 10.1/20/0.5 between the crankcase and the engine suspension frame. **NOTE** *Maximum allowed shimming distance is 2 mm (0.08 in.)*
3	Tighten second side of the engine suspension frame with Allen screws M10x35 including the lock washers A10 with 60 Nm (44 ft.lb.) and secured with LOCTITE 243.

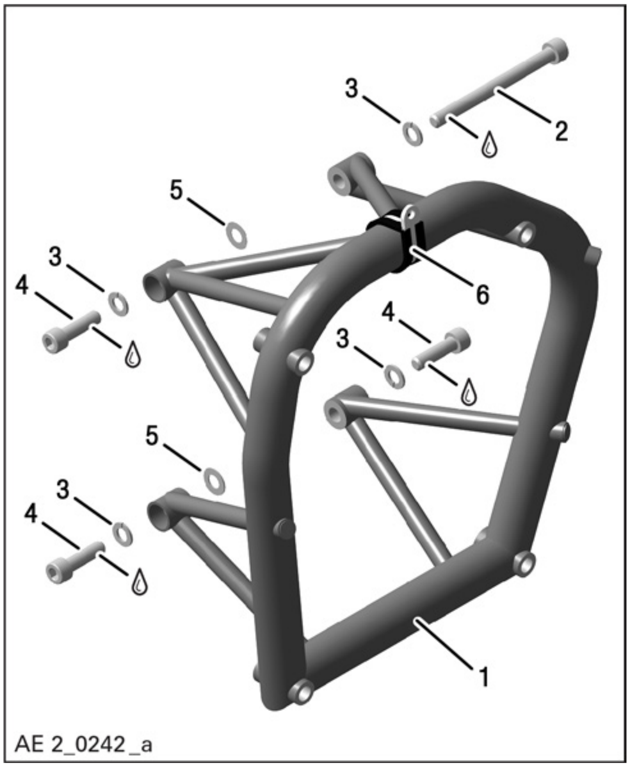

Figure 6.11: : 912 Series shown

1	*Engine suspension frame*	2	*Allen screw M10x110*
3	*Lock washer A10*	4	*Allen screw M10x35*
5	*Thrust washer 10.1/20/0.5*	6	*Cable clamp*

FINISHING WORK

- Install the water pump. See Chapter 75–00–00.
- Install the coolant hoses. See Chapter 75–00–00.
- Engine type 914 Series only: Install turbocharger and muffler, if necessary. See Chapter 78-20-00 section Turbocharger assy.— installation and Chapter 78-10-00 section Muffler assy. — installation (914 Series only).

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Carry out an engine test.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

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Chapter: 72–00–00
ENGINE

TOPICS IN THIS CHAPTER

This section describes the maintenance of the ROTAX® 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

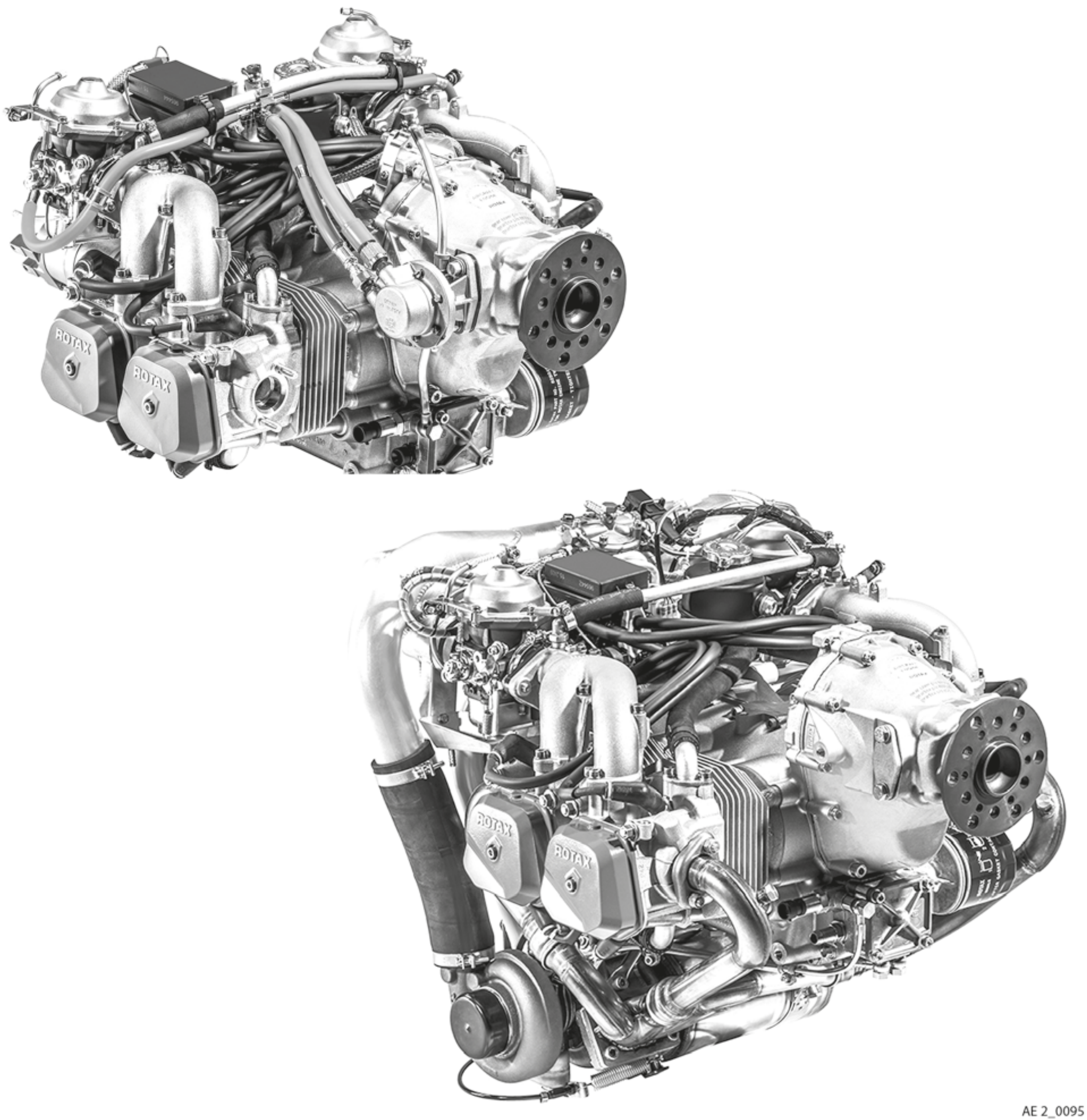

Figure 7.1: engine

SYSTEM DESCRIPTION

The 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!

NOTICE
Ensure that the ignition is switched off!Discon-nect the battery!Prevent the engine from being unintentionally switched on!

NOTE

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

CRANKSHAFT DISTORTION — INSPECTION

Preparation

Drain oil. See current Maintenance Manual Line (MML) for the respective engine type.

Remove the propeller gearbox. See current Maintenance Manual Line (MML) for the respective engine type.

- Remove ignition cover. See Chapter Chapter 24–20–00.

NOTE

The inspection of the crankshaft only makes sense if the shaft runout of the crankshaft AS or MS is less than 0.080 mm (0.0031 inch).

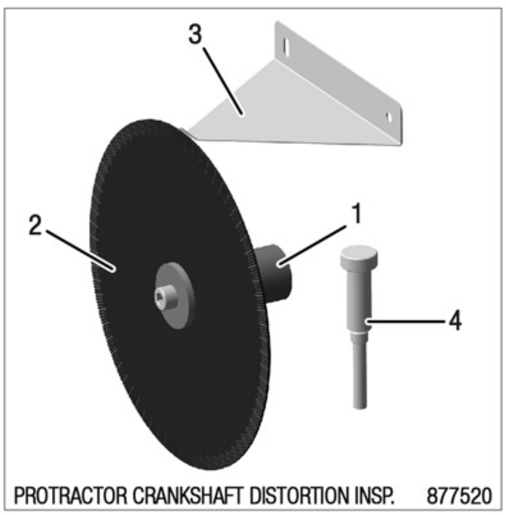

Figure 7.2: Protractor

1	*Bushing*	2	*Gauge block*
3	*Indicator*	4	*Piston stopper*

NOTICE
Do not damage the crankshaft

Step	Procedure
1	Carefully mount bushing for gauge block onto the crankshaft.
2	Install the indicator between the ball bearing and the roller bearing with Allen screws M6x20.

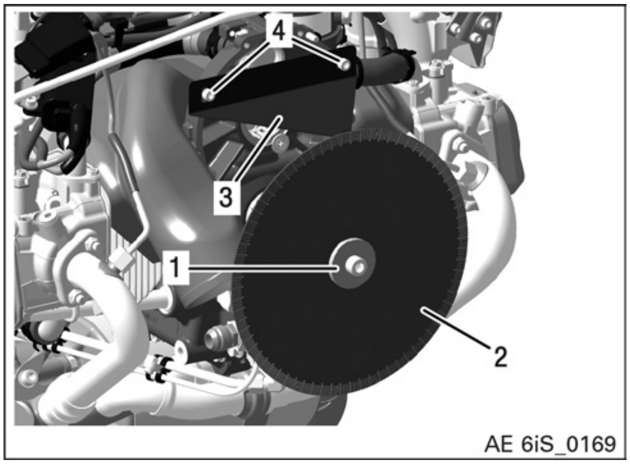

Figure 7.3

1	*Bushing*	2	*Gauge block*
3	*Indicator*	4	*Allen screw M6x20*

Step	Procedure
3	Remove the upper spark plugs, see Chapter 74–20–00.
4	Install the piston stopper into cylinder 1 completely.

NOTE

On all 4 cylinders the piston stopper has to be installed in the upper spark plug thread.

NOTE

Make sure that the piston stopper has been screwed in completely – so there is no space between the spark plug hole and the tooling surface.

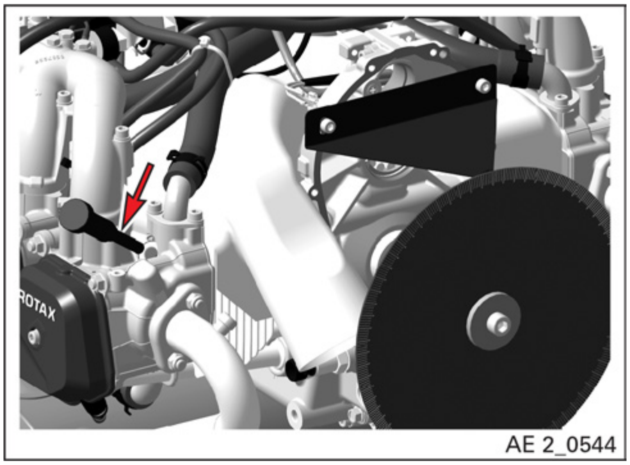

Figure 7.4: Piston stopper

Step	Procedure
5	Turn the crankshaft carefully in direction of engine rotation until the piston touches the piston stoppers.

NOTE

Always turn the crankshaft in direction of engine rotation, to move the piston towards the piston stopper.

NOTE

The force applied should be strong enough to break-through possible accumulations on the piston's surface.

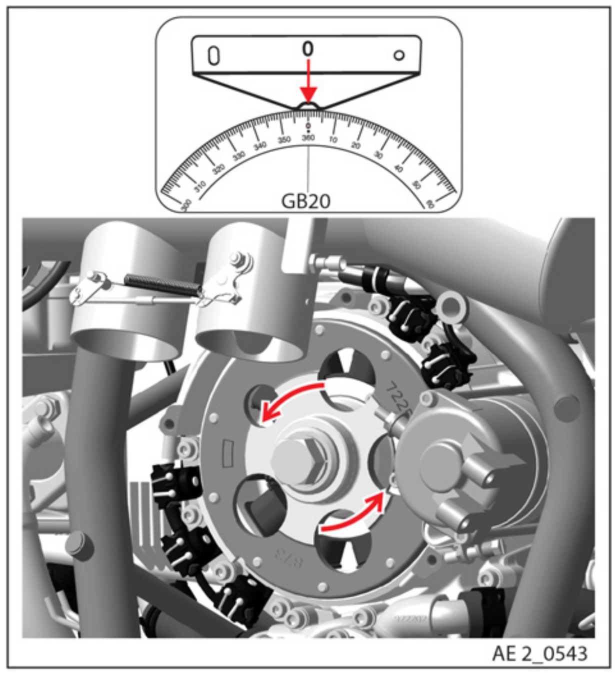

Figure 7.5: Direction of engine rotation

Step	Procedure
6	Turn the gauge block itself until the arrow of the indicator points to 0°. Then tighten the Allen screw of the gauge block holder.

NOTE

From this point onwards until the measurement procedure has ended the protractor must not be turned on the metal sheet.

NOTE

In this position the piston of cylinder 1 touches the piston stopper.

NOTICE
Values can always be positive or negative, which is very important for the whole measurement.

Step	Procedure
7	Turn the piston slightly away from the piston stopper so it is easier to remove it.
8	Install the piston stopper at cylinder 2 and proceed like at cylinder 1.
9	Note the difference to 0° from the protractor
10	Turn the piston slightly away from the piston stopper so it is easier to remove it. Repeat this procedure for cylinder 3 and 4. The piston will be stopped at 180°. Note the difference to 180° from the protractor for cylinder 3 and 4.

NOTICE
If a value exceeds the GB20 limit, then the engine needs to be overhauled by a ROTAX® Authorized overhaul facility.

NOTICE
The deviation of the crank pin (as a whole) must not exceed the GB20 value. For GB20 see “wear limits”.

Example showing the results from measuring a crankshaft, where the GB20 threshold is not exceeded.

Cylinder	Deviation – good
1	0°
2	+2°
3	0°
4	+1°

Example showing the results from measuring a crankshaft, where the GB20 threshold is exceeded.

Cylinder	Deviation – bad
1	0°
2	+2°
3	0°
4	-1°

FINISHING WORK

- Install ignition cover. See Chapter 24–20–00 Ignition cover - installation.
- Install the upper spark plug. See Chapter 74–20–00 Spark plugs - installation

Install propeller gearbox assy.
See current Maintenance Manual Line (MML) for the respective engine type.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

WEAR LIMITS

<table>
<tr><th rowspan="2">Descrip-tion</th><th rowspan="2">Code</th><th colspan="2">Reading new</th><th colspan="2">Wear limit</th><th rowspan="2"></th><th colspan="4" rowspan="2">Readings</th></tr>
<tr><th>min.</th><th>max.</th><th>100 %</th><th>50 %</th></tr>
<tr><td colspan="7">CRANKSHAFT</td><td>Cyl. 1</td><td>Cyl. 2</td><td>Cyl. 3</td><td>Cyl. 4</td></tr>
<tr><td rowspan="2">Crank-shaft angle of twist</td><td rowspan="2">GB20</td><td rowspan="2">0 (degrees)</td><td rowspan="2">2 (degrees)</td><td rowspan="2"></td><td rowspan="2"></td><td>actual</td><td></td><td></td><td></td><td></td></tr>
<tr><td>renewed</td><td></td><td></td><td></td><td></td></tr>
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Chapter: 72–10–00
PROPELLER GEARBOX

TOPICS IN THIS CHAPTER

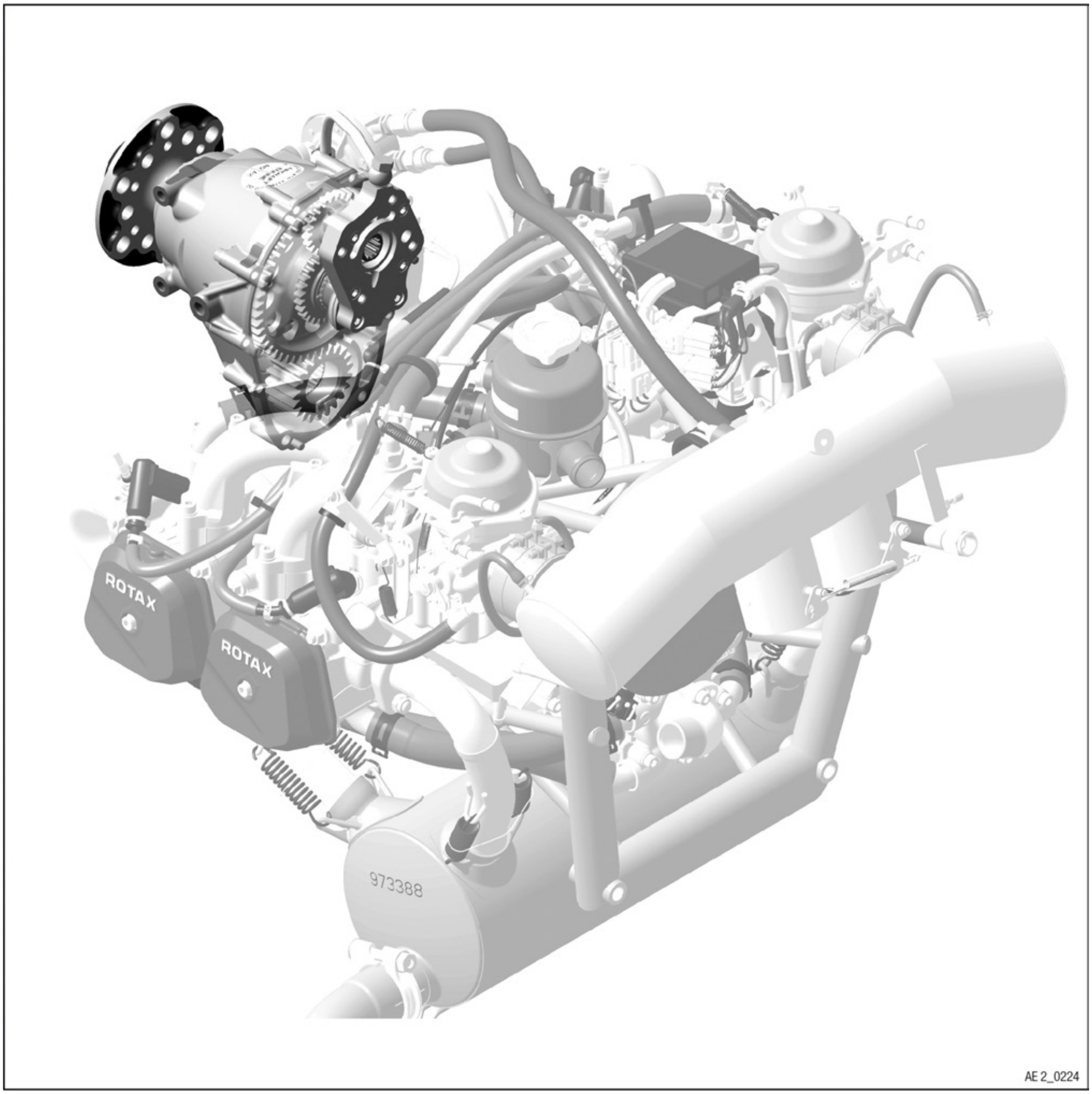


Figure 8.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Hot air gun	n.a.
Socket wrench assy. 41x12.5	877445
Mounting yoke to compress dog gear	876885
Circlip pliers	n.a.
Extractor	877615
Press-out mushroom (version 2)	877605
Press-out mushroom (version 3)	877600
Insertion jig	876518
Stud M10x45/20 (version 2)	941180
Pull-out-plate (version 2)	877561
Hex. nut M10 (version 2)	242092
Puller assy. (version 3)	876489
Press-in jig (version 2)	877594
Press-in mushroom	877590

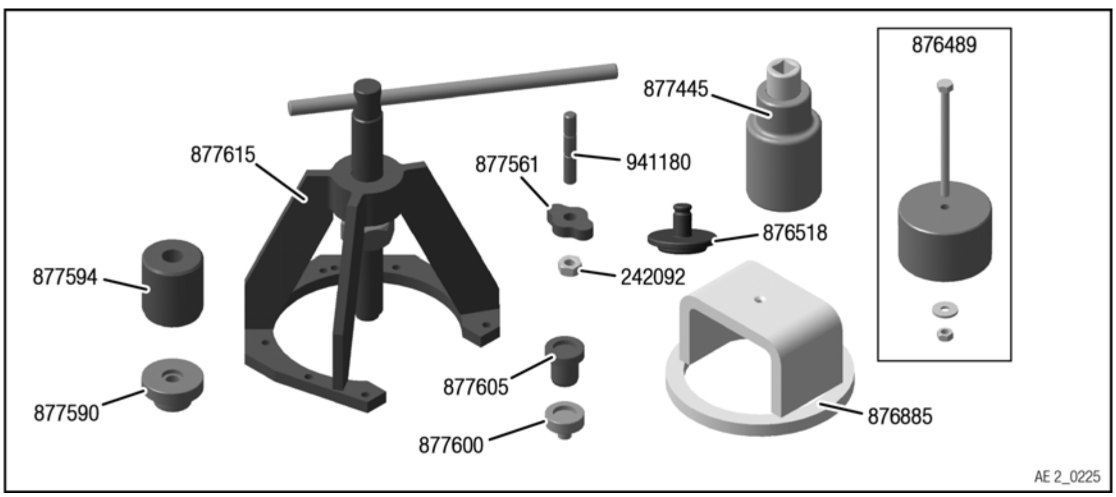


Figure 8.2

SERVICE PRODUCTS

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

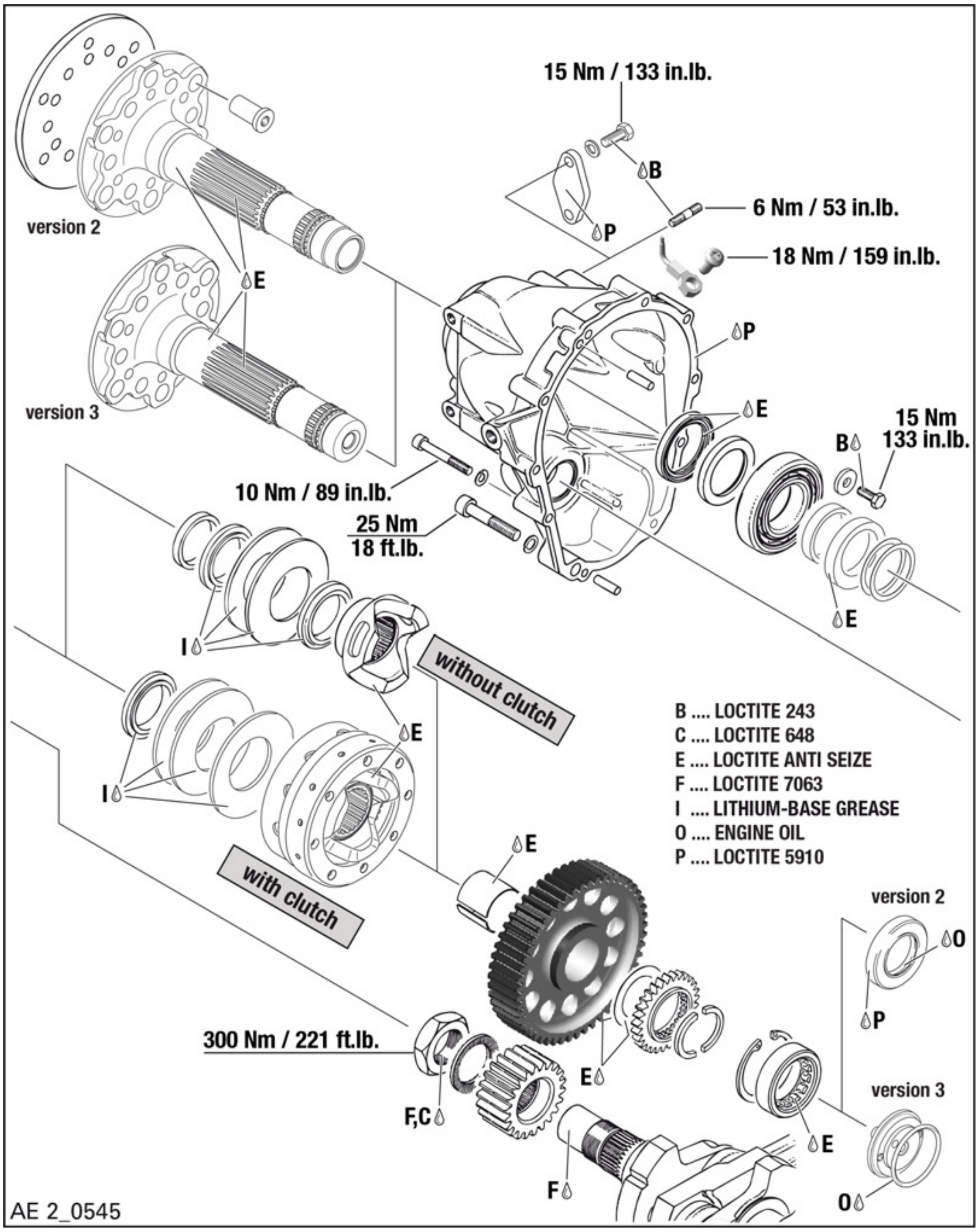


Figure 8.3: Components

SYSTEM DESCRIPTION

The propeller shaft is powered by the crankshaft via spur gear drive. Gear ratio Crankshaft : propeller shaft see following table:

Gear ratio	Engine type
2.43 : 1	912 S, ULS, ULSFR / 914 F, UL / 912 A, F, UL - optional
2.27 : 1	912 A, F, UL

The propeller gearbox has a damping means to counteract torsional vibrations. This consists of torsional shock absorption by means of contoured dogs with axial spring loading by disc springs.

The design also includes a friction damped free rotation at the dogs to ensure smooth engine idling. Due to this free rotation, a distinct torsional impact arises at engine start and stop and in the event of sudden load changes, but due to the integrated overload clutch it will remain harmless.

NOTE

This overload clutch also protects the crankshaft from overloading if the propeller comes into contact with the ground.

NOTE

The overload clutch is fitted in serial production on both certified aircraft and uncertified aircraft engines of configuration 3.

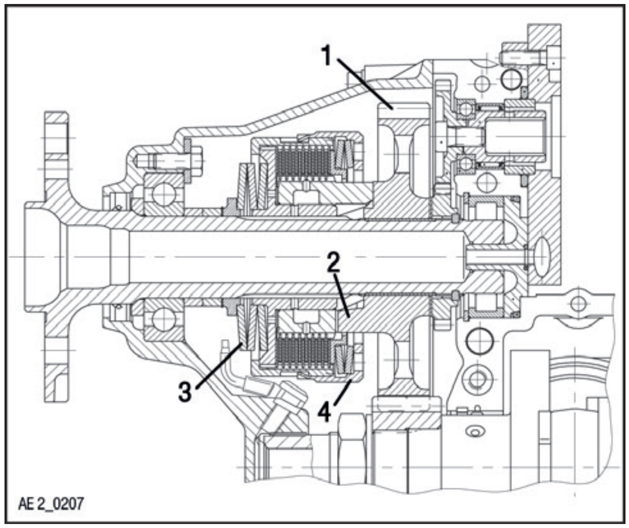


Figure 8.4: Configuration 3 with overload clutch

1	*Straight toothed spur gear*	*2*	*Dogs*
3	*Disc springs*	*4*	*Overload clutch*

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!

GEARBOX VERSION

There are 2 gearbox configurations for the 912 / 914 Series. See Chapter 00-00-00 Type description

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

REMOVAL

For removal of the propeller gearbox, see current Maintenance Manual Line (MML) for the respective engine type.

For removal of the drive gear, see current Maintenance Manual Line (MML) for the respective engine type.

DISASSEMBLY

DISASSEMBLY OF THE PROPELLER GEARBOX

NOTICE

Gearbox housing may be damaged.
Push the dog gear down only until the ring halves can be taken out. The gear cover must be freely rotatable!

Step	Procedure
1	Place the entire gearbox into a suitable fixture and press down the gear with the mounting yoke part no. 876885 until the ring halves can be taken out.

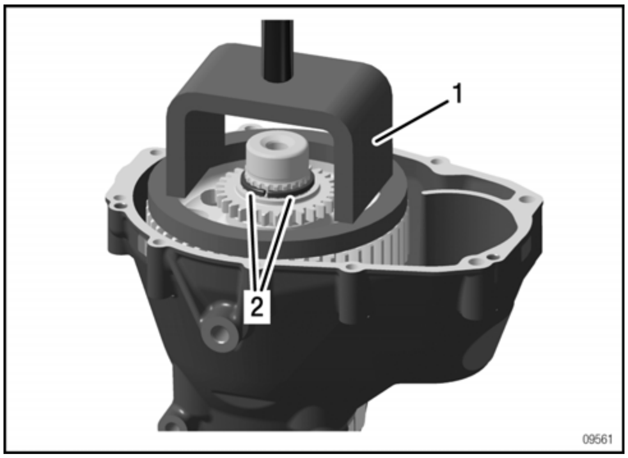


Figure 8.5

1 Mounting yoke 876885 *2 Ring halves*

NOTICE

Do not over-stretch the bearing bushing, otherwise it will become unusable.

Step	Procedure
2	Relieve the pressure on the gear.
3	Remove mounting yoke and the gearbox from the fixture.
4	Remove the drive gear, the thrust washer and the dog gear.
5	Force bearing bushing apart with circlip pliers and withdraw from propeller shaft.

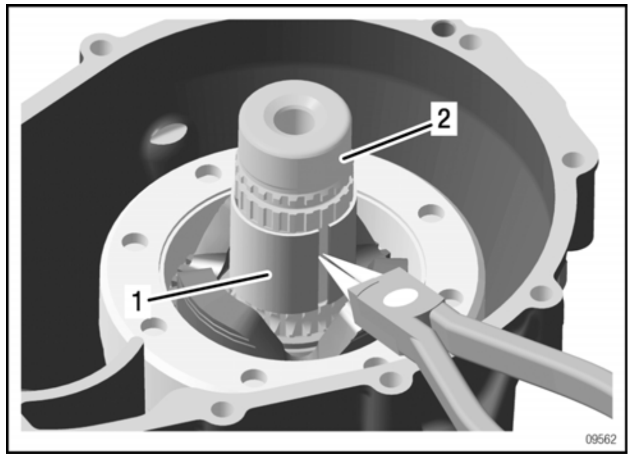


Figure 8.6: typical

1 Bearing bushing *2 Propeller shaft*

Step	Procedure
6	With clutch: Remove the clutch assy., 3 disc springs 80x35x3, step collar or step collar (for gearbox with oil spray nozzle), distance sleeve, eccenter (for fuel pump on the ROTAX® 912 Series, of no significance on the 914 Series) and 8 mm (0.31 in) distance sleeve.
	Without clutch: Remove the dog hub, step collar, 2 disc springs 80x35x3, step collar or step collar (for gearbox with oil spray nozzle), distance sleeve, compensating shim, eccenter (for fuel pump on the ROTAX® 912 Series, of no significance on the 914 Series) and 8 mm (0.31 in) distance sleeve.

NOTICE
The overload clutch is built in as standard in all certified and non-certified aircraft engines.

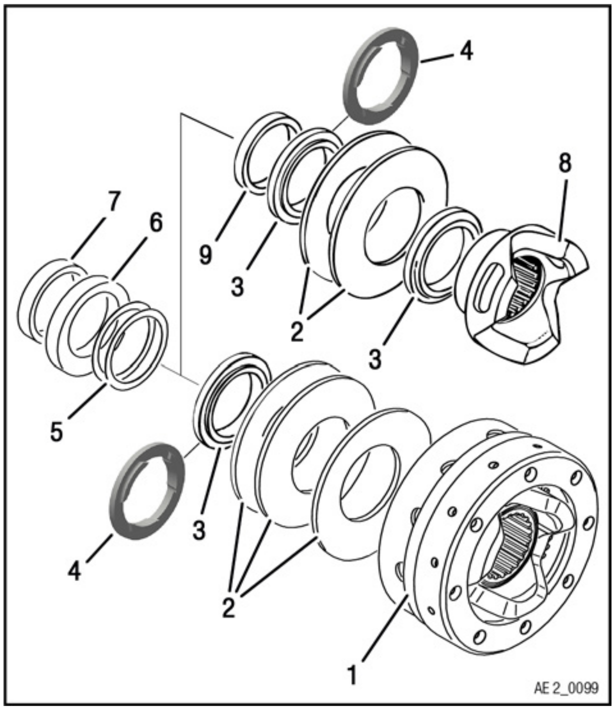


Figure 8.7

1	*Clutch assy.*	2	*Disc springs*
3	*Step collar*	4	*Step collar with recesses*
5	*Compensating shim*	6	*Eccenter*
7	*Distance sleeve 35.2/ 42/8*	8	*Dog hub*
9	*Distance sleeve 35.2/ 42/6*		

NOTE

Propeller gearbox with oil spray nozzle has a step collar with recesses in bore.

REMOVAL OF THE PROPELLER SHAFT

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

Step	Procedure
1	Place the gearbox housing on a suitable support.

NOTICE
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
2	Screw the extractor part no. 877615 onto the gearbox housing with six Allen screws M6x25 and place press-out mushroom part no. 877605 (for propeller shaft 2) or press-out mushroom part no. 877600 (for propeller shaft 3) onto the end of the propeller shaft as protection.
3	Place the pull-in spindle into the extractor support and screw the hex. nuts M24x1.5 onto the spindle from the inside.
4	Held with the spanner, the propeller shaft is pushed out of the gearbox housing by turning the spindle clockwise.

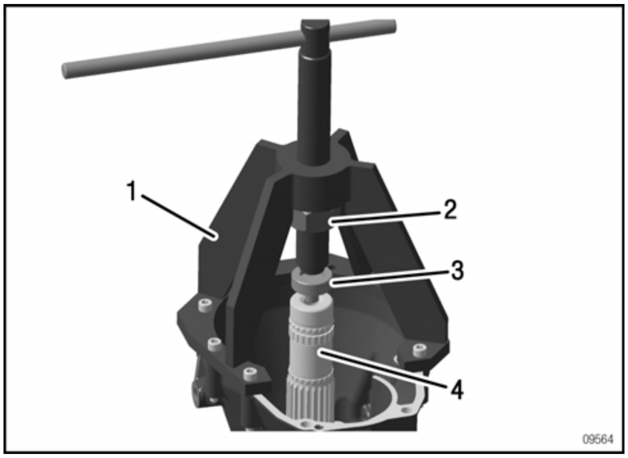


Figure 8.8

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

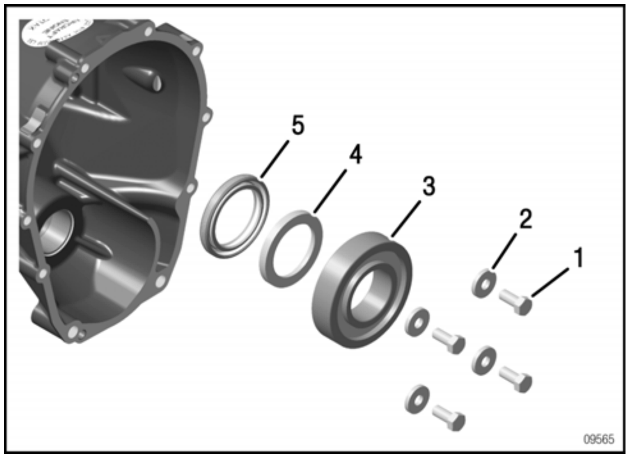


Figure 8.9: Typical

1	*Hex. screw M7x16*	*2*	*Washer 7.2/18.8/3*
3	*Ball bearing 6207 E THNC3*	*4*	*Radius ring 36/50/5.5*
5	*Oil seal AS 40x55x7 FPM*		

REMOVAL OF THE BALL BEARING

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

NOTICE

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

Step	Procedure
1	Loosen 4 hex. screws M7x16 with washers from the gearbox housing.
2	Heat the gearbox housing about 100 to 120 °C (176 to 212 °F) and press the ball bearing together with the oil seal and radius ring inwards with a suitable insertion jig.

REMOVAL OF THE ROLLER BEARING — VERSION 2

Preparation

Remove propeller gearbox in order to remove the roller bearing. See current Maintenance Manual Line (MML) for the respective engine type.

Step	Procedure
1	Remove retaining ring with circlip tires.
2	Attach extractor part no. 877615 with six Allen screws M6x25 to the crankcase.
3	Install stud M10x45/20 part no. 941180 into the pull-in spindle and fix hex. nut M24x1.5 onto the pull-in spindle.
4	For better guidance, place the press-in mushroom part no. 877590 into the roller bearing.
5	Place the pull-in spindle into the extractor and through the crankcase.
6	On the rear side of the crankcase, push the pull-out plate part no. 877561 onto the stud and attach with the hex. nut M10 part no. 242091.

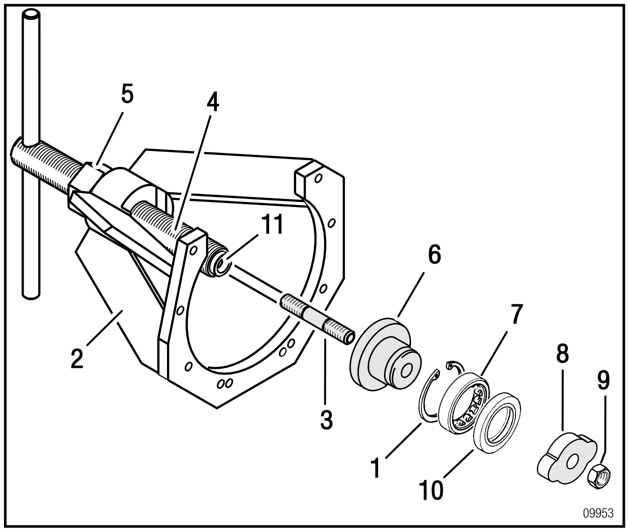


Figure 8.10

1	*Retaining ring*	2	*Extractor 877615*
3	*Stud M10x45*	4	*Pull-in spindle*
5	*Hex. nut M24x1,5*	6	*Press-in mushroom 877590*
7	*Roller bearing*	8	*Pullout plate 877561*
9	*Hex. nut M10*	10	*Oil seal*
11	*Spindle*		

Step	Procedure
7	Keep pull-in spindle in position with the handle lever and turn the hex. nut clockwise until the roller bearing with oil seal is pulled out of housing.
8	Loosen hex. nut, remove pullout plate with roller bearing and oil seal and withdraw spindle. Unscrew extractor from housing.

NOTICE

The oil seal is damaged in the process and must therefore be replaced.

REMOVAL OF THE ROLLER BEARING — VERSION 3

Remove propeller gearbox in order to remove the roller bearing. See current Maintenance Manual Line (MML) for the respective engine type.

Preparation

- Remove the governor flange. See Chapter 61-20-00.
- Remove the vacuum pump gear: See Chapter 37-10-00 section Vacuum pump gear.

NOTICE

The pressing out process for version 3 with the hydraulic governor is different from that for versions 2. The roller bearing is pressed out together with the oil inlet flange.

Step	Procedure
1	Remove the retaining ring with the circlip pliers.
2	Put on puller part no. 876489 and push the hex. screw through the cap, roller bearing and oil inlet flange.

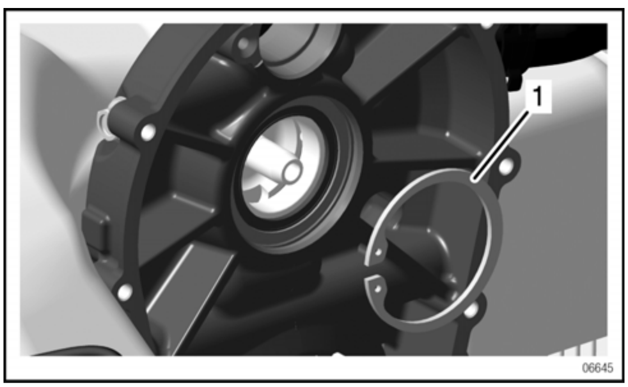


Figure 8.11

1 *Retaining ring*

Step	Procedure
3	Install the washer and nut on the rear.
4	The roller bearing is pressed out together with the oil inlet flange by turning the hex. screw clockwise.
5	Remove the O-rings.

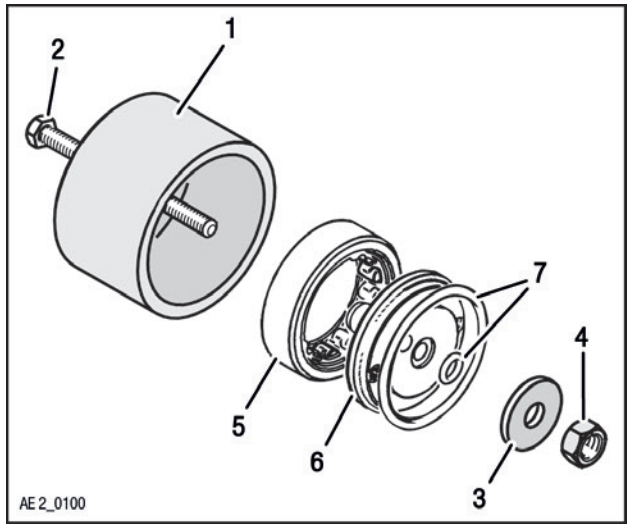


Figure 8.12

1	*Puller 876489*	2	*Hex. screw*
3	*Washer*	4	*Hex. nut*
5	*Roller bearing*	6	*Oil inlet flange*
7	*O-rings*		

INSPECTION

PROPELLER GEARBOX SINGLE PARTS — INSPECTION

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 ground contact!

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.

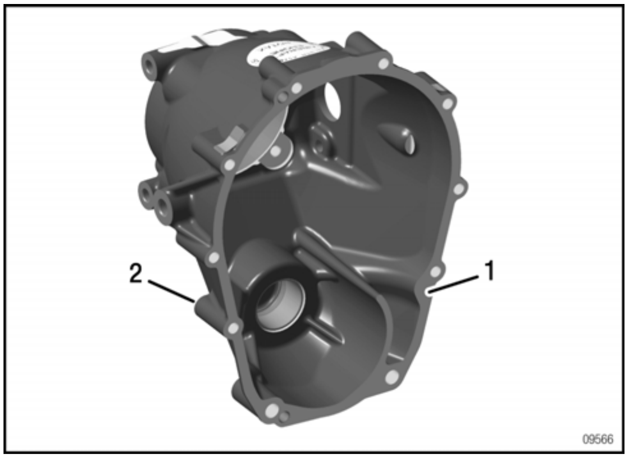


Figure 8.13: Typical

1 Flat sealing surfaces *2 Contact surfaces*

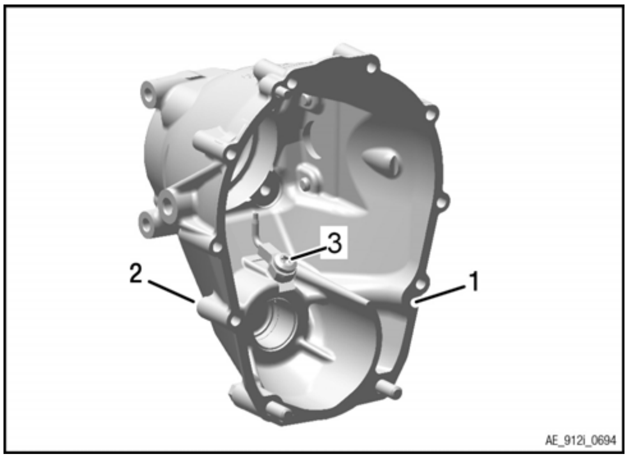


Figure 8.14: Propeller gearbox with oil spray nozzle

1 Flat sealing surfaces *2 Contact surfaces*

3 Oil spray nozzle assy.

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.

Step	Procedure
5	Check oil nozzle for blockage and if it is bended. Check also the correct position of the jet.
6	In case of disassembly loosen the banjo bolt with Torx T40.

NOTE

Inside the oil spray nozzle there is a check ball with a spring, therefore it is necessary to use forced air to blow out the oil spray nozzle.

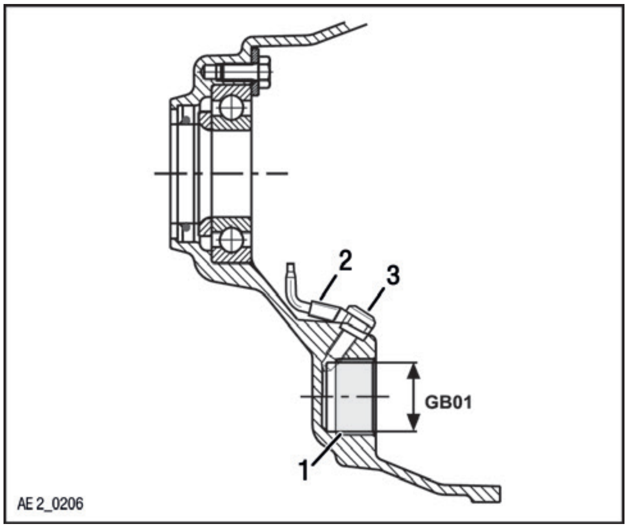


Figure 8.15

1 *Bearing bushing*
2 *Oil spray nozzle*
3 *Banjo bolt*

PROPELLER SHAFT — CHECK

NOTICE

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 both bearing seats. See Chapter 72–10–00 section Wear limits (GB02 and GB03)
2	Roll the propeller shaft and check for runout. Check the axial runout of the propeller flange. See Chapter 72–10–00 section Wear limits (GB04)
3	Check the oil seal running surface.

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.

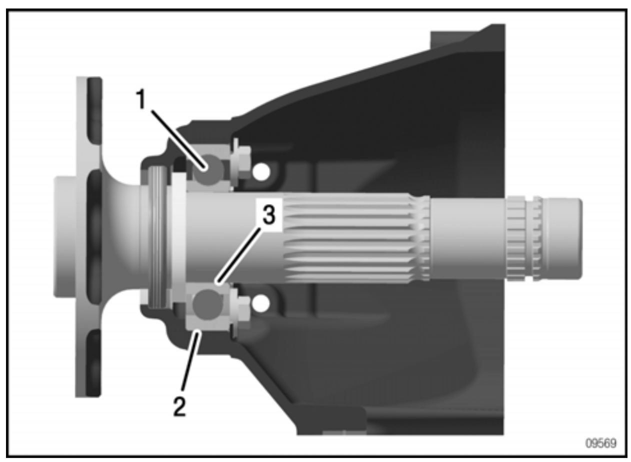


Figure 8.16

1 *Ball bearing*
2 *Outer ring*
3 *Inner ring*

Step	Procedure
4	Check the groove for the retaining rings and gear-tooth system for wear and damage.

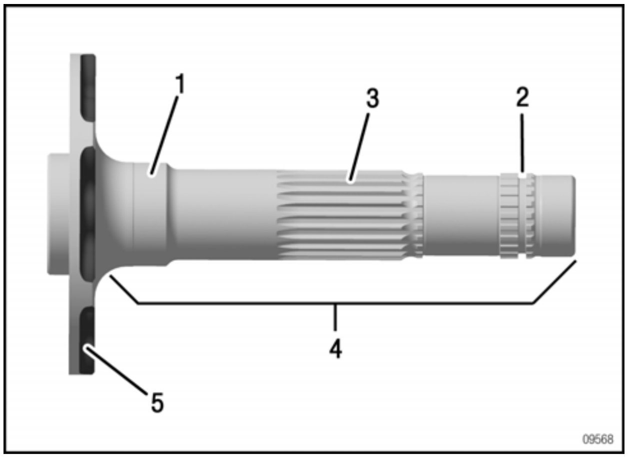


Figure 8.17

1	*Oil seal running surface*	*2*	*Groove for retaining ring*
3	*Gear-tooth system*	*4*	*Propeller shaft*
5	*Propeller flange*		

Configuration 3 only

- Measure the inner diameter of the propeller shaft. See wear limits GB05.
- Measure the journal of the oil inlet flange. See wear limits GB06.

NOTE

The dimension GB05 or GB06 by itself is not as important as the radial clearance between GB05/GB06.

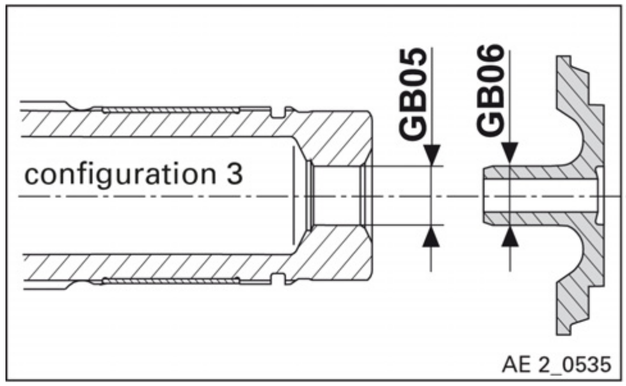


Figure 8.18

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.

NOTICE
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.

DOG HUB CHECK

Step	Procedure
1	Visually check the dog hub for visible pitting on the gear-tooth system and/or in the engagement faces of the dogs; see Chapter 72-10-00 section Wear limits (GB08)

NOTE

The cam peaks of the gear must never rest in the trough of the dog hub.

Step	Procedure
2	Measure the gap between the cam peak and the cam trough; see Chapter 72-10-00 section Wear limits (GB07)

NOTE

Slight to moderate traces of wear and pitting on the dogs are permissible.

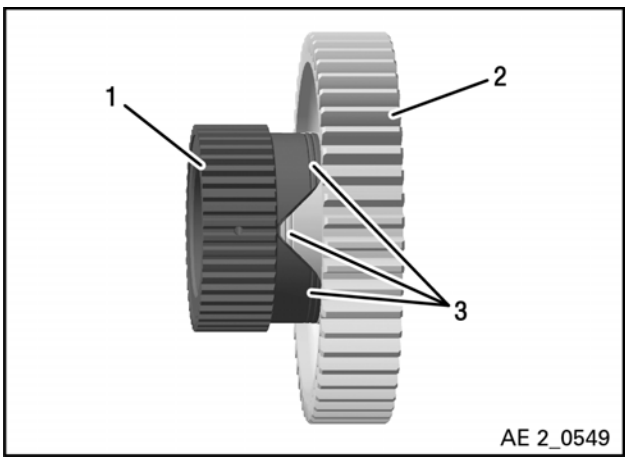


Figure 8.19: Typical

1 *Dog hub*
2 *Gear (propeller shaft)*
3 *Identifying lines*

NOTE

Verify that the parts are matched, also the lines on the gear and dog hub should be the same.

THRUST WASHER CHECK, BEARING BUSHING CHECK

Step	Procedure
1	Measure the thickness of the plastic thrust washer between the gear set and the drive gear; see Chapter 72-10-00 section Wear limits (GB11)
2	Check the heat-treated steel bearing bushing for wear.

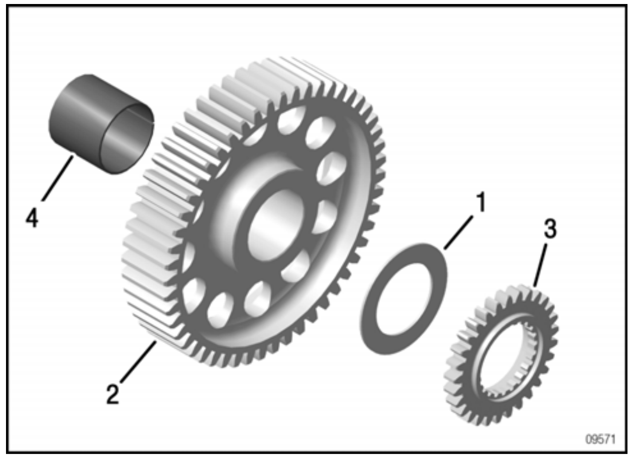


Figure 8.20

1 *Thrust washer*
2 *Gear (propeller shaft)*
3 *Drive gear 29 T*
4 *Bearing bushing*

STEP COLLAR CHECK, DISC SPRING CHECK

Step	Procedure
1	Check the step collar in the vicinity of the disc spring support for wear.
2	If wear of the disc springs is visible in the contact area, replace the disc springs. Inspect the dimension (GB13) of the non-tensioned disc spring; see Chapter 72-10-00 section Wear limits.

NOTE

The step collar for gearbox with oil spray nozzle has recesses in bore.

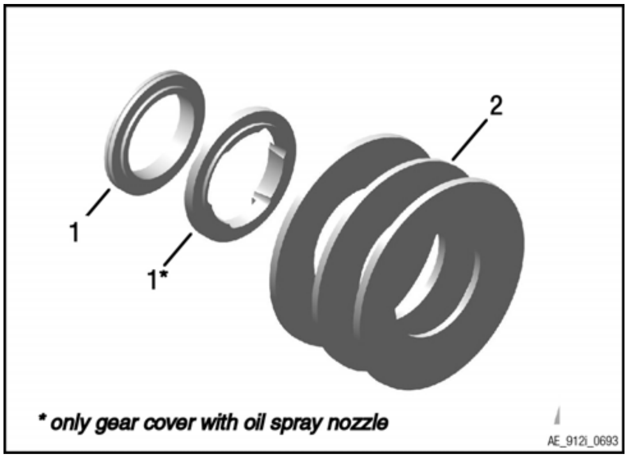


Figure 8.21: Typical

1 Step collar
2 Disc springs

CHECKING THE SPLINES

There are 2 essential splined shaft connections in the gearbox.

1. Propeller shaft to clutch hub of the overload clutch.
2. Crankshaft to drive gear.

NOTE

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.

Step	Procedure
1	Check all the splines visually for damage and wear, see Chapter 72-10-00 section Wear Limits.

GEAR SET CHECK (GEARS)

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

NOTICE
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
- Fuel pump damage (912 Series only)

NOTE

*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)

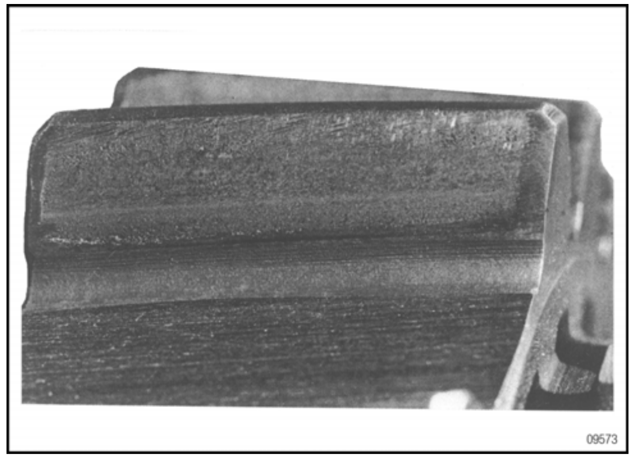


Figure 8.22: Magnification: approx. 2x

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.

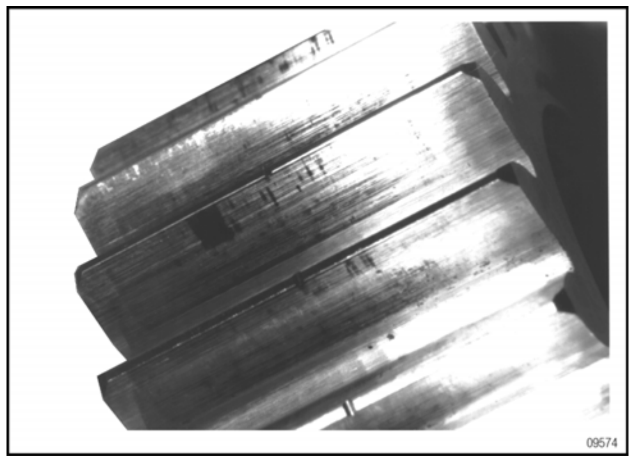


Figure 8.23: Magnification: approx. 1.5x

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.

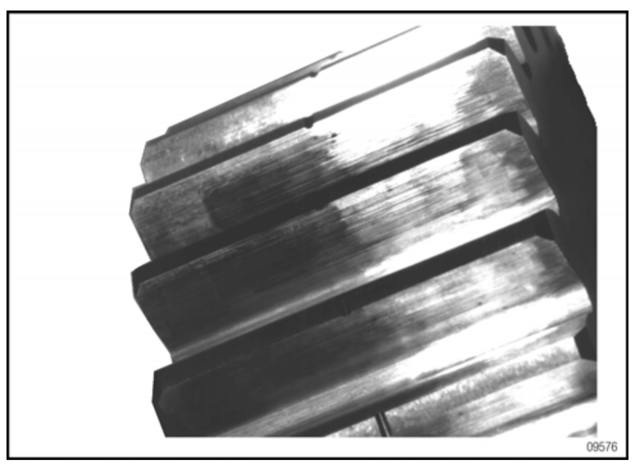


Figure 8.24: Magnification: approx. 1.5x

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.

NOTICE

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

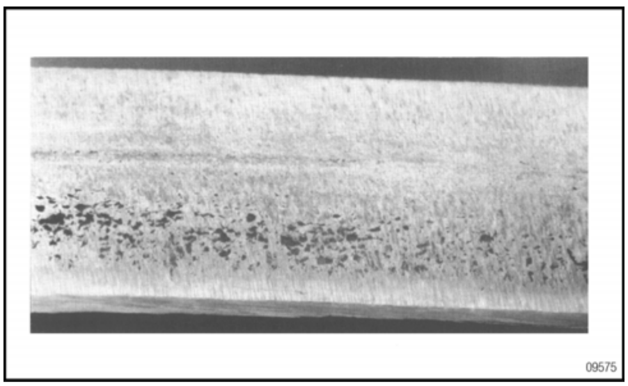


Figure 8.25: Magnification approx. 5x.

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

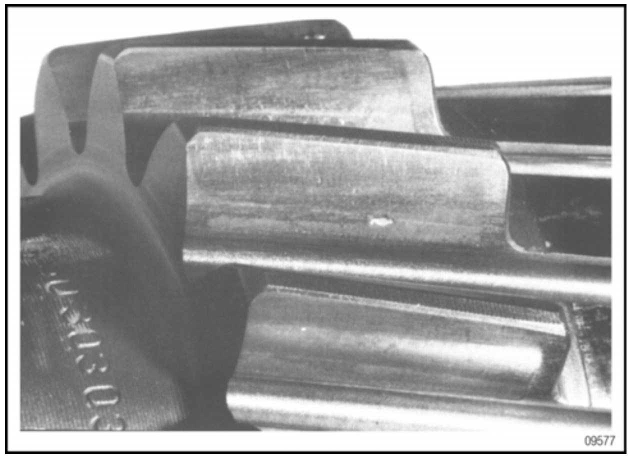


Figure 8.26: Magnification approx. 1.5x.

Pit formation in the root 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.

NOTICE

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

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

NOTICE

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.

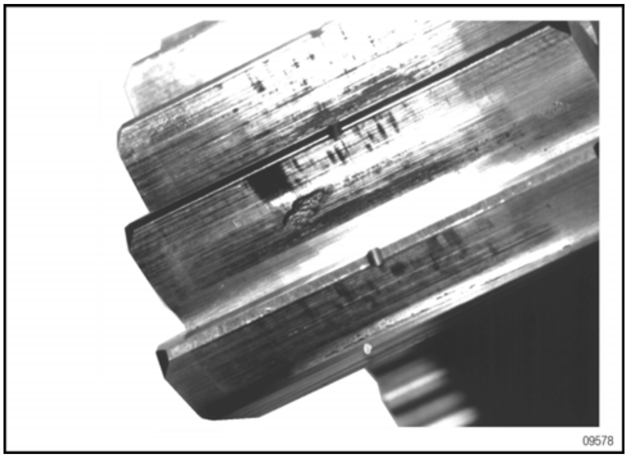


Figure 8.27: Magnification approx. 2x.

Triangular flake pitting

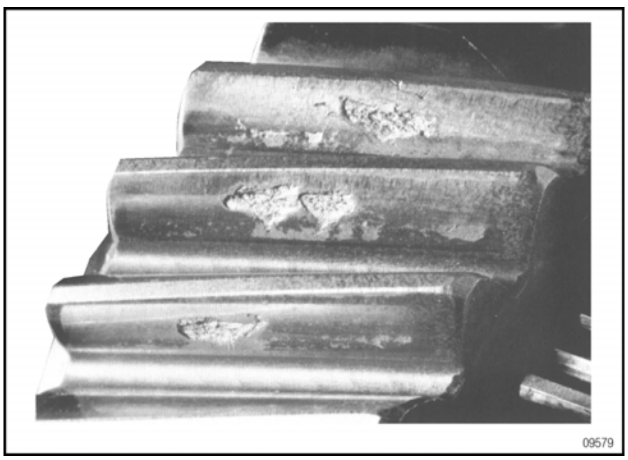


Figure 8.28: Magnification approx. 2x.

Triangular flake pitting

WEAR LIMITS

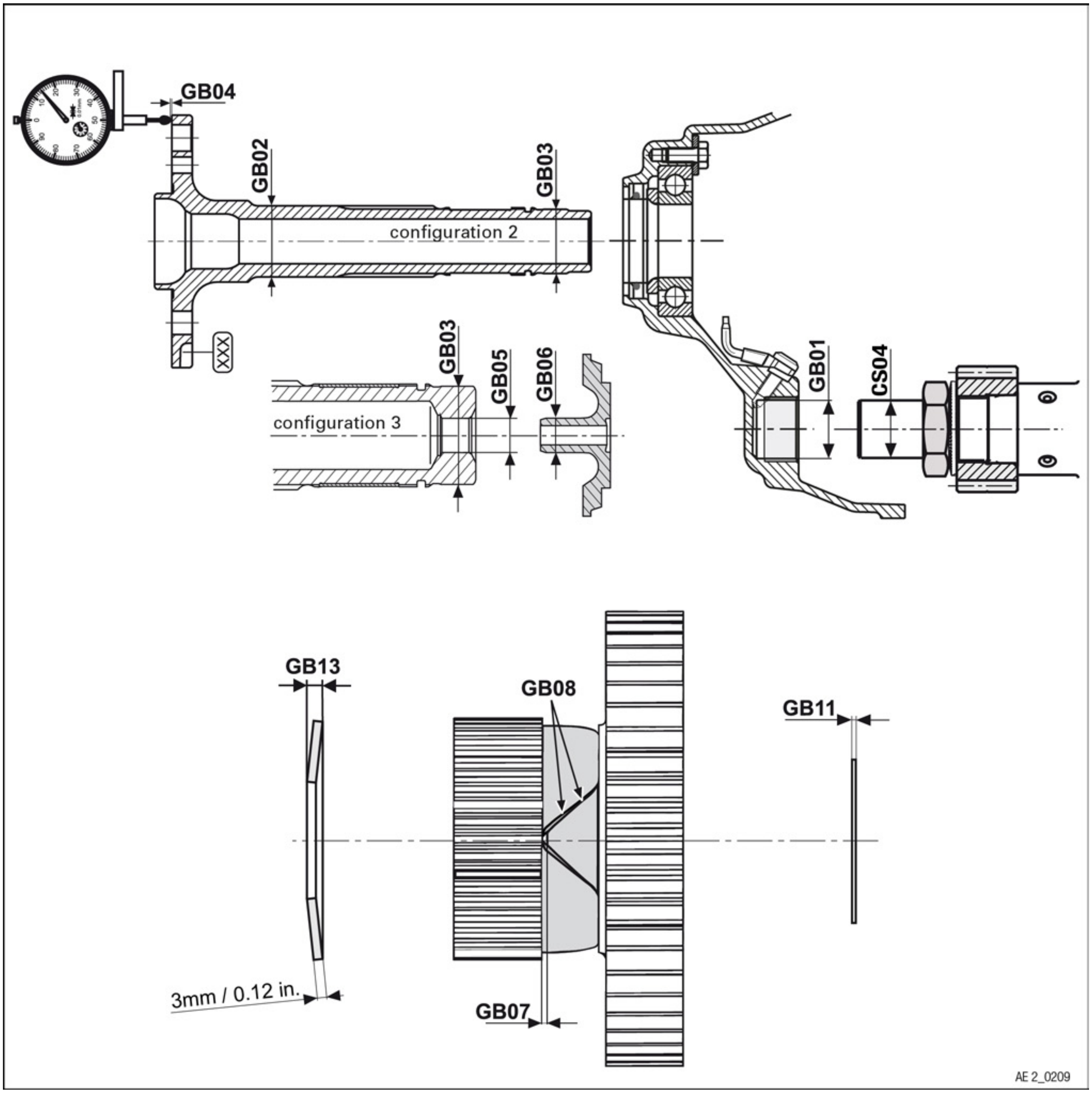


Figure 8.29

Description	Code	Reading new		Wear limit			Read-ings
		min.	max.	100 %	50 %		
Propeller gearbox							
Bearing bushing in gear cover							
Bore	GB01	28.04 mm 1.1035 in	28.05 mm 1.1039 in	28.10 mm 1.1063 in	28.075 mm 1.1051 in	actual	
						renewed	
Radial clearance	GB01/ CS04	0.03 mm 0.0012 in	0.05 mm 0.0020 in	0.12 mm 0.0047 in	0.09 mm 0.0035 in	actual	
						renewed	
Propeller shaft							
Shaft diameter 35 mm	GB02	35.009 mm 1.3783 in	35.020 mm 1.3787 in	35.003 mm 1.3780 in	35.006 mm 1.37815 in	actual	
						renewed	
Shaft diameter 31.5 mm	GB03	31.470 mm 1.2390 in	31.481 mm 1.2394 in	31.460 mm 1.2386 in	31.465 mm 1.2388 in	actual	
						renewed	
Radial run-out, propeller flange at Ø 122 mm	GB04	0.00 mm 0.000 in	0.05 mm 0.0020 in	0.06 mm 0.0024 in	0.055 mm 0.0022 in	actual	
						renewed	
Bore at rear end of propeller shaft (only in vers. 3)	GB05	11.00 mm 0.4331 in	11.02 mm 0.4339 in			actual	
						renewed	
Journal diameter at oil inlet flange (only in vers. 3)	GB06	10.935 mm 0.4305 in	10.960 mm 0.4315 in			actual	
						renewed	
Radial clearance, bore/ journal	GB05/ GB06	0.040 mm 0.0016 in	0.085 mm 0.0033 in	0.160 mm 0.0063 in	0.123 mm 0.0048 in	actual	
						renewed	
Dog gear, thrust washer							
Thickness of thrust washer	GB11	1.075 mm 0.042 in	1.325 mm 0.052 in	1.00 mm 0.039 in	1.04 mm 0.041 in	actual	
						renewed	
Total height of disc spring	GB13	5.20 mm 0.2047 in	5.40 mm 0.2126 in	4.80 mm 0.1889 in	5.00 mm 0.1968 in	actual	
						renewed	

PROPELLER GEARBOX

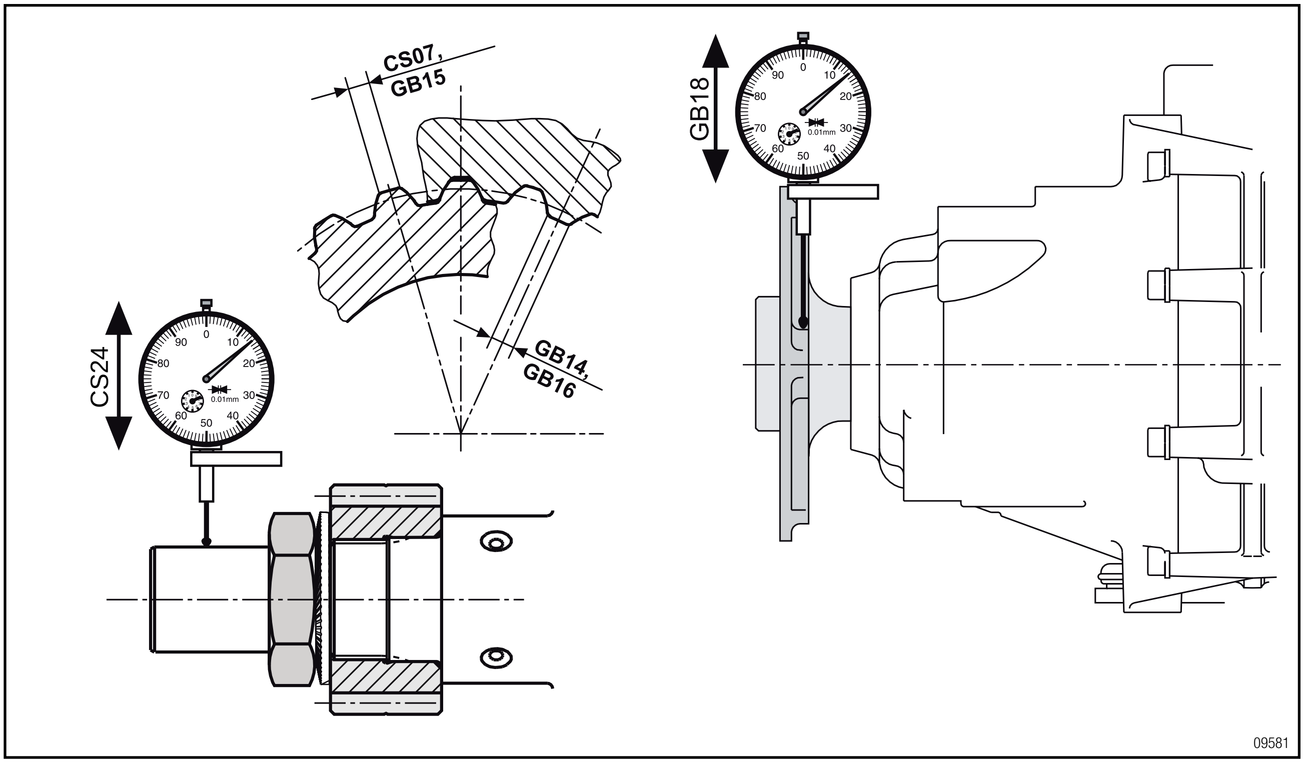


Figure 8.30

Description	Code	Reading new		Wear limit			Readings
		min	max	100 %	50 %		
Tooth profile							
Crankshaft	CS07	0.95 mm 0.0374 in	1.00 mm 0.0374 in.	0.80 mm 0.0315 in.	0.88 mm 0.0344 in.	actual	
						renewed	
Drive gear	GB14	0.95 mm 0.0374 in.	1.00 mm 0.0374 in.	0.80 mm 0.0315 in.	0.88 mm 0.0344 in.	actual	
						renewed	
Propeller shaft	GB15	1.50 mm 0.0591 in.	1.60 mm 0.0630 in.	1.10 mm 0.0433 in.	1.30 mm 0.0512 in.	actual	
						renewed	
Clutch/dog hub	GB16	1.50 mm 0.0591 in.	1.60 mm 0.0630 in.	1.10 mm 0.0433 in.	1.30 mm 0.0512 in.	actual	
						renewed	
Gear set, backlash							
Pitting on drive gear up to 5%		0	0	5%	2.5%	actual	

Description	Code	Reading new		Wear limit			Readings
		min	max	100 %	50 %		
						renewed	
Pitting on dog gear up to 5 %		0	0	5%	2.5%	actual	
						renewed	
Gear backlash	GB18	0.07 mm 0.003 in.	0.15 mm 0.006 in.	0.20 mm 0.008 in.	0.18 mm 0.007 in.	actual	
						renewed	
Overload clutch							
Axial gap	GB07	1.0 mm 0.039 in.	1.2 mm 0.047 in.	0.5 mm 0.020 in.	0.8 mm 0.030 in.	actual	
						renewed	
Clutch/dog hub	GB08	0.0 mm 0.000 in.	0.0 mm 0.000 in.	0.2 mm 0.0079 in.	0.1 mm 0.0039 in.	actual	
						renewed	
Crankshaft							
Measure crank-shaft run-out (in-stalled in housing with drive gear)	CS24	0.00 mm 0.000 in.	0.06 mm 0.002 in.	0.08 mm 0.003 in.		actual	
						renewed	
Crankshaft diameter	CS04	27.99 mm 1.102 in.	28.00 mm 1.102 in.	27.95 mm 1.100 in.	27.97 mm 1.101 in.	actual	
						renewed	

ASSEMBLY

Preparation

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

- Install the oil spray nozzle with the banjo bolt M8x1 into the gearbox housing. Tightening Torque 18 Nm (159 in. lb).
- Heat the gearbox housing with hot air (or in an oven) to approx. 100 to 120 °C (212 to 248 F°).

INSTALLATION OF BALL BEARING

NOTE

If the gearbox housing is damaged at the area of the oil seal, LOCTITE 5910 can be applied.

.

Step	Procedure
1	Press the oil seal into the gearbox housing from the inside using insertion jig part no. 876518.

NOTE

Lubricate sealing lips with engine oil.

Step	Procedure
2	Insert the radius ring 36/50/5.5 with the radius facing the oil seal.
3	Insert the ball bearing. (The cage must be visible.)

NOTE

The ball bearing must drop into the bearing position under its own weight!

Step	Procedure
4	Lubricate with LOCTITE 243 and tighten 4 hex. screws M7x16 with hardened washers 7.2/18.8/3. Tightening torque 15 Nm (133 in. lb.).

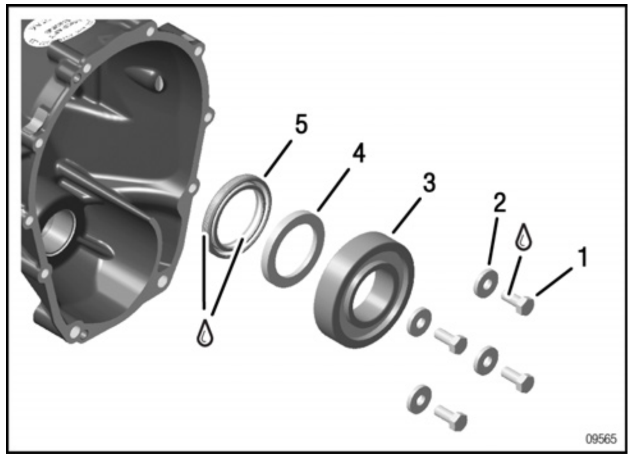


Figure 8.31: Typical

1	*Hex. screw M7x16*	2	*Washer 7.2/18.8/3*
3	*Ball bearing 6207 E THNC3*	4	*Radius ring 36/50/5.5*
5	*Oil seal AS 40x55x7 FPM*		

PROPELLER SHAFT — INSTALLATION

Preparation

- Place the propeller shaft with the gearbox housing placed on it onto a suitable flat support.
- Lubricate the propeller shaft with lithium-base grease on the bearing seat.

NOTICE
Push or press on, do not tap on.

Step	Procedure
1	Install the sleeve, which is approx. 30 mm longer than the propeller shaft.

NOTE

Be careful not to damage or bend the oil spray nozzle.

NOTE

The inner diameter of the sleeve should be selected such that it presses on the inner ring of the bearing.

Step	Procedure
2	Press on the gearbox housing with a slight turning movement.

NOTE

It is advantageous when the gearbox housing is still warm.

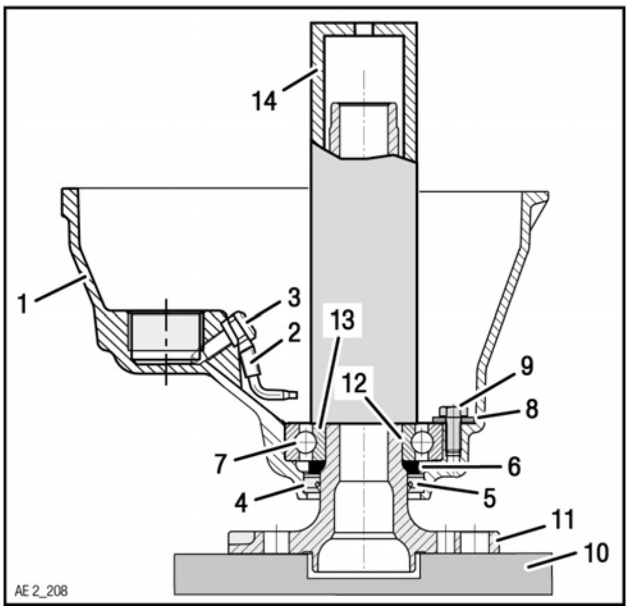


Figure 8.32

1	*Gearbox housing*	*2*	*Oil spray nozzle*
3	*Banjo bolt*	*4*	*Oil seal AS 40x55x7 FPM*
5	*Sealing lips*	*6*	*Radius ring 36/50/5.5*
7	*Ball bearing*	*8*	*Washer 7.2/18.8/3*
9	*Hex. screw M7x16*	*10*	*Support*
11	*Propeller shaft*	*12*	*Bearing seat*
13	*Inner ring*	*14*	*Sleeve*

Step	Procedure
3	Push distance sleeve 8 mm (0.31 in.) and eccenter (for fuel pump on the ROTAX® 912 Series, of no significance on the 914 Series) onto the propeller shaft.

With clutch

Step	Procedure
4	Lubricate 2 disc springs (lying against each other) along with the step collar (for gearbox with oil spray nozzle) or step collar with a diameter of 40.8 mm (1.6 in.) facing the disc spring with lithium-base grease and push them on.

NOTE

The disc springs must lie on the centring collar of the clutch hub!

Step	Procedure
5	Lubricate the third disc spring (with its rear facing the others) with lithium-base grease and push it on.
6	Lubricate the clutch on the gear profile with lithium-base grease and push it onto the propeller shaft.

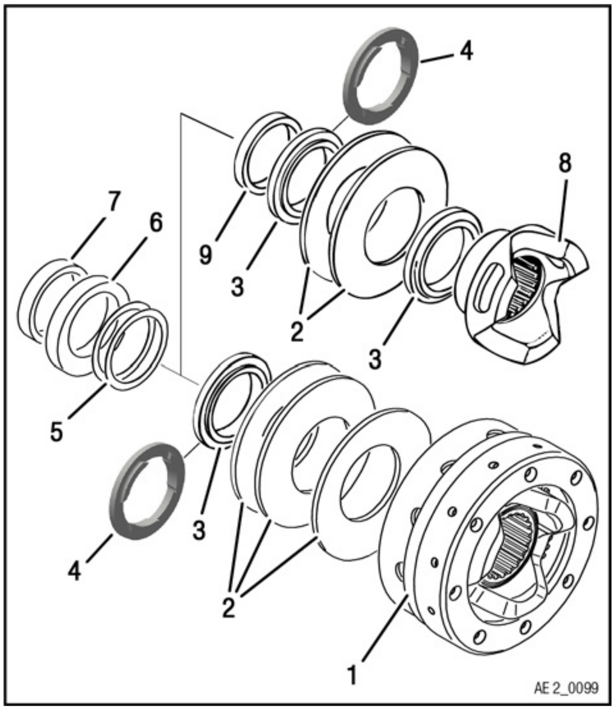


Figure 8.33

1	*Clutch assy.*	2	*Disc springs*
3	*Step collar*	4	*Step collar with recesses in bore*
5	*Compensating shim*	6	*Eccenter*
7	*Distance sleeve 35.2/42/8*	8	*Dog hub*
9	*Distance sleeve 35.2/42/6*		

Without clutch

Step	Procedure
7	Insert distance sleeve 6 mm (0.24 in.) on the propeller shaft.
8	Lubricate 2 disc springs (lying against each other) along with the step collar or step collar (for gearbox with oil spray nozzle) with a diameter of 40.8 mm (1.6 in.) facing the disc spring with lithium-base grease and push them on.

Step	Procedure
	NOTE *The disc springs must lie on the centring collar of the clutch hub!*
9	Lubricate step collar with lithium-base grease and install it onto the propeller shaft.
10	Lubricate the dog hub on the gear profile with lithium-base grease and install it onto the propeller shaft.

General

Step	Procedure
11	Install the lubricated bearing bushing carefully on the propeller shaft with circlip pliers.

NOTE

If the bearing bushing has been stretched, it will have a tight fit inside the gear and must be replaced.

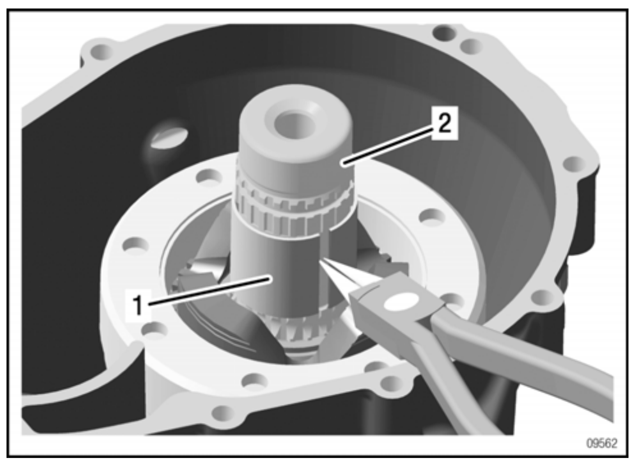


Figure 8.34: Typical

1	*Bearing bushing*	2	*Propeller shaft*

Step	Procedure
12	Push on the gear (propeller shaft).
13	Lubricate the plastic thrust washer 33.2/51/1.2 on both sides with lithium-base grease and push it on along with the drive gear.

NOTICE

The thrust washer must be replaced every repair.

NOTICE

The contact surface of the plastic thrust washer must be level (flat). Risk of breakage!

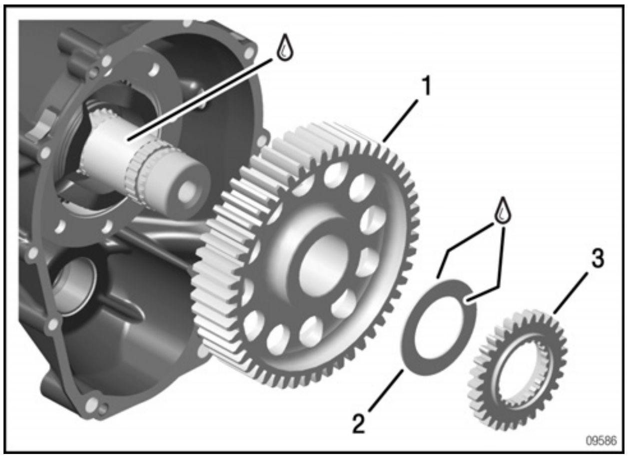


Figure 8.35

1 *Gear (propeller shaft)* 2 *Thrust washer*

3 *Drive gear*

ADJUSTMENT OF THE DISC SPRING PRETENSION WITH OVERLOAD CLUTCH

NOTE

When the propeller shaft assembly is not tensioned, the contact face for the ring halves must lie 1 mm above upper edge in the groove of the propeller shaft.

Step	Procedure
1	Place compensating shims between the eccentric and step collar.

ADJUSTMENT OF THE DISC SPRING WITH DOG HUB

Step	Procedure
1	Completely compress disk springs utilizing mounting yoke part no. 876885.
2	After completing the adjustment of the disk spring travel, depress dog gear with mounting yoke part no. 876885, until both ring halves can be inserted.
3	Check that the ring halves are positioned correctly.

NOTE

The distance between the lower edge of the groove and the top edge of the retaining ring must not be more than 0.2 mm (0.008 in). By distance more than 0.2 mm (0.008 in) set compensating shims between eccenter and distance sleeve 6 mm (0.24 in.).

NOTE

If the spacing is insufficient, never over-press the springs, as this will cause the dog gear to collide with the gear cover.

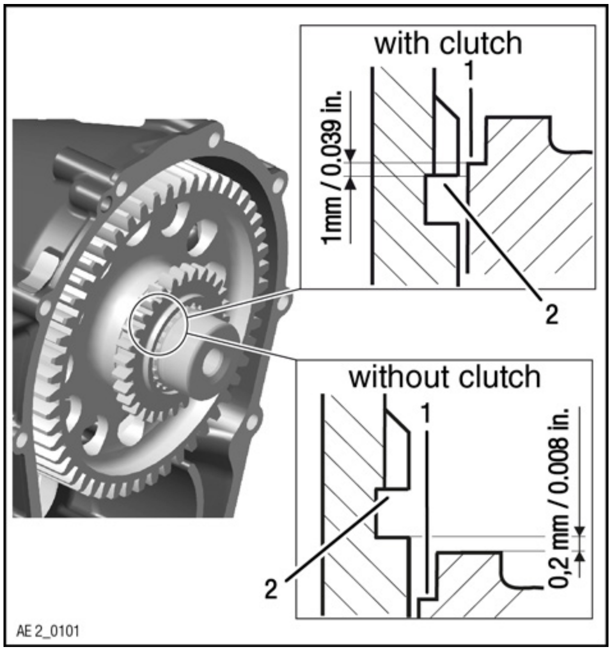


Figure 8.36

1 Contact face	*2 Upper edge*

ASSEMBLY OF THE PROPELLER GEARBOX ASSY.

NOTICE

If the disc springs do not sit centrally, the gear (propeller shaft) cannot be pressed down enough to insert the ring halves. Do not increase the force, but remove the clutch again and center the disc springs correctly.

NOTICE

Gearbox housing may be damaged.
Only push the dog gear down until the ring halves can be mounted on the propeller shaft. The gear cover must be freely rotatable!

Step	Procedure
1	Place the whole gearbox in a suitable fixture.
2	Press down the gear (propeller shaft) with a mounting yoke part no. 876885 and assemble with new ring halves.

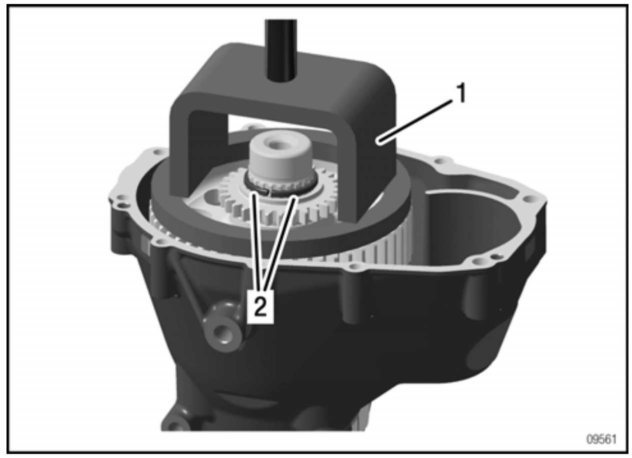


Figure 8.37

1 Mounting yoke 876885	*2 Ring halves*

INSTALLATION

INSTALLATION OF ROLLER BEARING – VERSION 2

Step	Procedure
1	Apply LOCTITE 5910 sparingly on the outside diameter of the new oil seal 30x52x7 and install it into the crankcase with press-in jig part no. 877594.

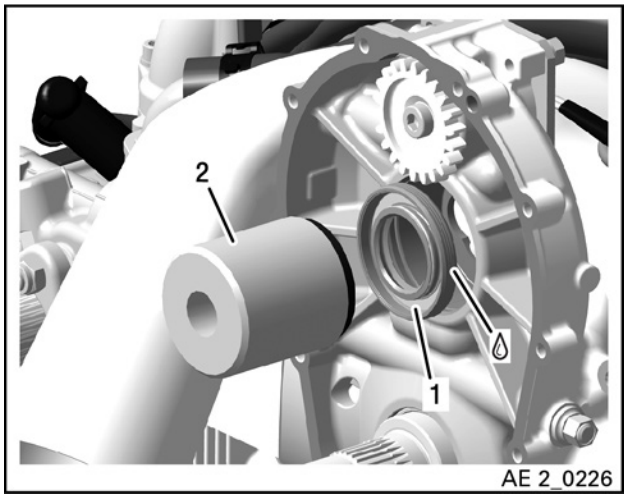


Figure 8.38

1 Oil seal 30x52x7 *2 Press-in jig 877594*

Step	Procedure
2	Install the extractor part no. 877615 with 6 Allen screws M6x25 onto the crank-case, place the press-in mushroom part no. 877590 into the roller bearing, center and press it with the spindle into the crankcase as far as it will go.
3	Insert the retaining ring with the circlip pliers. **NOTE** *Place the circlip into the groove with the sharp edge pointing outwards.*

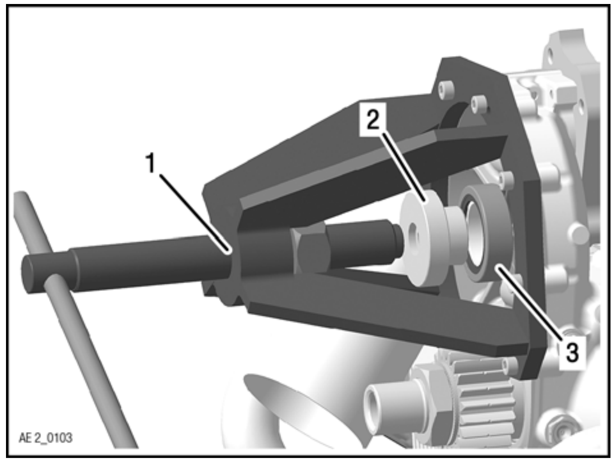


Figure 8.39

1 Extractor 877615 *2 Press-in mushroom 877590*

3 Roller bearing

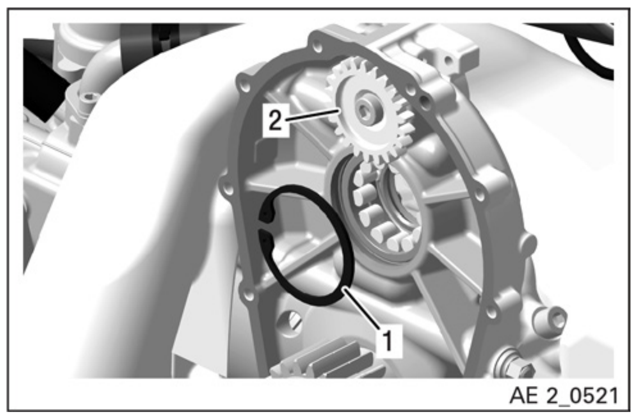


Figure 8.40

1 Retaining ring 52x2 *2 Vacuum pump gear*

Step	Procedure
4	If necessary install the vacuum pump gear. See Chapter 37–10–00 section Vacuum pump gear

INSTALLATION OF ROLLER BEARING – VERSION 3

NOTICE

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

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.

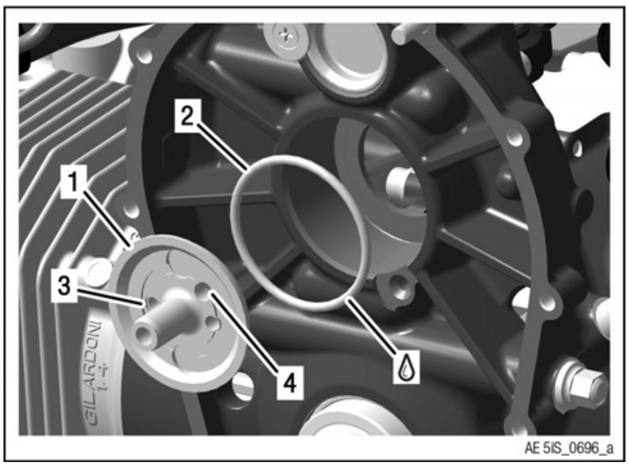


Figure 8.41

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

Step	Procedure
2	Install the governor flange with two Allen screws M6x20 and the brass oil inlet flange with two Allen screws M6x16. At first hand-tight the screws for better positioning.

NOTE

This procedure is only done to set the Oil inlet flange- brass in place. It must not be tightened and glued in.

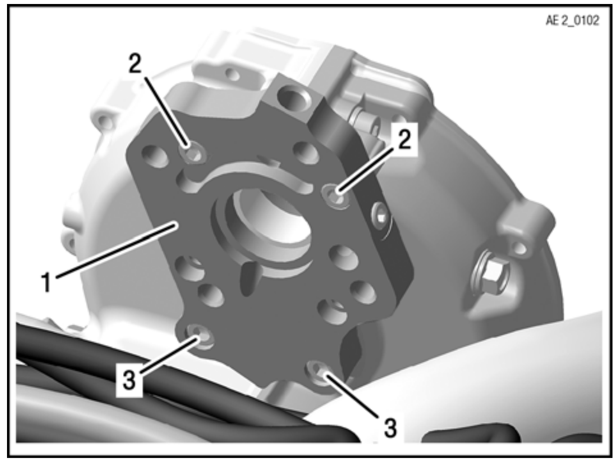


Figure 8.42

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

Step	Procedure
3	Install the extractor part no. 877615 with 6 Allen screws M6x25 onto the crankcase, place the press-in mushroom part no. 877590 in the roller bearing, put it on the centring and press it with the spindle into the crankcase as far as it will go.
4	Insert the retaining ring with the circlip pliers.

NOTE

Place the circlip in the groove with the sharp edge pointing outwards.

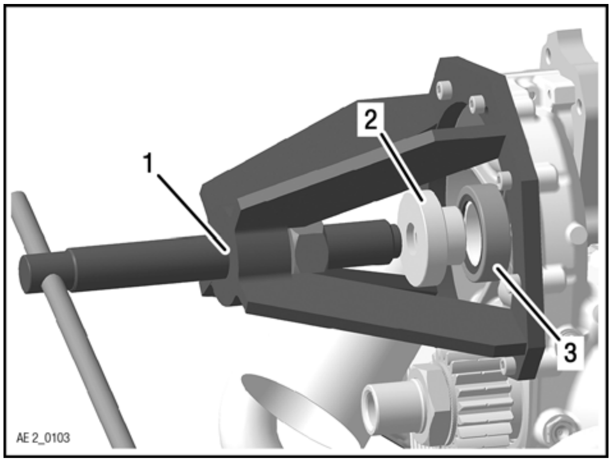


Figure 8.43

1	*Extractor part no. 877615*	2	*Press-in mushroom part no. 877590*
3	*Roller bearing*		

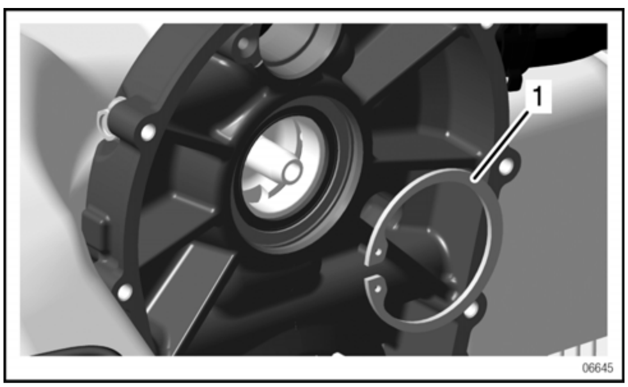


Figure 8.44

1 *Retaining ring 52x2*

Step	Procedure
5	Remove the governor flange.

FINISHING WORK

- Installation of the vacuum pump gear: See Chapter 37–10–00 section Vacuum pump gear.
- Installation of the governor flange. See Chapter 61-20-00 section Governor flange — installation — configuration 3

Install propeller gearbox assy.
See current Maintenance Manual Line (MML) for the respective engine type.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

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

Chapter: 72–20–00
ENGINE BLOCK

TOPICS IN THIS CHAPTER

SPECIAL TOOLS

Description	Part number
Hot air gun	n.a.
Puller assy.	877375
Puller assy., narrow configuration	877377
Protection mushroom	877417
Seeger ring pliers	n.a.
Free wheel gear axial clearance measuring fixture	n.a.
Socket wrench 46x20	877450
Reducing socket 3/4" – 1"	877465
Thread bolt M8x50	240880

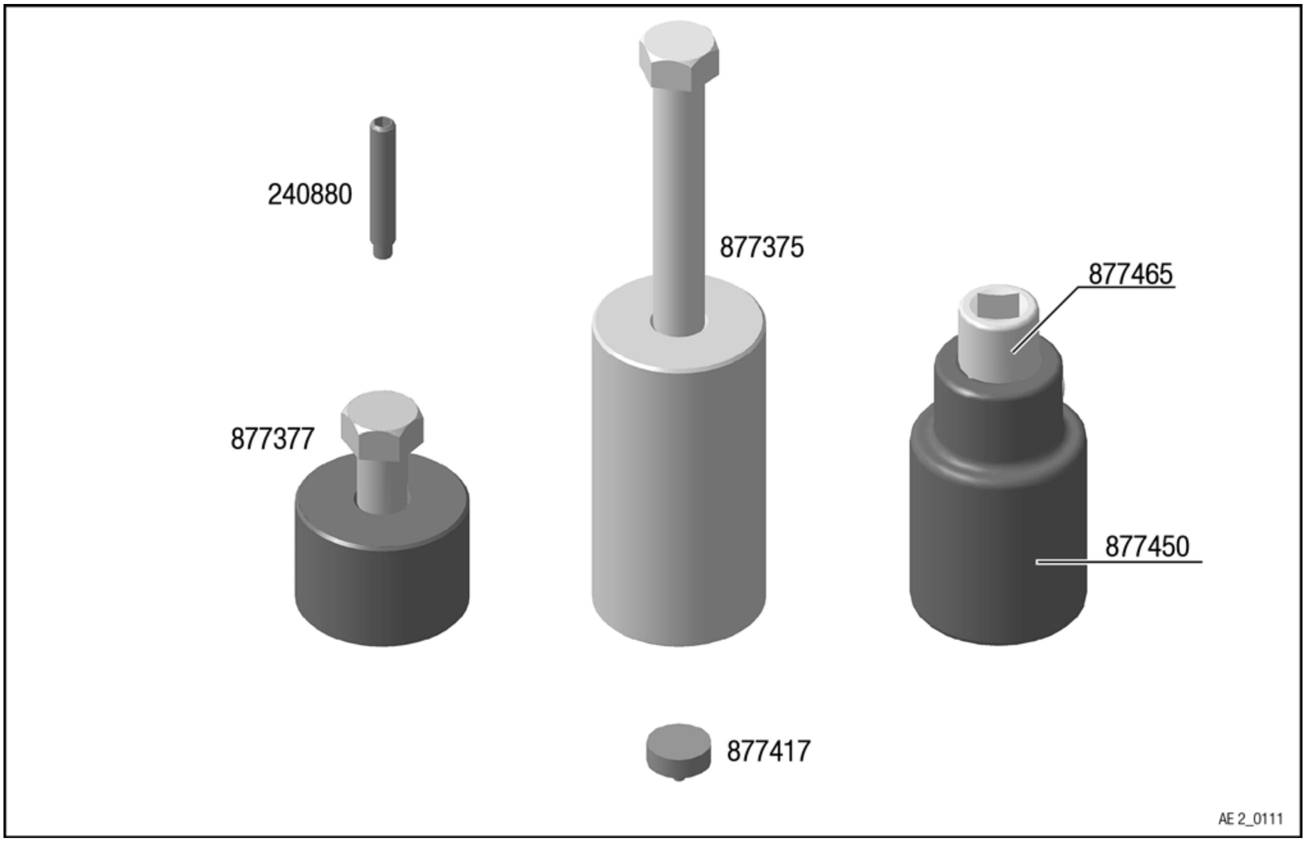


Figure 9.1

SERVICE PRODUCTS

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

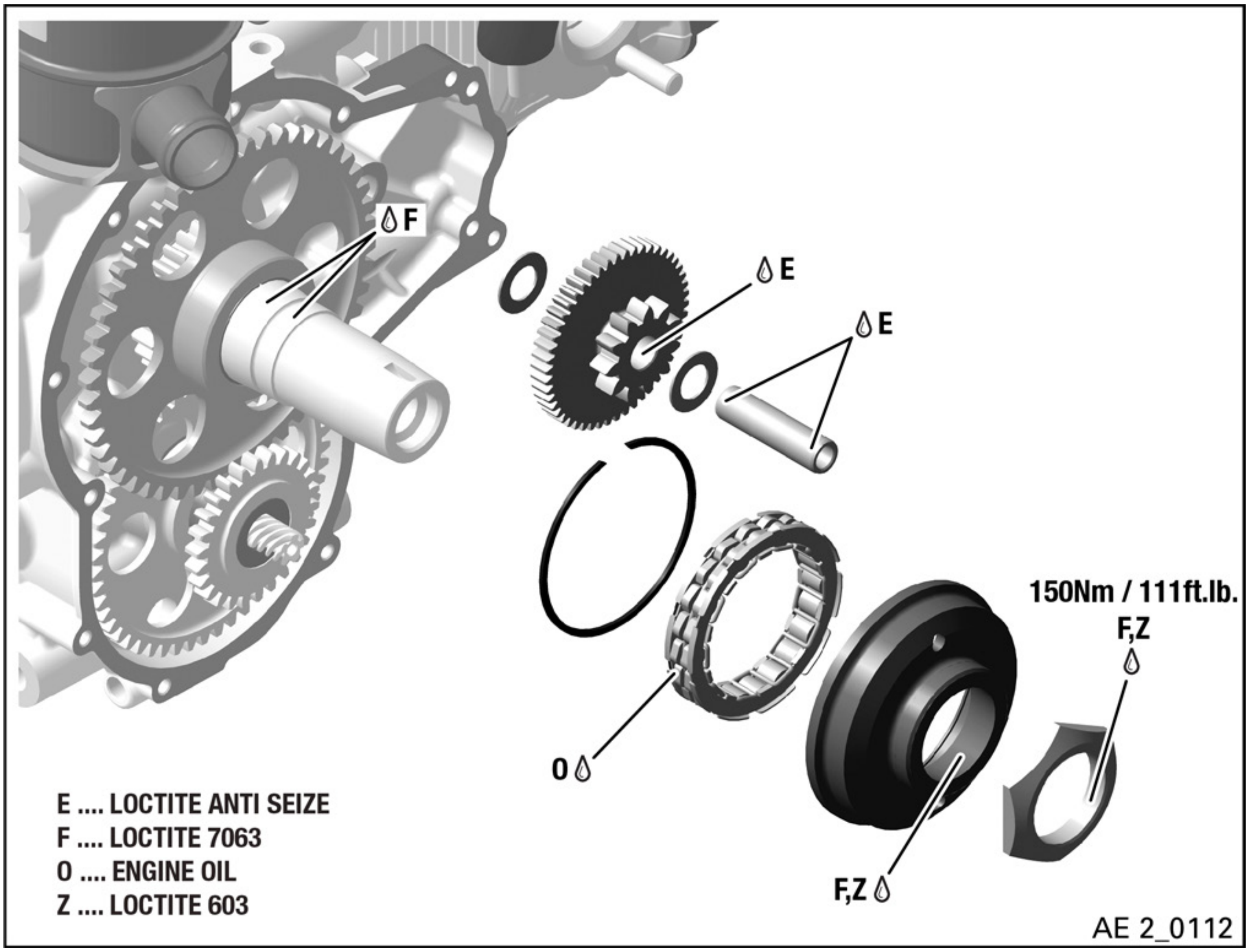


Figure 9.2: Lubricant locations

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 current Maintenance Manual Line (MML) for the respective engine type.

REMOVAL

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.

NOTICE

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

General visual inspection.
See current Maintenance Manual Line (MML) for the respective engine type.

Engine cleaning.
See current Maintenance Manual Line (MML) for the respective engine type.

SPRAG CLUTCH — REMOVAL

Preparation

NOTICE

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

- Remove coolant hoses from cylinder head, water inlet elbow and water pump housing. See Chapter 75-00-00 section Water pump housing — removal
- Remove the electric starter. See Chapter 80-00-00 section Electric starter.
- Remove the ignition housing. See Chapter 24-20-00 section Internal generator.

Lock the crankshaft.
See current Maintenance Manual Line (MML) for the respective engine type.

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 with the thrust washers 12.5/21.5/1 on both sides of the intermediate gear.

NOTICE

The M34x1.5 hex. collar nut (secured with LOCTITE 603) must be heated correspondingly. The nut has a left handed thread!

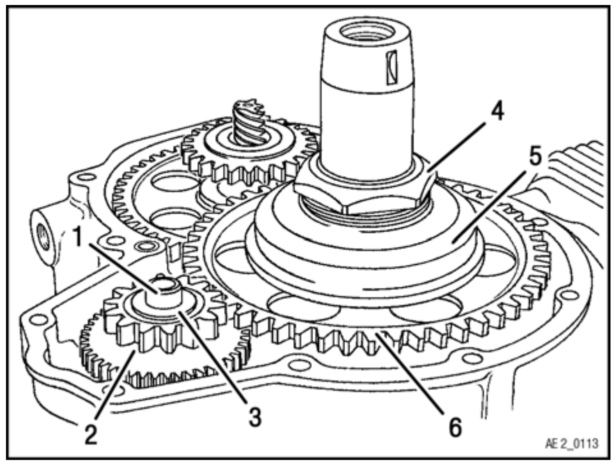


Figure 9.3

1	*Intermediate gear shaft*	2	*Starter intermediate gear*
3	*Thrust washer*	4	*Hex. collar nut*
5	*Sprag clutch housing*	6	*Free wheel gear*

Step	Procedure
3	Heat the hex. collar nut about 100 °C to 120 °C using a hot air gun.
4	Loosen the M34x1.5 hex. collar nut from the crankshaft with a 46 mm (1.81 in.) deep socket part no. 877450.

5	Lubricate the end of the crankshaft with LOCTITE Anti Seize and place the protection piece part no. 877417 onto the crankshaft.
6	Pull off the sprag clutch housing using the puller part no. 877375.

NOTE

The free wheel gear, the pump gear pressed onto the crankshaft and the timing gear underneath it can be removed only after splitting the crankcase.

NOTE

The mechanical rev counter is driven via the worm gear pressed into the camshaft. The worm gear is optional on newer engine versions.

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.

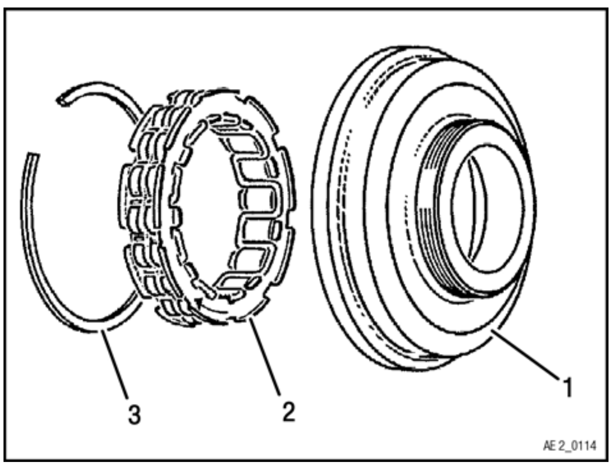


Figure 9.4

1 Sprag clutch housing *2 Sprag clutch*

3 Circlip

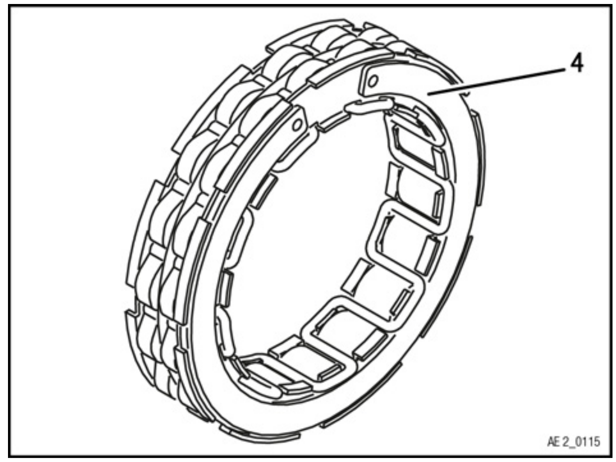


Figure 9.5

4 Seeger ring

INSPECTION

SPRAG CLUTCH HOUSING SINGLE PARTS — INSPECTION

Preparation

Clean all parts carefully.
See current Maintenance Manual Line (MML) for the respective engine type.

SPRAG CLUTCH HOUSING CHECK

Step	Procedure
1	Check whether oil sludge has accumulated in the sprag clutch housing.
2	Check the taper surface
3	Check the sprag clutch engagement faces in the sprag clutch housing.

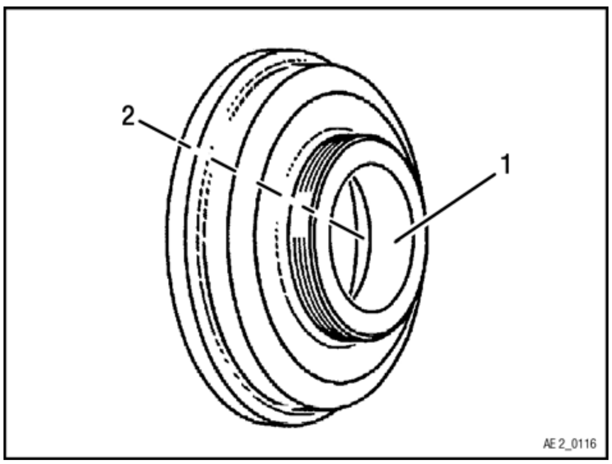


Figure 9.6

1 Taper surface *2 Sprag clutch engagement face*

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.

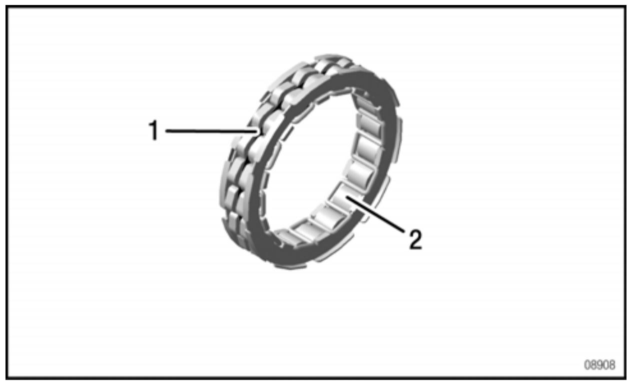


Figure 9.7

1 Helical spring *2 Spear body*

NOTE

If the sprag clutch is damaged it is a good practice to make a precautionary change of the sprag housing. Regardless of the condition or appearance of the housing.

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.

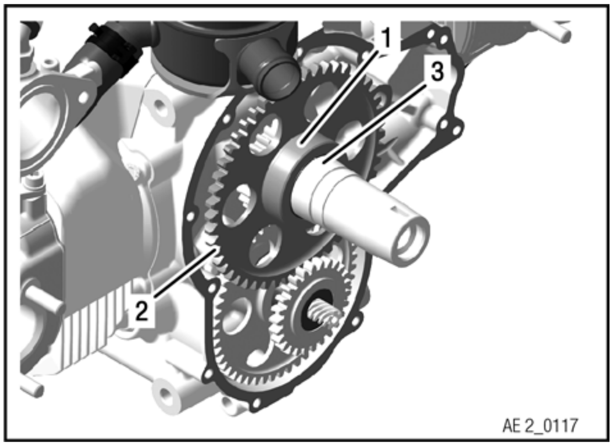


Figure 9.8

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.

NOTICE

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

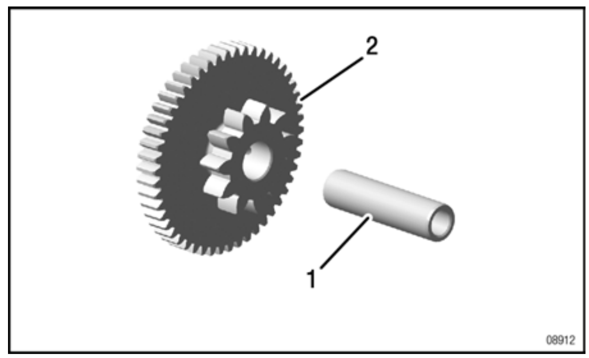


Figure 9.9

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

WEAR LIMITS

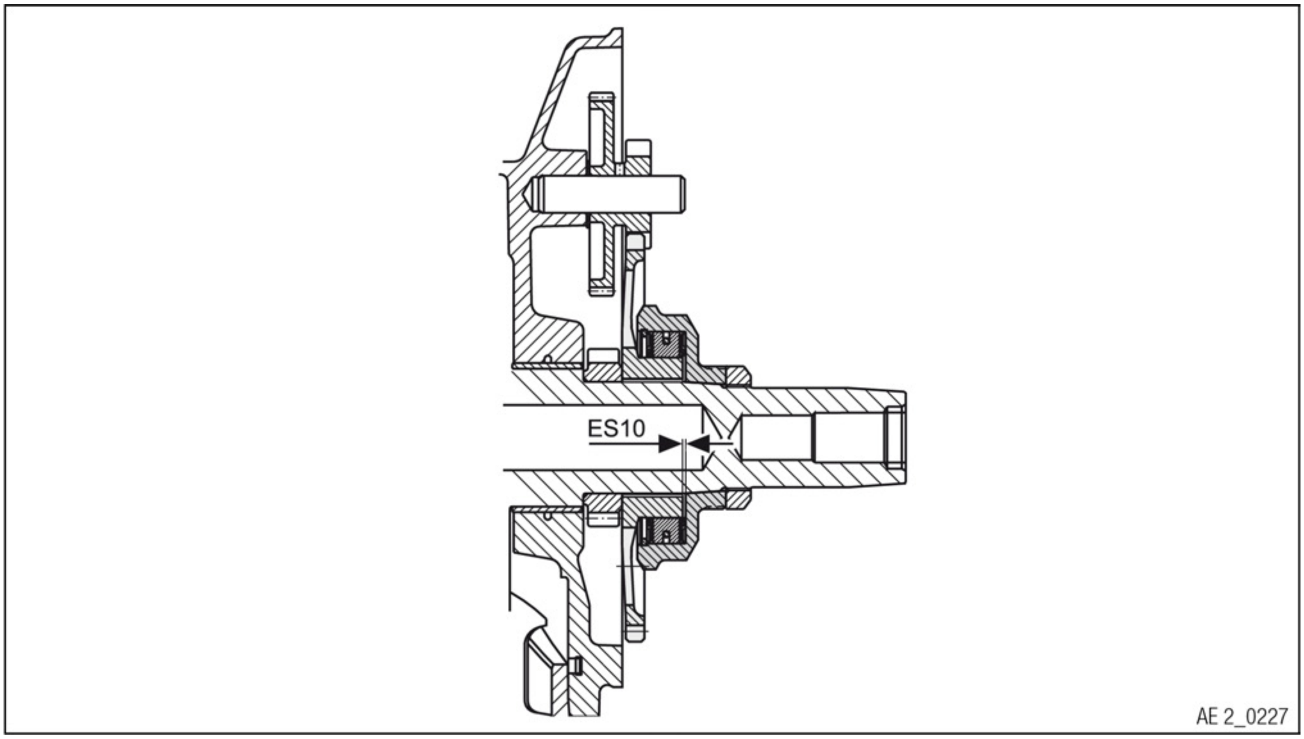


Figure 9.10

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	

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.

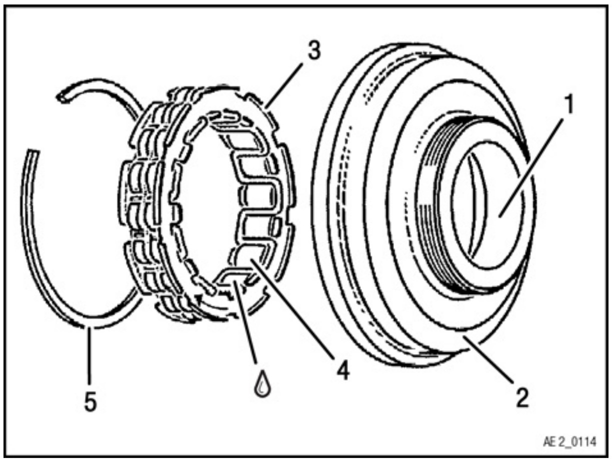


Figure 9.11

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

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.*

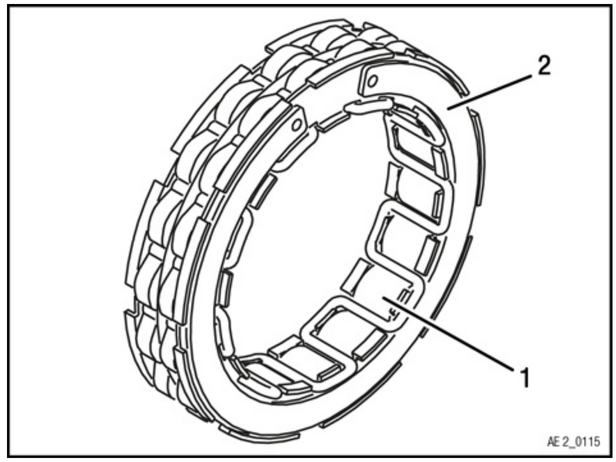


Figure 9.12

1 Sprag clutch *2 Seeger ring*

NOTE

If there is a circlip 68 (part no. 845420) still fitted, it must be replaced with a circlip 70 (part no. 845425).
Circlip 68 and circlip 70 can be distinguished by the different outside dimension before they are installed.

INSTALLATION

Preparation

Lock crankshaft.
See current Maintenance Manual Line (MML) for the respective engine type.

INSTALLATION OF THE SPRAG CLUTCH HOUSING

NOTICE

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 603.

Step	Procedure
1	Degrease the thread and cone of the crankshaft with LOCTITE 7063.

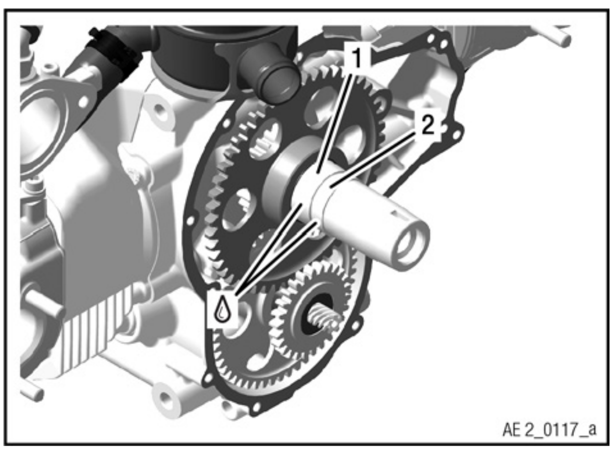


Figure 9.13

1 Cone *2 Thread*

Step	Procedure
2	Degrease the cone in the sprag clutch housing with LOCTITE 7063.
3	Lubricate the cone in the sprag clutch housing thinly with LOCTITE 603.

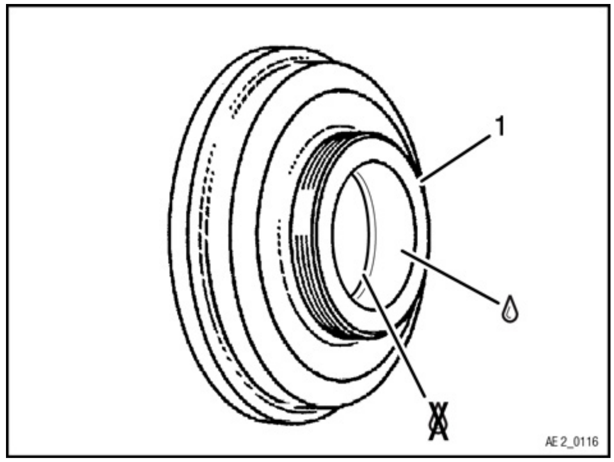


Figure 9.14

1 Sprag clutch housing

Step	Procedure
4	Place the sprag clutch housing on the crankshaft. Turn the free wheel gear in the process to align the spear body.
5	Degrease M34x1.5 hex. collar nut with LOCTITE 7063, then secure it with LOCTITE 603 and tighten it. Tightening torque 150 Nm (111 ft. lb.).

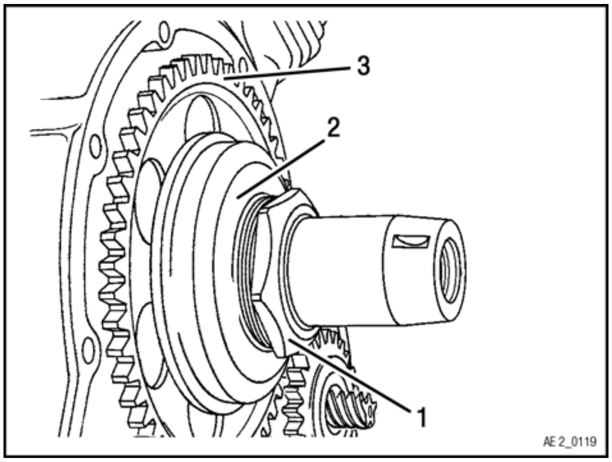


Figure 9.15

1 *M34x1.5 hex. collar nut*
2 *Sprag clutch housing*
3 *Free wheel gear*

NOTE

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

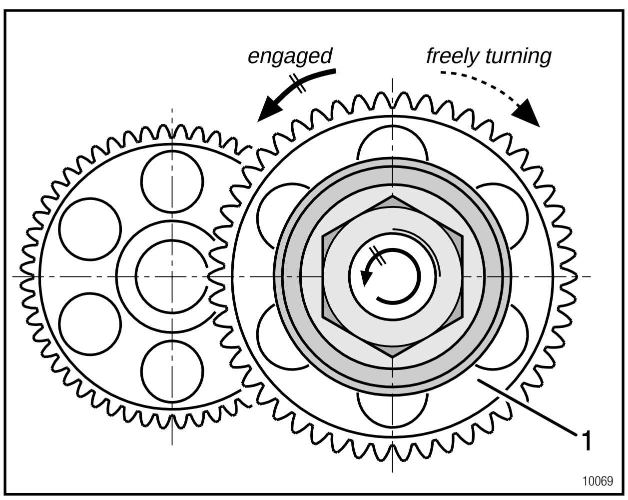


Figure 9.16

1 *Free wheel gear*

Step	Procedure
6	Place thrust washer 12.5/21.5/1 on the crankcase.
7	Lubricate the intermediate gear and the intermediate gear shaft with LOCTITE ANTI SEIZE.
8	Place the starter intermediate gear.
9	Install the intermediate gear shaft.
10	Place thrust washer 12.5/21.5/1 on top.

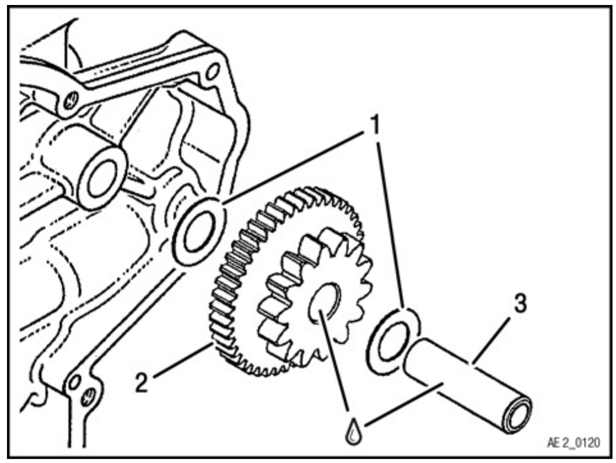


Figure 9.17

1 *Thrust washer*
2 *Starter intermediate gear*
3 *Intermediate gear shaft*

MEASURING THE AXIAL CLEARANCE OF THE FREE WHEEL GEAR

NOTICE

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

NOTE

For measurement of the axial clearance ES10 of the free wheel gear, see section Wear Limits.

FINISHING WORK

- Install the ignition housing. See Chapter 24-20-00 section Ignition housing assy. — installation.
- Install the electric starter. See Chapter 80-00-00 section Standard starter — installation
- Install coolant hoses from cylinder head, water inlet elbow and water pump housing. See Chapter 75-00-00 section Coolant hose — installation
- Install the surrounding assemblies.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

Chapter: 72–30–00
CYLINDER HEAD

TOPICS IN THIS CHAPTER

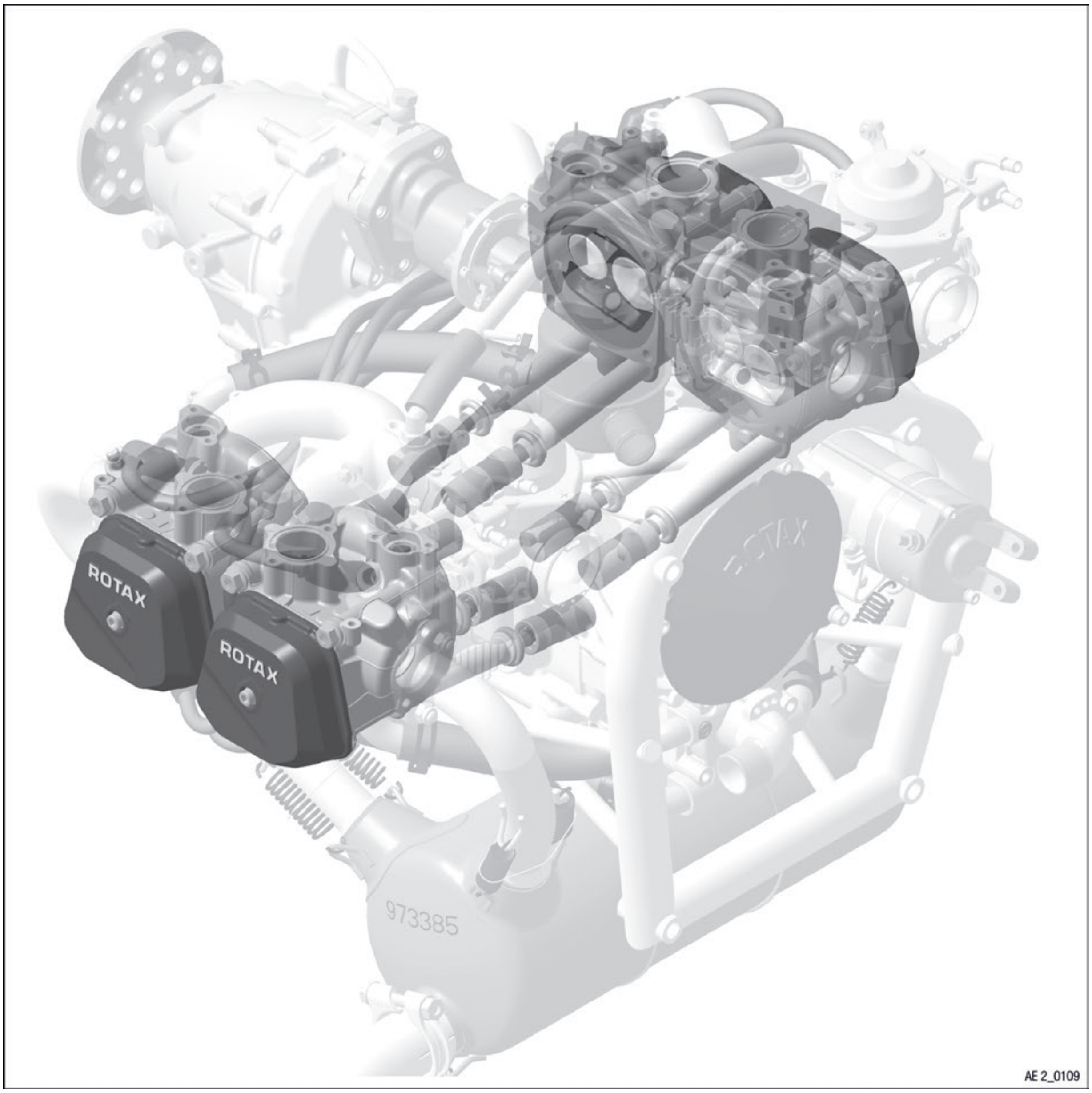


Figure 10.1: Location on the engine

SPECIAL TOOLS

Description	Part number
Valve spring loading jig	877387
Dial gauge adapter assy.	976140
Valve spring mounting device	877380
Adapter ring assy.	877790
Cylinder aligning tool	877262
Spring clamp pliers	877840
Torx T30 ball head insert	876180
Hot air gun	n.a.

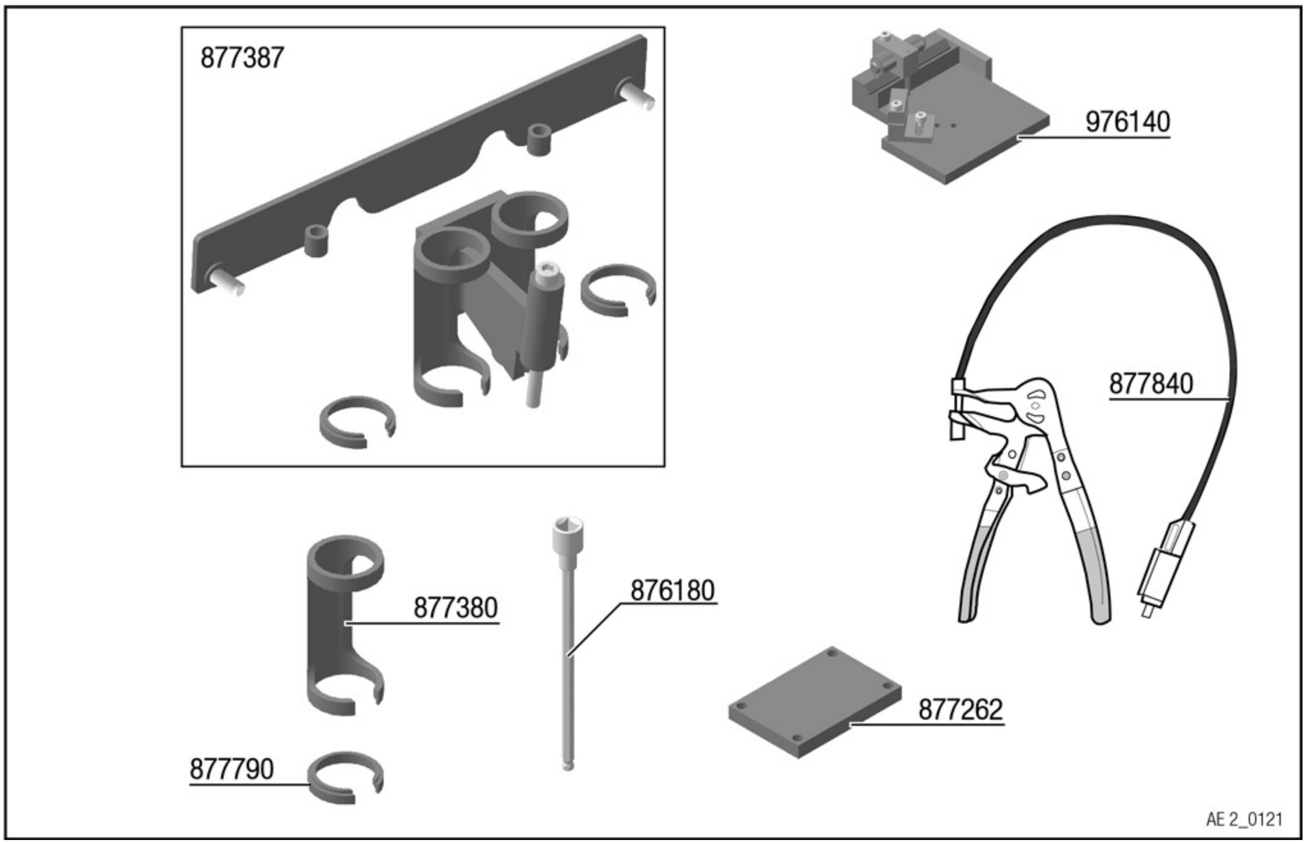


Figure 10.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 648	899788
Engine oil	n.a.
LOCTITE ANTI SEIZE	297434

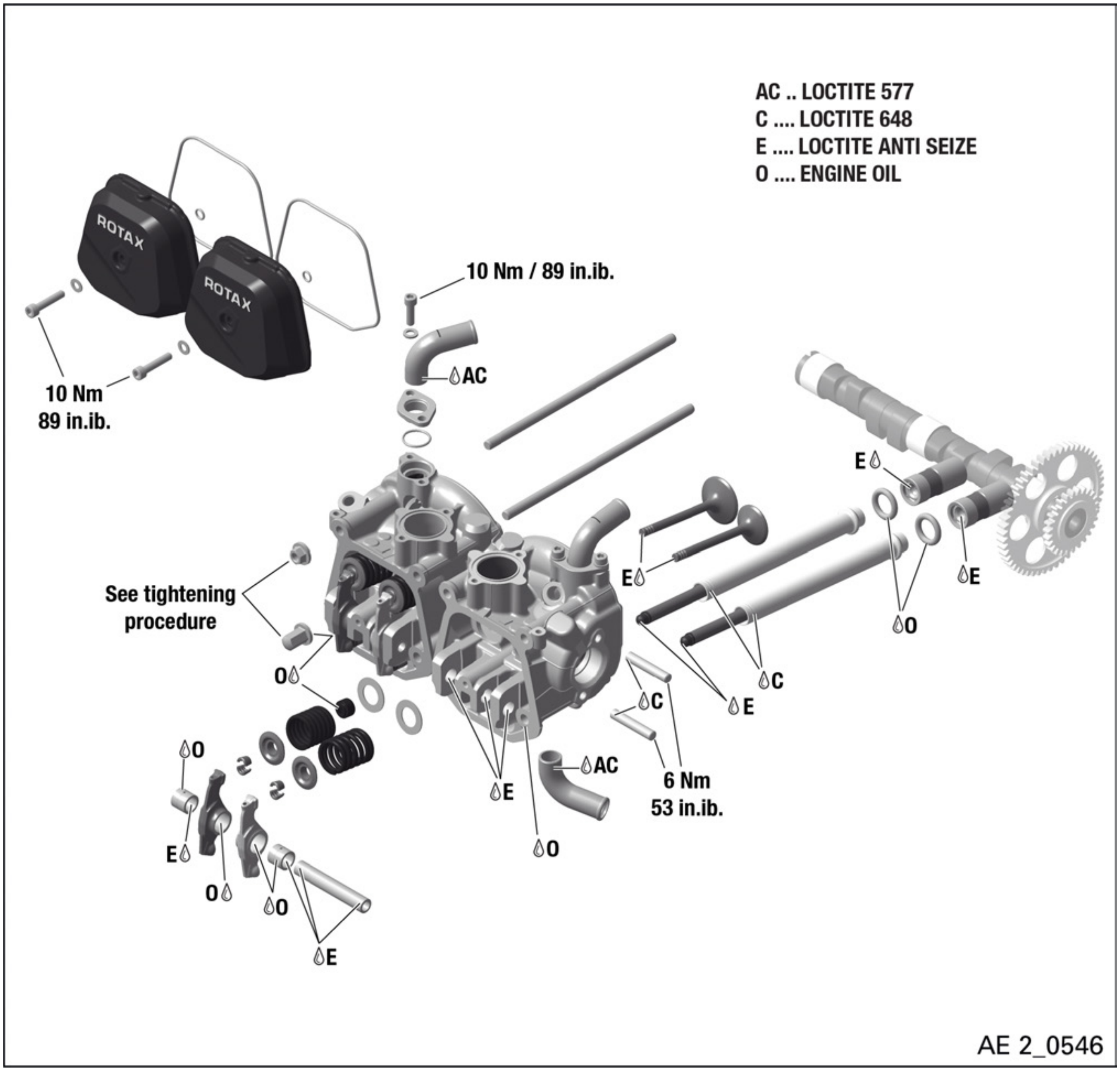


Figure 10.3: Cylinder head

SYSTEM DESCRIPTION

The engine type 912 / 914 Series 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 current Maintenance Manual Line (MML) for the respective engine type.

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.

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

Drain coolant.
See current Maintenance Manual Line (MML) for the respective engine type.

Drain oil.
See current Maintenance Manual Line (MML) for the respective engine type.

Engine cleaning.
See current Maintenance Manual Line (MML) for the respective engine type.

General visual inspection.
See current Maintenance Manual Line (MML) for the respective engine type.

REMOVAL OF SURROUNDING ASSEMBLIES

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

- Remove the exhaust system. See Chapter 78-10-00 section Exhaust.

NOTE

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

NOTE

If parts of more than one cylinder are removed, they must be numbered accordingly.

.

Step	Procedure
1	Loosen 4 Allen screws M6 with washer from the intake manifold.

NOTE

Remove the 2 O-rings at each side between the intake manifold and the cylinder head.

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

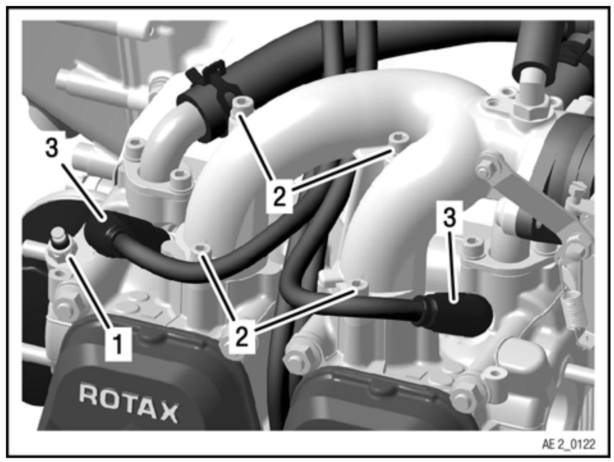


Figure 10.4: Typical

1	*Temperature sensor*	*2*	*Allen screw M6 with washer*
3	*Resistance spark plug connector*		

Step	Procedure
3	Take off the spring type hose clip 25 using spring clamp pliers part no. 877840.
4	Mark the coolant hoses and pull them out of the coolant elbows (inlet). See Chapter 75-00-00 section Cooling system.

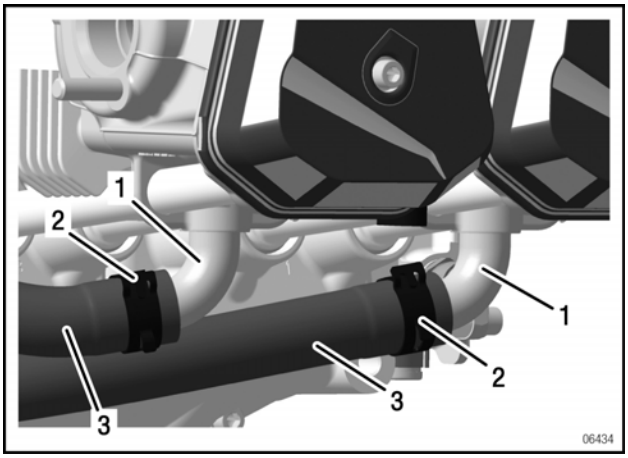


Figure 10.5

1 Coolant elbow
2 Spring type hose clip 25
3 Coolant hose

Step	Procedure
5	Loosen 2 M6x20 Allen screws along with the washers and remove the elbow flange.

NOTE

There is an O-ring under the elbow flange.

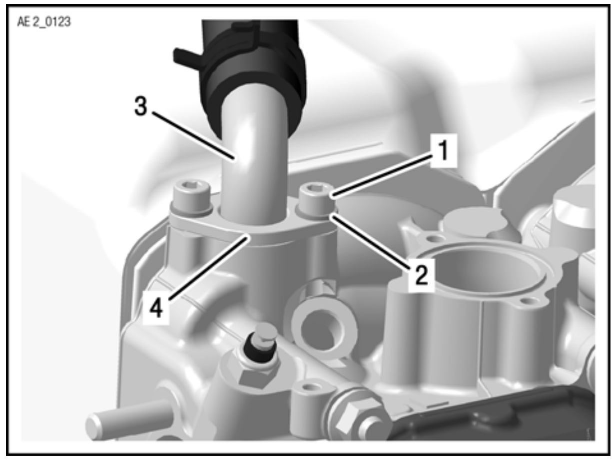


Figure 10.6

1 M6x20 Allen screw
2 6.4 washer
3 Coolant elbow
4 Elbow flange

CYLINDER HEAD — REMOVAL

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

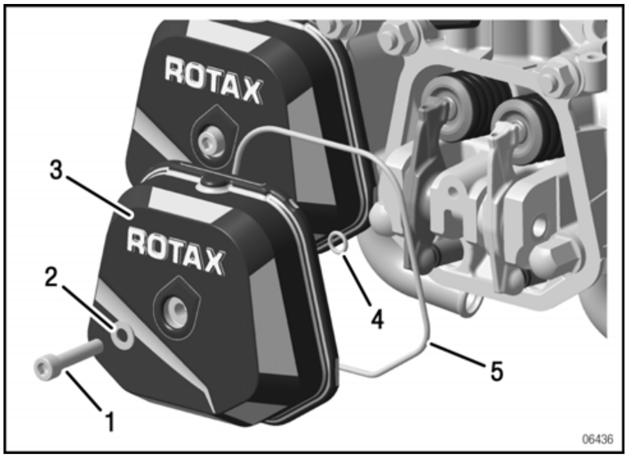


Figure 10.7: Typical

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

NOTICE

Do not lose the O-rings!

Step	Procedure
3	Loosen 2 hex nuts and 2 M8 collar cap nuts diagonally.

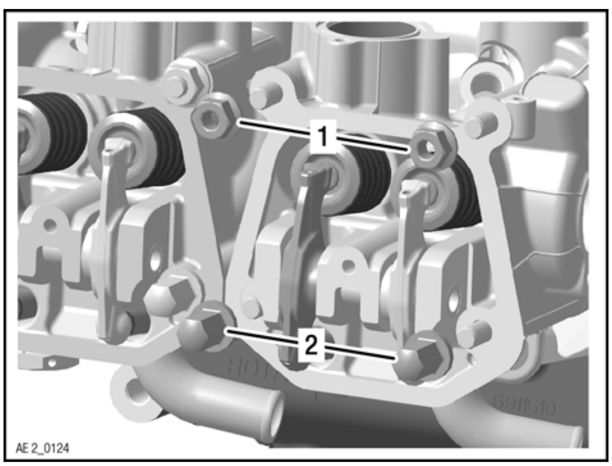


Figure 10.8

1	*Hex nuts*	*2*	*Collar cap nuts*

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

NOTICE

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.

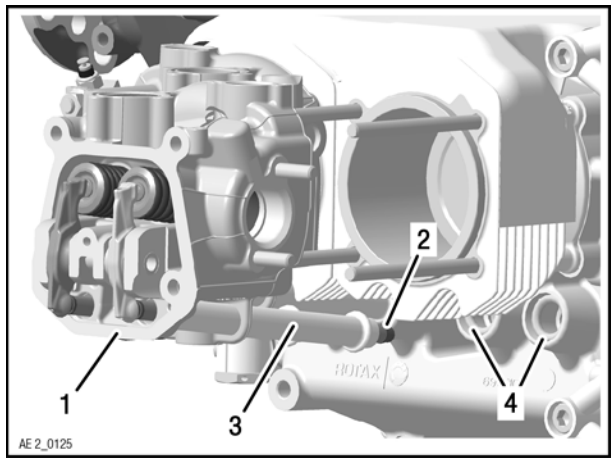


Figure 10.9

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

Step	Procedure
7	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.

NOTICE

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

NOTICE

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.

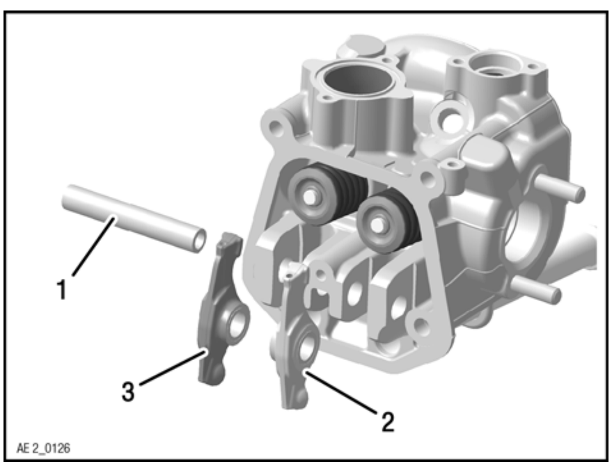


Figure 10.10

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

VALVE — REMOVAL

NOTICE

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	Remove 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.

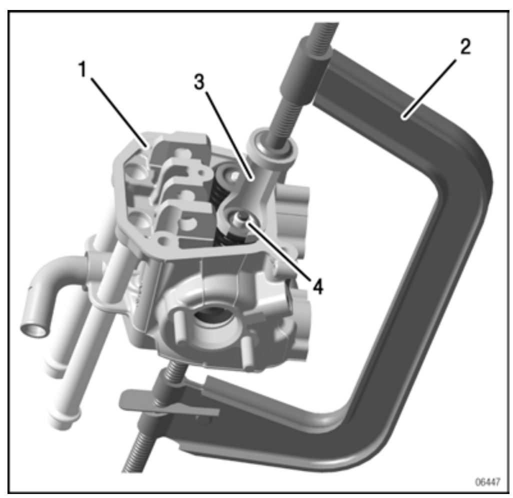


Figure 10.11

1	*Cylinder head assy.*	2	*Valve spring collet*
3	*Valve spring mounting device 877380*	4	*Valve cotter*

COOLANT ELBOW INLET — REMOVAL

NOTE

When replacing the coolant elbow, mark its position.

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.

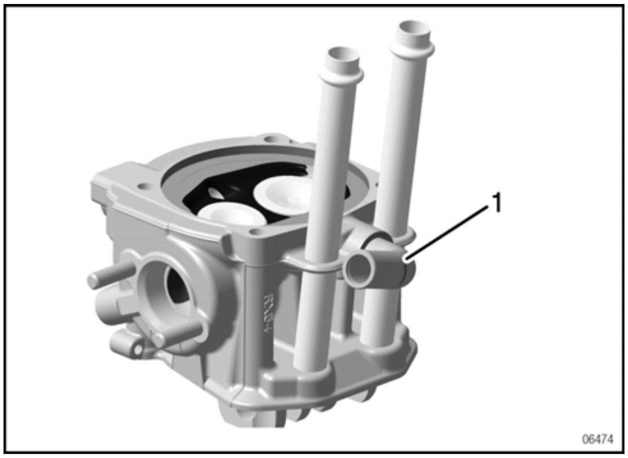


Figure 10.12

1 Coolant elbow

OIL RETURN TUBE - REMOVAL

Preparation

General visual inspection.
See current Maintenance Manual Line (MML) for the respective engine type.

NOTICE

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.

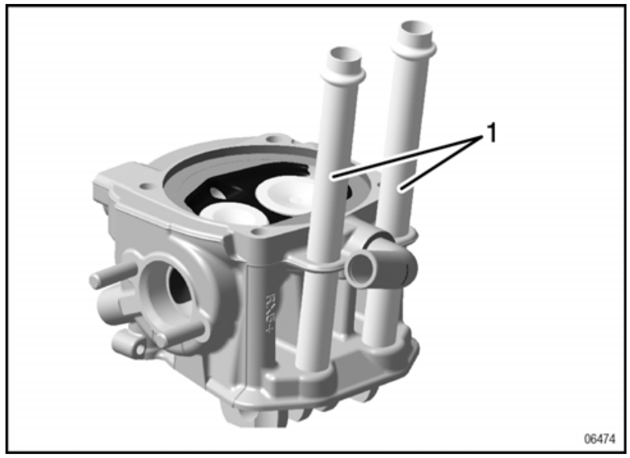


Figure 10.13

1 Oil return tube

NOTE

If removing of the oil return tubes is not possible, heat them with a hot air gun up to max. 120 °C (248 °F).

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.
4	Remove the elbow flange and O-ring.

NOTE

When replacing the coolant elbow, mark it´s position.

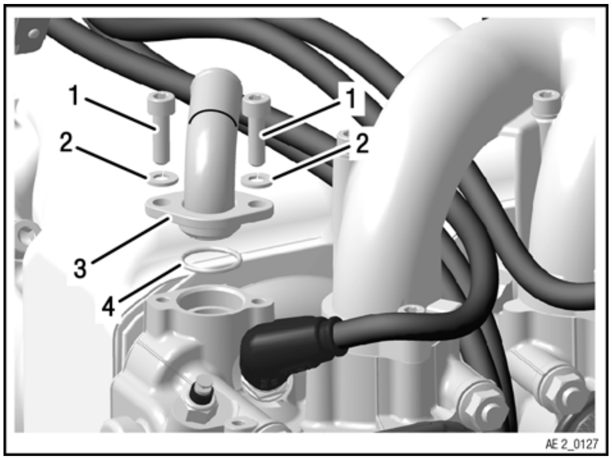


Figure 10.14

1	*Allen screw M6x20*	2	*Washer 6.4*
3	*Elbow flange*	4	*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 - INSPECTION

Preparation

Clean all parts carefully.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 05-00-00 section Procedure.

CYLINDER HEAD STUDS - INSPECTION

Step	Procedure
1	M8x20/23 studs are used to attach the exhaust manifold. Check that they are securely fitted and undamaged.
2	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.
3	Secure studs with LOCTITE 648. Tightening torque 6Nm (53 in. lb.).

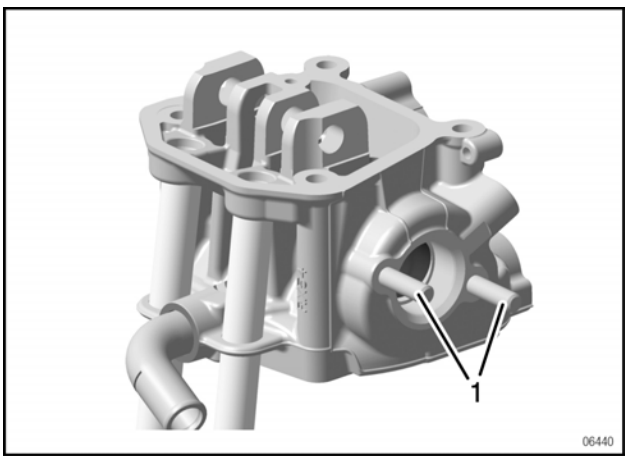


Figure 10.15

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.

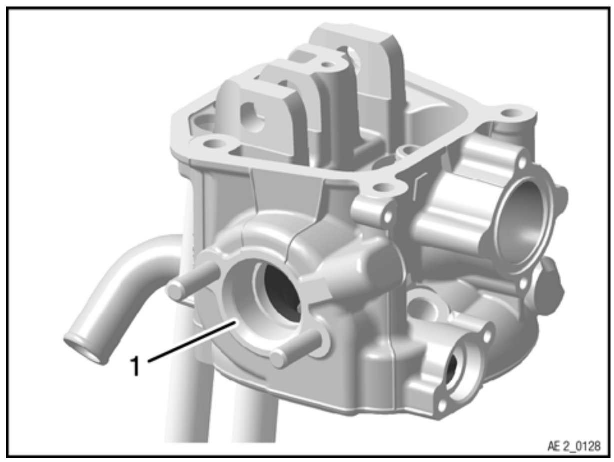


Figure 10.16

1 Cone (exhaust manifold)

NOTICE

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.

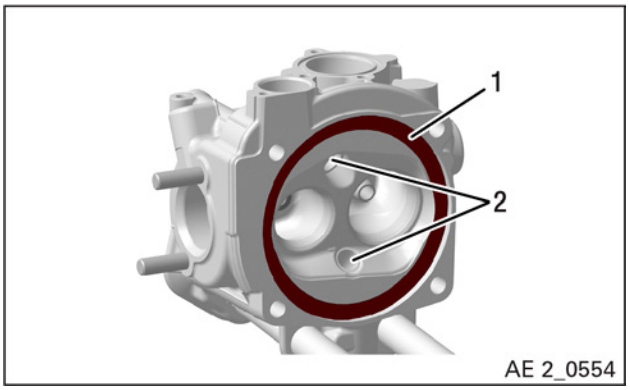


Figure 10.17

1 Sealing surface *2 Spark plug bore*

HARDNESS TEST METHOD

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

See current Maintenance Manual Line (MML) for the respective engine type.

The hardness test takes place at measurement point CH08.

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

NOTICE
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.

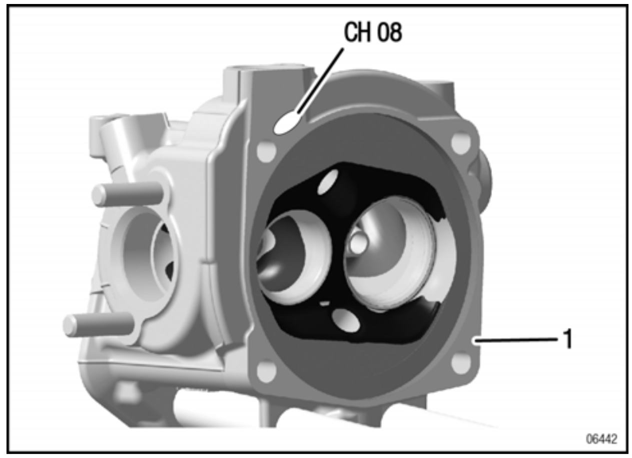


Figure 10.18

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 authorized ROTAX® overhaul facility.

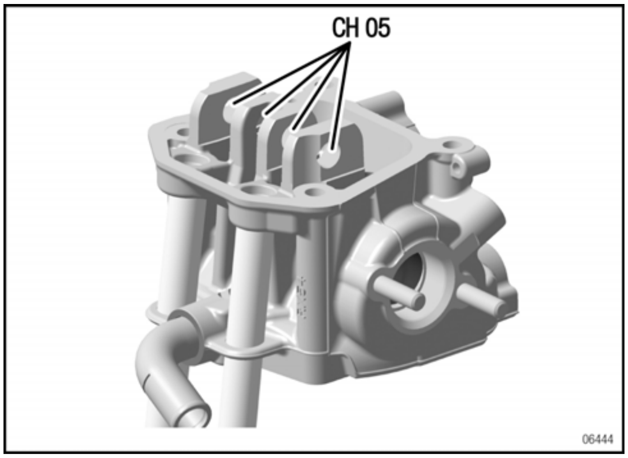


Figure 10.19

VALVE GUIDE — INSPECTION

NOTICE

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.

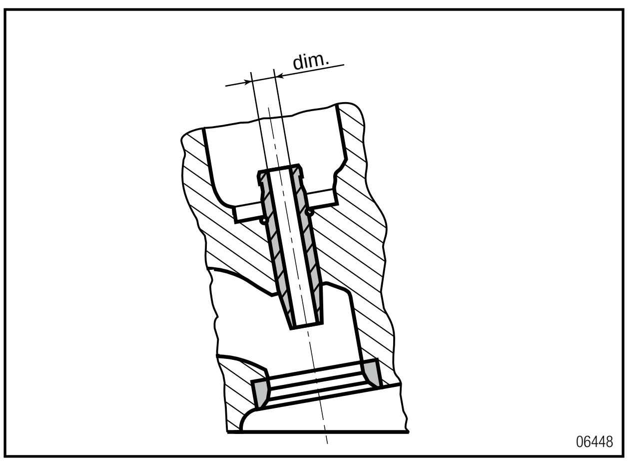


Figure 10.20

VALVE - INSPECTION

NOTICE

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.

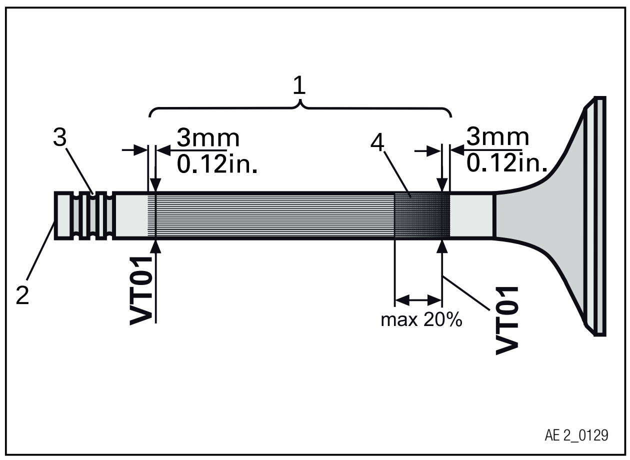


Figure 10.21

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

NOTICE

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.

Step	Procedure
6	Place the valve on roller blocks, roll it and measure the max. permissible out of true value VT02 on the valve disk using a dial gauge. See Chapter 72-30-00 section Wear limits

NOTE

The out of true value can also be measured with the dial gauge adapter assembly part no. 976140.

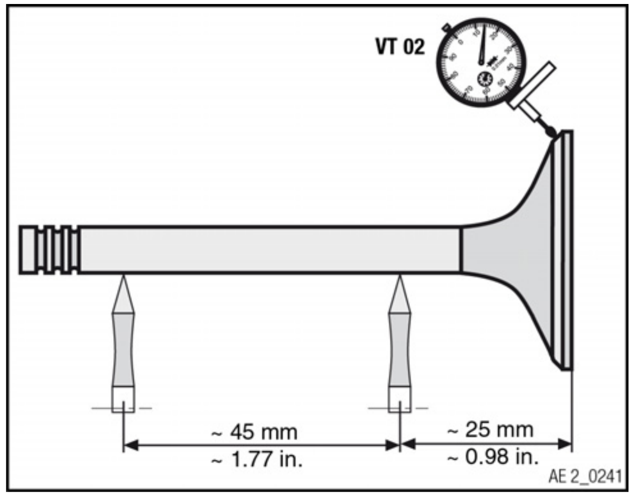


Figure 10.22

Step	Procedure
7	Check the valve face for wear caused by pounding VT03. See Chapter 72-30-00 section Wear limits

NOTICE

The end of the valve stem must not be ground.

VALVE SEATS - INSPECTION

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.

NOTICE
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.

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

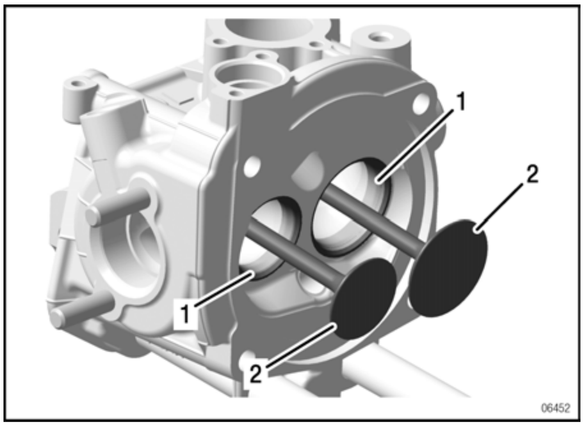


Figure 10.23: Typical

1 Valve seat ring *2 Valve*

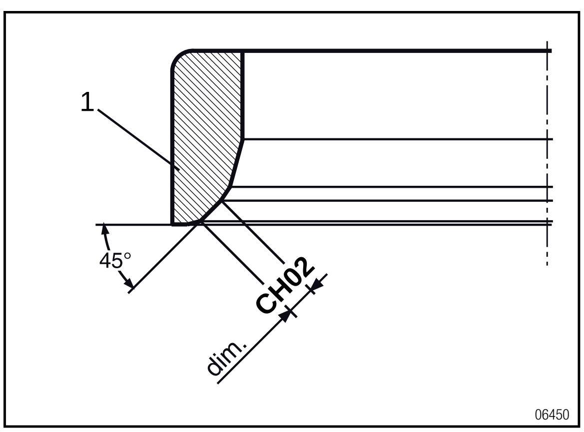


Figure 10.24

1 Valve seat ring

VALVE SPRING - INSPECTION

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

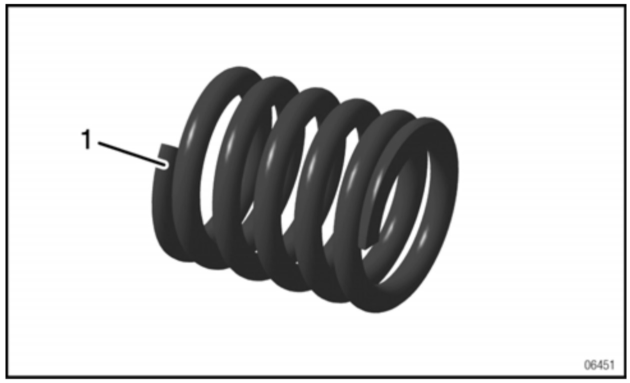


Figure 10.25

1 Valve spring

NOTE

Since 1997 the engines have only single valve springs. If dual valve springs are configured, change to single valve springs including valve cotter, valve spring retainer and valve spring support.

Spring force check
For the measurement necessary tools are available on the free market.

Step	Procedure
1	Apply a test load (F) and measure the remaining spring length VT04.
2	Replace valves shorter than the minimum length.

Test load for single valve spring configuration	
Single valve spring	200 N (45 lbf)

NOTE

The spring length should be as equal as possible on the inlet and outlet sides (max. 0.4 mm (0.016 in) in difference), otherwise replace the springs.

WASHER - INSPECTION

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.

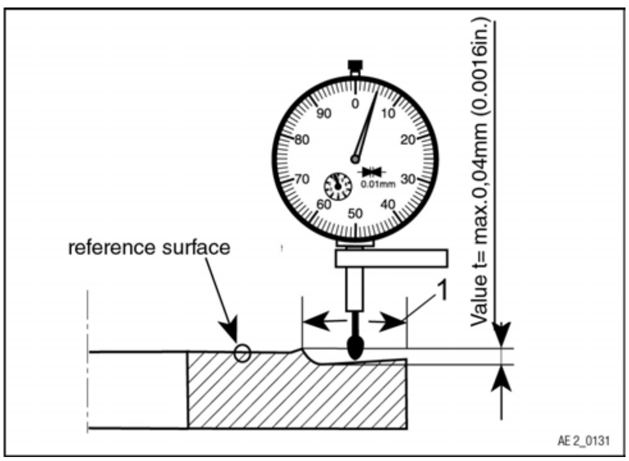


Figure 10.26: Typical

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.

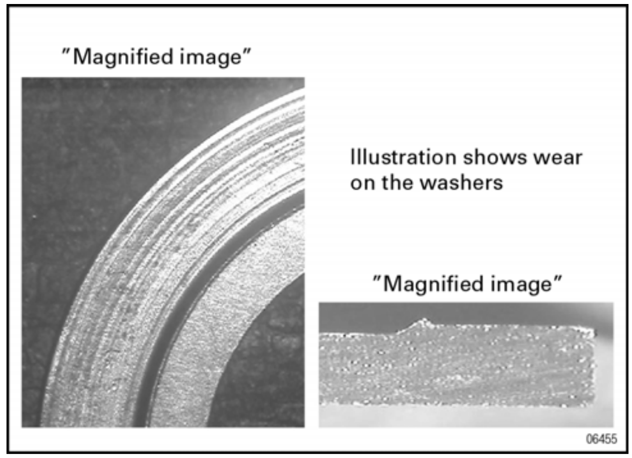


Figure 10.27

ROCKER ARM AND ROCKER ARM SHAFT - INSPECTION

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.

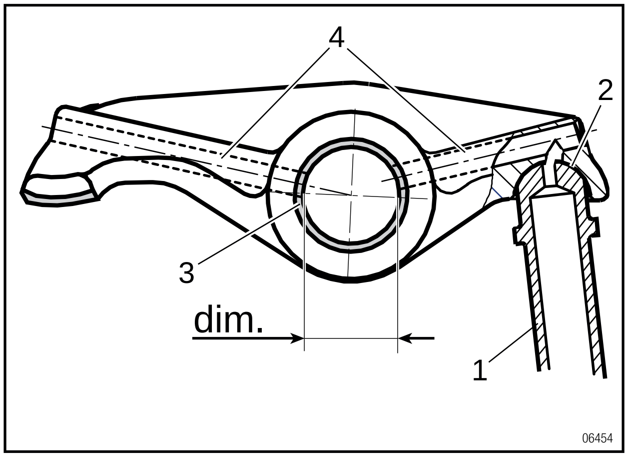


Figure 10.28

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.

NOTICE

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.

Step	Procedure
3	Check oil bores in the rocker arm for free passage

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.

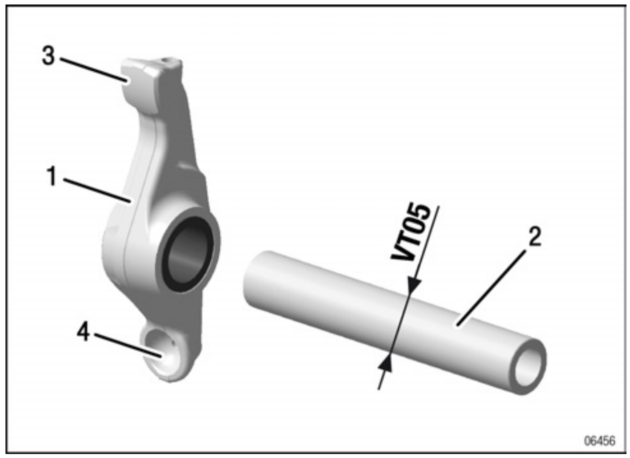


Figure 10.29

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

NOTE

The bronze colored fitted bearing bushing cannot be replaced. If necessary, it must be replaced with a rocker arm with a plastic bushing.

ROCKER ARM BUSHING - INSPECTION

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.

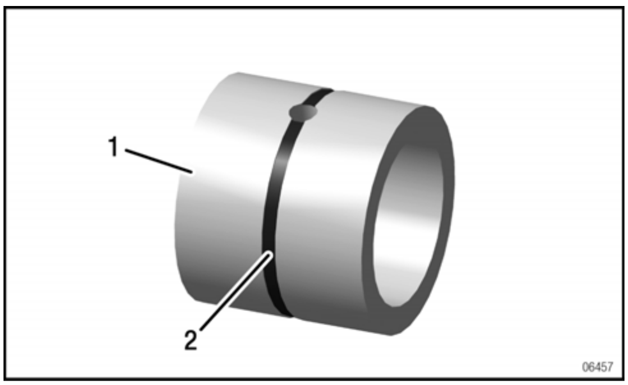


Figure 10.30

1 *Rocker arm bushing* 2 *Groove*

PUSH ROD – INSPECTION

NOTICE

Excessive engine speed can cause bending of the push rods.

Step	Procedure
1	Clean push rods and carry out a visual inspection.

NOTE

Make sure that the two ball heads pressed into the rod fit tightly.

NOTE

Lube oil from the hydraulic valve tappet passes the rocker arm through the bore.

Step	Procedure
2	Roll push rods and check for run out, see section Wear Limits (VT09).

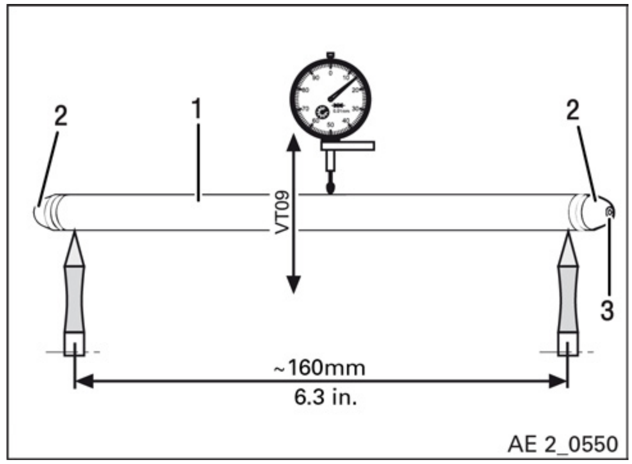


Figure 10.31

1 *Push rod* 2 *Ball heads*
3 *Bore*

WEAR LIMITS

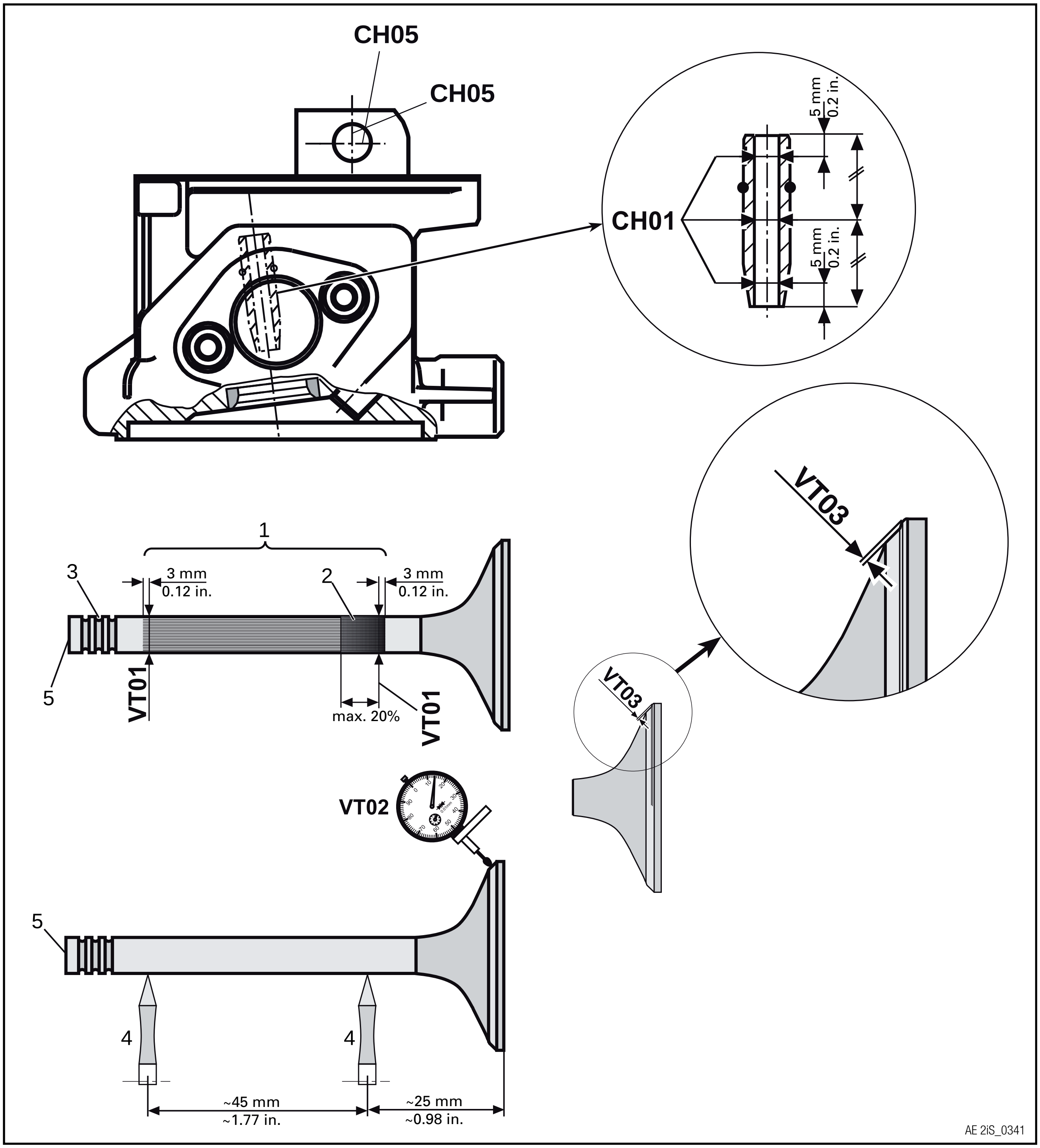


Figure 10.32

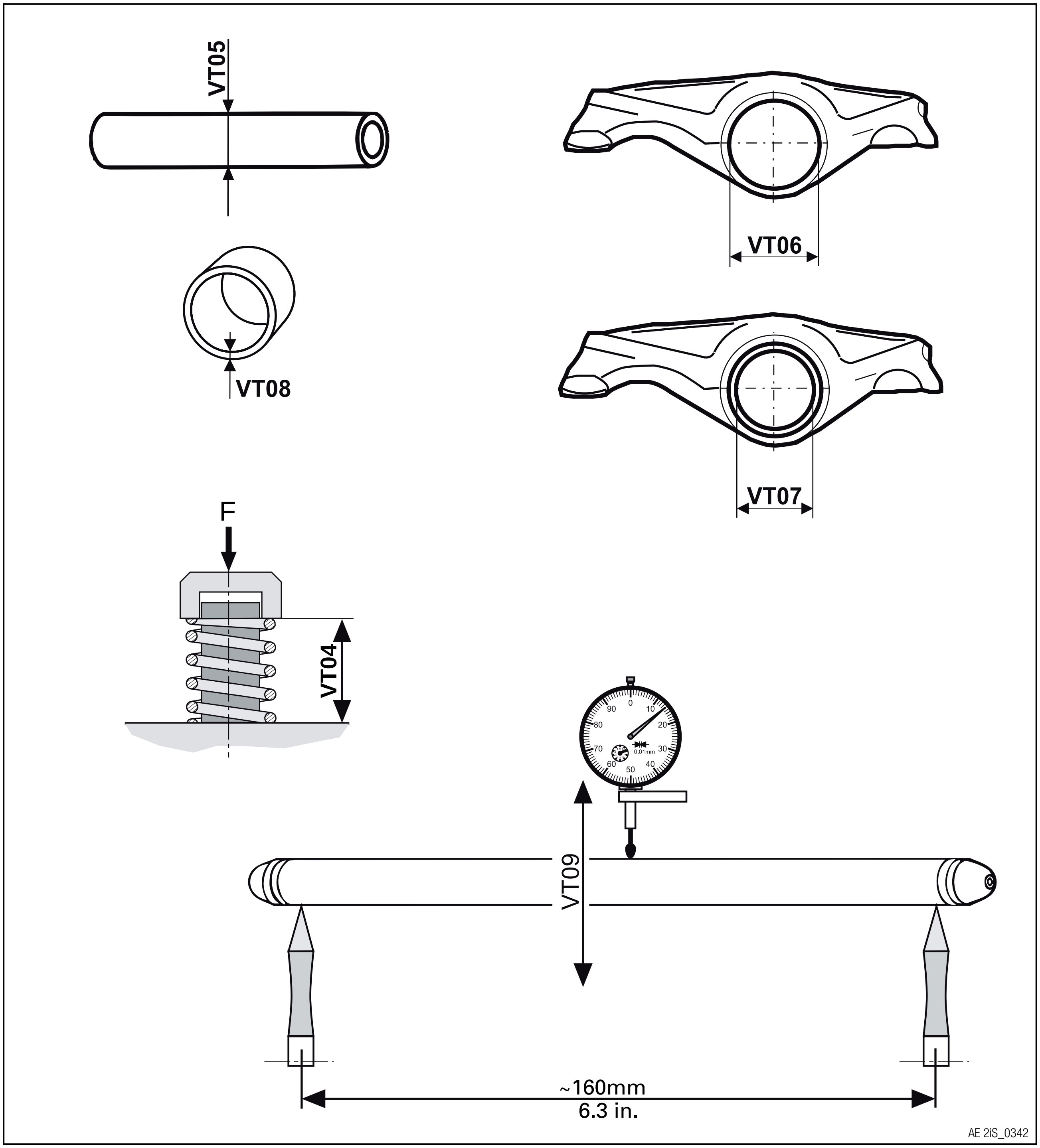


Figure 10.33

Description		Code	Reading new		Wear limit			Readings			
			min.	max.	100 %	50 %					
Cylinder head								1	2	3	4
Diameter of Valve guide											
	Intake 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	actual				
							renewed				
	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	actual				
							renewed				
Width of Valve seat											
	Intake Valve	CH02	1.40 mm 0.0551 in	1.90 mm 0.0748 in	2.40 mm 0.0945 in	2.15 mm 0.0846 in	actual				
							renewed				
	Exhaust Valve	CH02	1.50 mm 0.0591 in	2.00 mm 0.0787 in.	2.50 mm 0.0984 in	2.25 mm 0.0886 in	actual				
							renewed				
Hardness test		CH08	85 HB								
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	actual				
							renewed				
	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	actual				
							renewed				
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	actual				
							renewed				
	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	actual				
							renewed				
Circularity of Valve disc											
	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	actual				
							renewed				
	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	actual				
							renewed				

Description		Code	Reading new		Wear limit			Readings			
			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	actual				
							renewed				
	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	actual				
							renewed				
Length of valve spring at test force											
	Intake Valve	VT04	32.40 mm 1.2760 in	33.60 mm 1.3230 in	32.00 mm 1.2600 in	32.20 mm 1.2680 in	actual				
							renewed				
	Exhaust Valve	VT04	32.40 mm 1.2760 in	33.60 mm 1.3230 in	32.00 mm 1.2600 in	32.20 mm 1.2680 in	actual				
							renewed				
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	actual				
							renewed				
	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	actual				
							renewed				

Bore for rocker arm shaft "oversized”											
	Intake Valve	CH05	12.200 mm 0.4803 in	12.218 mm 0.4810 in	12.290 mm 0.4839 in	12.254 mm 0.4824 in	actual				
							renewed				
	Exhaust Valve	CH05	12.200 mm 0.4803 in	12.218 mm 0.4810 in	12.290 mm 0.4839 in	12.254 mm 0.4824 in	actual				
							renewed				
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	actual				
							renewed				
	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	actual				
							renewed				
Diameter of rocker arm shaft "oversized"											

	Intake Valve	VT05	12.183 mm 0.4796 in	12.194 mm 0.4801 in	12.150 mm 0.4783 in	12.167 mm 0.4790 in	actual				
							renewed				
	Exhaust Valve	VT05	12.183 mm 0.4796 in	12.194 mm 0.4801 in	12.150 mm 0.4783 in	12.167 mm 0.4790 in	actual				
							renewed				
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	actual				
							renewed				
	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	actual				
							renewed				
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	actual				
							renewed				
	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	actual				
							renewed				
Rocker arm bushing (bronze)											
	Intake Valve	VT07	12.000 mm 0.4724 in	12.027 mm 0.4735 in	12.150 mm 0.4783 in	12.089 mm 0.4759 in	actual				
							renewed				
	Exhaust Valve	VT07	12.000 mm 0.4724 in	12.027 mm 0.4735 in	12.150 mm 0.4783 in	12.089 mm 0.4759 in	actual				
							renewed				
Rocker arm bushing (bronze)											
	Intake Valve	VT07	12.000 mm 0.7424 in	12.027 mm 0.4735 in	12.150 mm 0.4783 in	12.089 mm 0.4759 in	actual				
							renewed				
	Exhaust Valve	VT07	12.000 mm 0.7424 in	12.027 mm 0.4735 in	12.150 mm 0.4783 in	12.089 mm 0.4759 in	actual				
							renewed				
Rocker arm bushing radial clearance (bronze)											
	Intake Valve	VT07/ VT05	0.006 mm 0.0002 in	0.044 mm 0.0017 in	0.160 mm 0.0063 in	0.102 mm 0.0040 in	actual				
							renewed				
	Exhaust Valve	VT07/ VT05	0.006 mm 0.0002 in	0.044 mm 0.0017 in	0.160 mm 0.0063 in	0.102 mm 0.0040 in	actual				
							renewed				

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	actual				
						renewed				
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	actual				
						renewed				
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	actual				
						renewed				
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	actual				
						renewed				

ASSEMBLY

CYLINDER HEAD — ASSEMBLY

Preparation

- Clean all parts carefully.

NOTICE

Check sealing surface for damage! Remove carbon residues!

NOTICE

For valves sandblasting is not allowed (as cleaning method).

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.

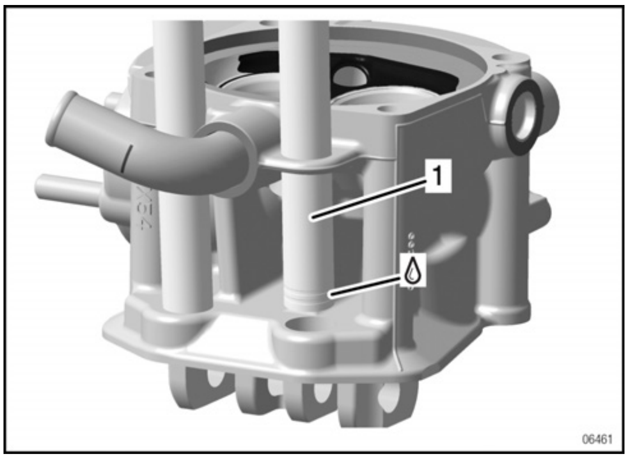


Figure 10.34

1 Oil return tube

NOTE

To prevent leakage between oil return tube and cylinder head, roughen the contact surfaces before lubrication with LOCTITE 648.

INSTALLATION OF THE COOLANT ELBOW INLET

Step	Procedure
1	Secure the coolant elbow with LOCTITE 577 and install the elbow in the cold cylinder head.

NOTE

Also apply LOCTITE 577 to 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!

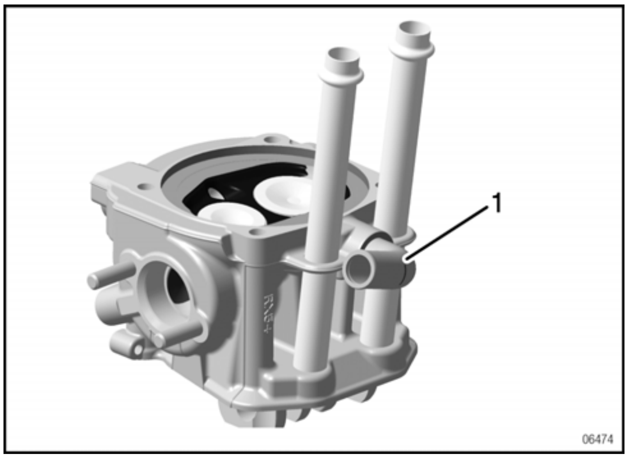


Figure 10.35

1 Coolant elbow inlet

COOLANT ELBOW OUTLET — ASSEMBLY

Step	Procedure
1	Secure the coolant elbow with LOCTITE 577 and install the elbow in the cold elbow flange.

NOTE

Also coat the thread in the elbow flange with LOCTITE 577.

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

NOTE

Remove excess LOCTITE.

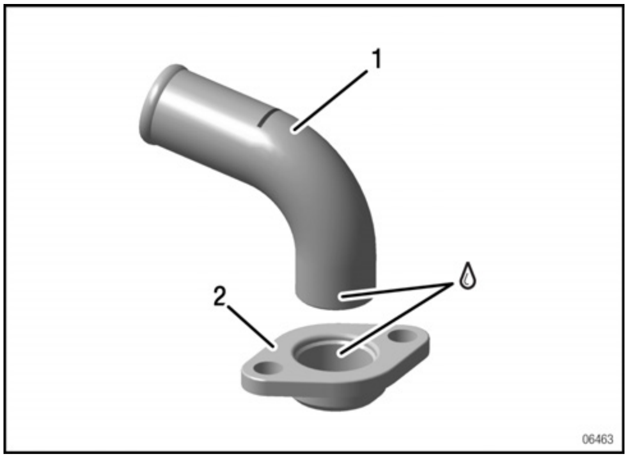


Figure 10.36

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.).

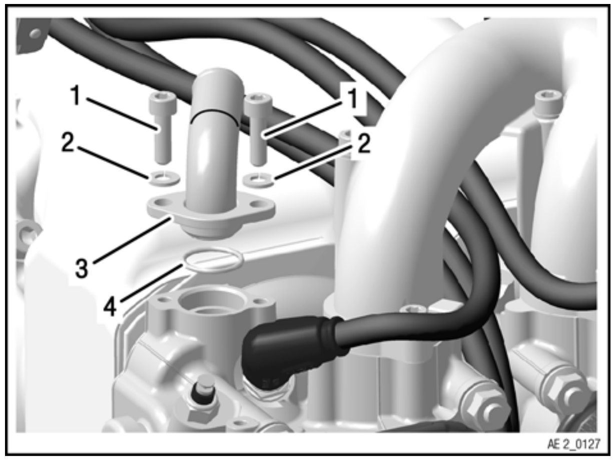


Figure 10.37

1	*Allen screws M6x20*	2	*Washers A6*
3	*Elbow flange*	4	*O-ring 19x2*

VALVE INSTALLATION

NOTICE

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!

NOTICE

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

NOTE

If dual valve springs are configured, change to single valve springs including valve cotter, valve spring retainer and valve spring support.

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

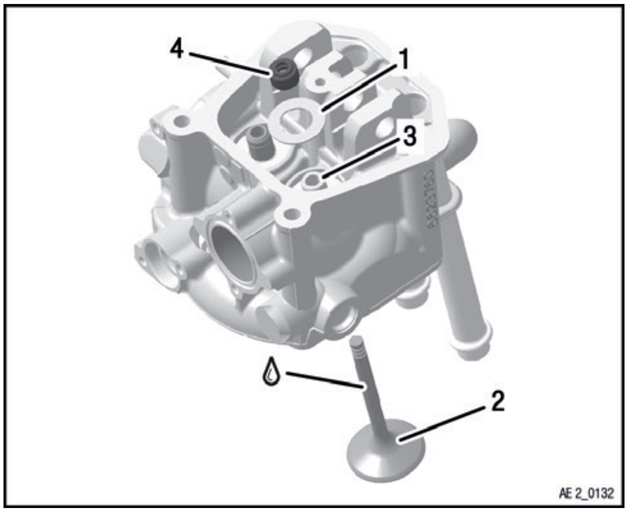


Figure 10.38

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

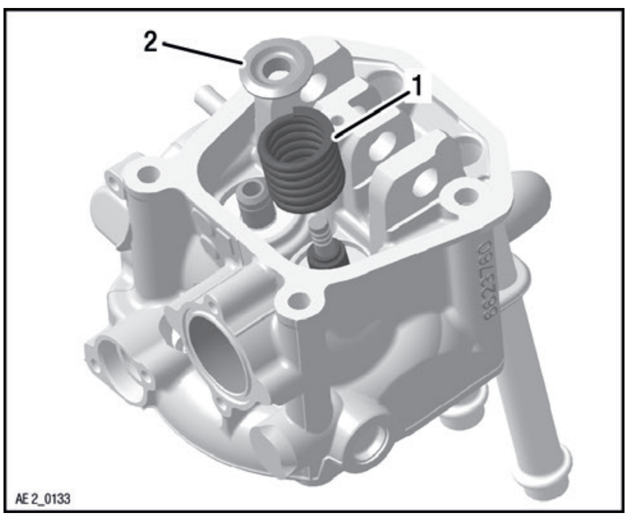


Figure 10.39

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.

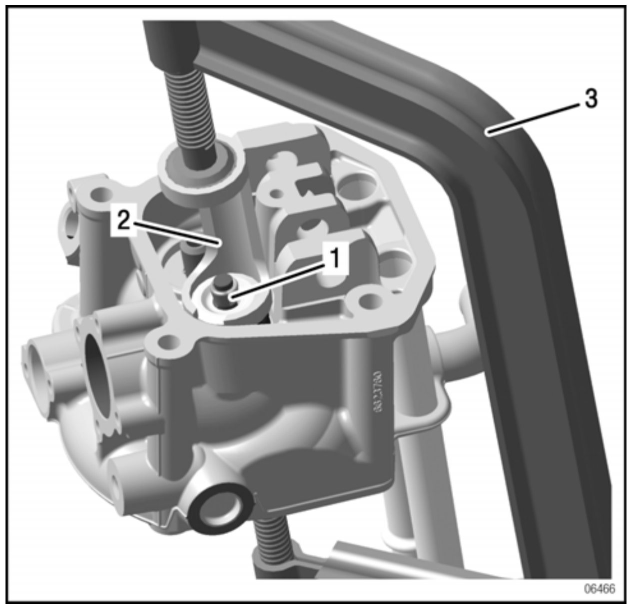


Figure 10.40: Typical

1	*Valve cotter*	2	*Mounting device 877380*
3	*Collet*		

ROCKER ARM — INSTALLATION

NOTICE
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.

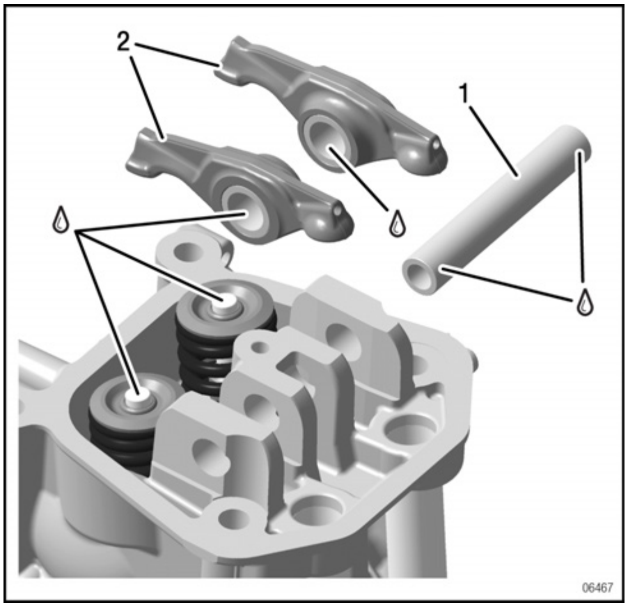


Figure 10.41

1 Rocker arm shaft *2 Rocker arm*

INSTALLATION

CYLINDER HEAD INSTALLATION

Preparation

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

NOTICE

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

NOTICE

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 LOCTITE ANTI SEIZE.
3	Lubricated O-ring 16x5 with engine oil and install it on the oil return tube.

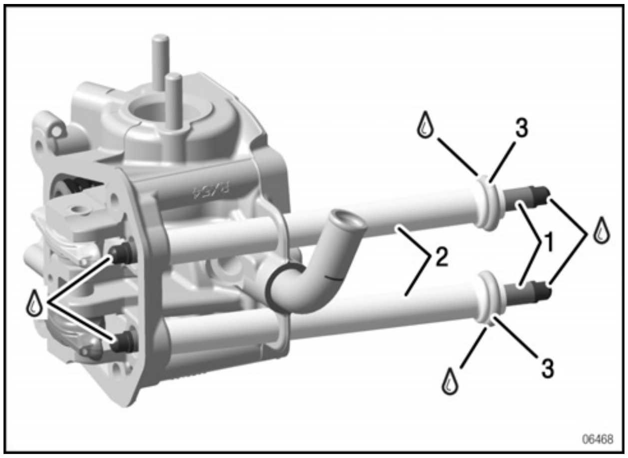


Figure 10.42

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

NOTE

The intake manifold 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.

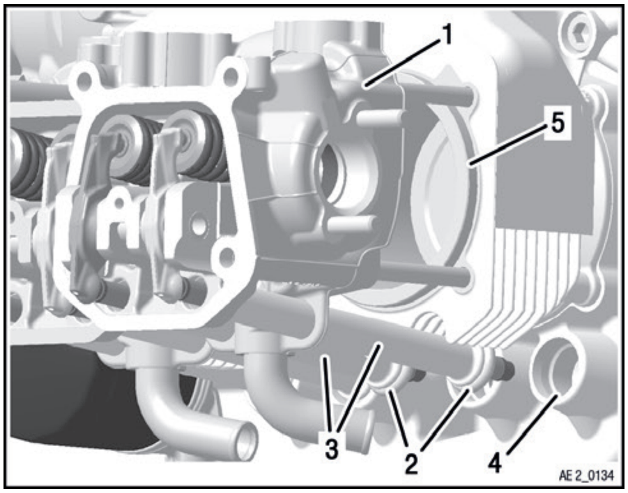


Figure 10.43

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

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

NOTE

On engines of older design, washers are fitted on the hex. nuts M8. Recent findings show, that it is no longer necessary to fit these washers. These washers are therefore not necessary when fitting a new cylinder head.

Step	Procedure
6	Clean and degrease all threads of studs.

NOTE

Collar cap nuts M8 and hex.nuts M8 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. **NOTE** *A slight “click” can be heard as they align together.*
8	Lubricate the contact area for the collar cap nuts M8 with grease.

NOTE

No grease for M8 hex. nuts contact areas!

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

NOTE

If necessary, repeat same procedure for the other cylinder heads.

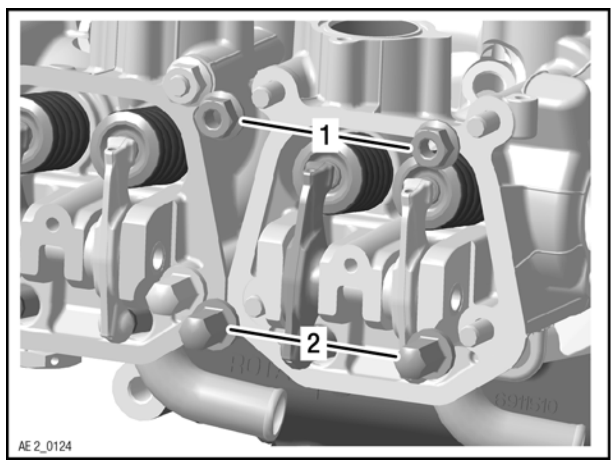


Figure 10.44

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

CYLINDER HEAD (SINGLE) REPAIRED PER ENGINE SIDE

Step	Procedure
1	Position the 2 O-rings between the intake manifold and the cylinder head.
2	Install the intake manifold on the cylinder head which has not been removed with 2 Allen screws M6 with washer. Tightening torque 10 Nm (89 in. lb.).

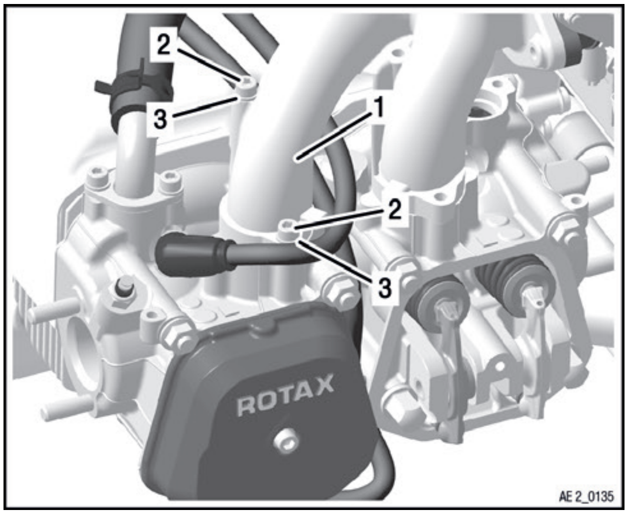


Figure 10.45

1 Intake manifold *2 Allen screw M6*
3 Washer

Step	Procedure
3	Align the second cylinder head on the intake manifold and fasten it with 2 Allen screws M6 with washer. Tightening torque 10 Nm (89 in. lb.).

NOTE

Skip to “Tightening torque procedure”.

CYLINDER HEADS (BOTH) REPAIRED PER ENGINE SIDE

NOTE

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

Step	Procedure
1	Clean and degrease all threads of studs.

NOTE

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

Step	Procedure
2	Squeeze the cylinder head and the cylinder together by hand and push towards crankcase.

NOTE

A slight “click” can be heard as they align together.

Step	Procedure
3	Lubricate the contact area for the collar cap nuts M8 with grease.

NOTE

No grease for hex. nuts M8 contact areas!

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

NOTE

Same procedure for the second cylinder.

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.

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

Step	Procedure
1	Attach the cylinder aligning tool part no. 877262 to the intake flange of the cylinder heads with 4 Allen screws M6x25 and tighten to 10 Nm (89 in. lb). **NOTE** *Only necessary to install alignment tool if 2 adjacent cylinder heads are being repaired.*

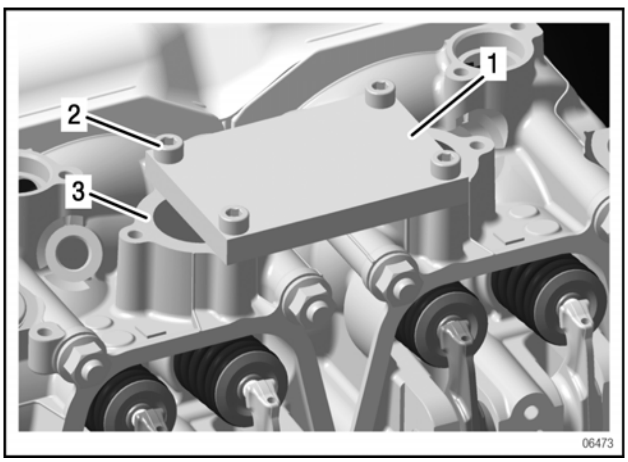


Figure 10.46: Typical

1	*Cylinder aligning tool 877262*	2	*Allen screw M6x25*
3	*Intake flange*		

Step	Procedure
2	Tighten the nuts in torque sequence following these steps. See following Fig.
3	All collar cap nuts M8 and hex. nuts M8 with 10 Nm (89 in lb).
4	All collar cap nuts M8 and hex. nuts M8 with 30 Nm (-5 Nm) / 22 ft. lb. (-4 ft. lb).

NOTE

Perform step 5 sequentially for each cylinder head nut one at a time following the torque sequence in following figure.

Step	Procedure
5	Loosen each collar cap nut M8 or hex. nut M8 360° then tighten to 10 Nm (89 in. lb.) + 150°.

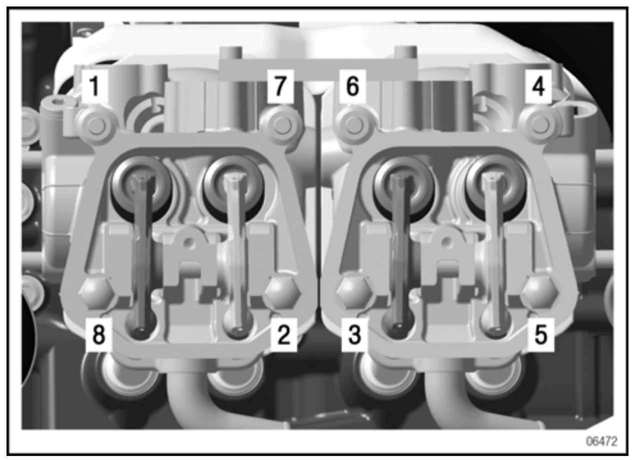


Figure 10.47: Screw diagram —Typical

Step	Procedure
6	Loosen 4 Allen screws M6x25 and remove the cylinder aligning tool, if installed for 2 adjacent cylinder head repairs.

VALVE COVER INSTALLATION

NOTICE

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!

NOTICE

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 will not return to the oil tank.

NOTICE

The thread of screw and head must be cleaned from oil.

Step	Procedure
1	Install O-ring 105x2.5 and O-ring 6.4x1.8 into the valve cover.
2	Install the valve cover and fasten it with an Allen screw M6x30 and washer 6/12/1. Tightening torque 10 Nm (89 in. lb.).

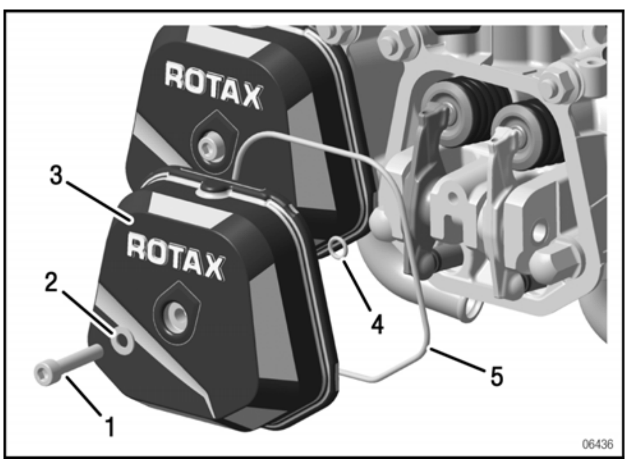


Figure 10.48

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

FINISHING WORK

- Install the coolant hose as far as the mark on the coolant elbow. See Chapter 75-00-00 section Cooling system.
- Install the spark plugs and connect the spark plug connectors. See Chapter 74-20-00 section Distribution.
- Install the intake manifold. See Chapter 73-00-00 section Fuel system.
- Install the exhaust system. See Chapter 78-00-00 section Exhaust.
- Install the temperature sensor. To do this, see Chapter 76-70-00 section Sensors and actuators.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

Chapter: 72–30–10
DISPLACEMENT PARTS

TOPICS IN THIS CHAPTER

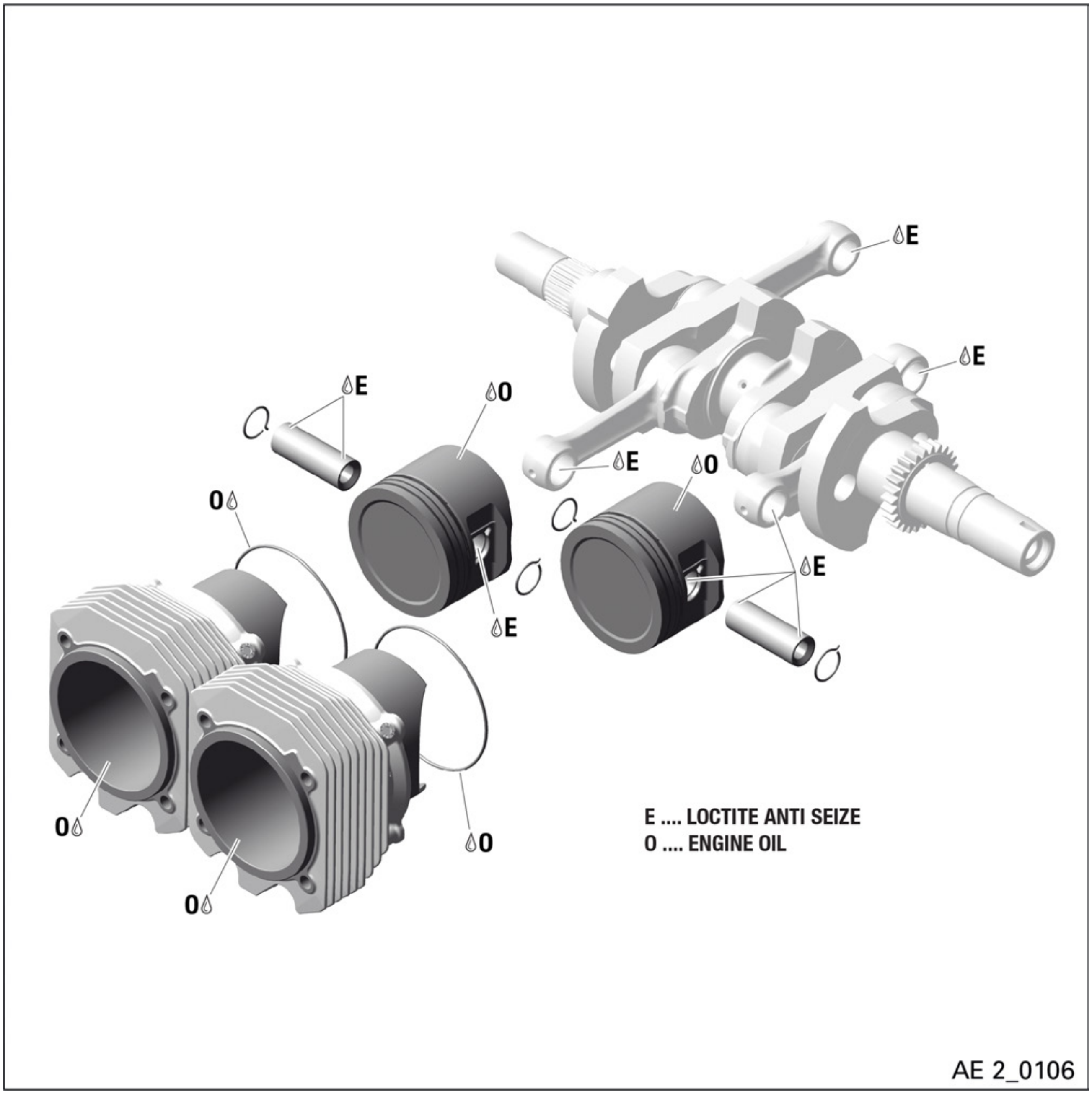


Figure 11.1

SPECIAL TOOLS

Description	Part number
Piston pin extractor assy.	877091
Extracting nut	877155
Piston ring spanner, 84 mm	876967
Piston ring spanner, 79.5 mm	876978
Monohook circlip remover	976380
Installation tool assy.	877802

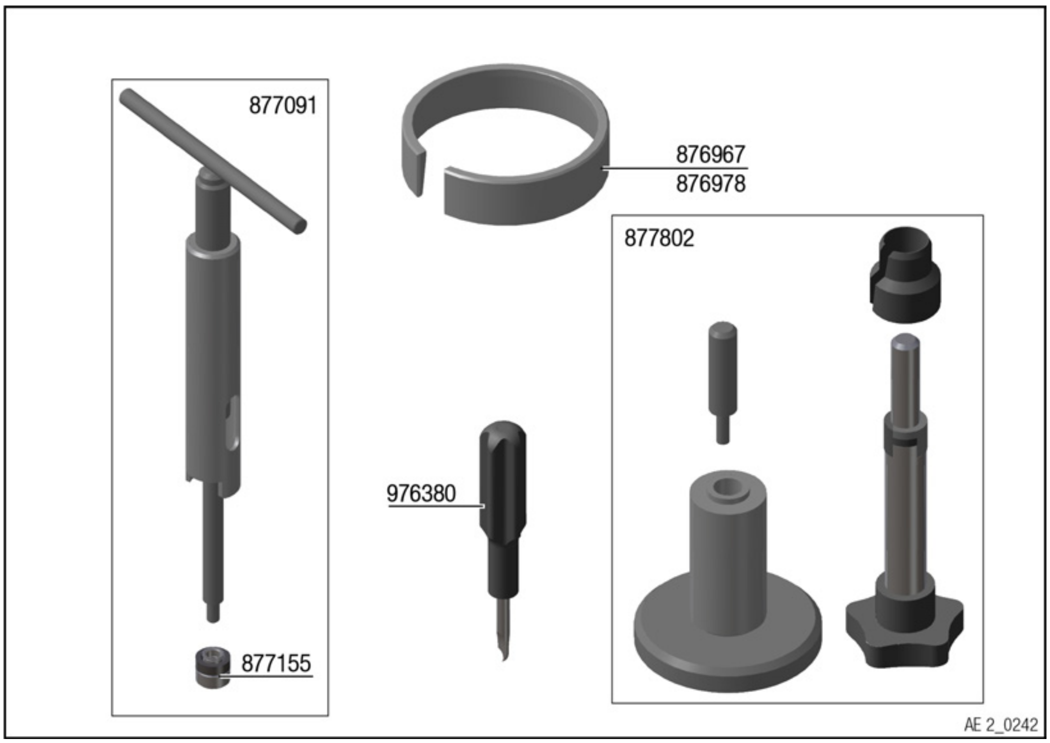


Figure 11.2

SERVICE PRODUCTS

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

SYSTEM DESCRIPTION

In the 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 current Maintenance Manual Line (MML) for the respective engine type.

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.

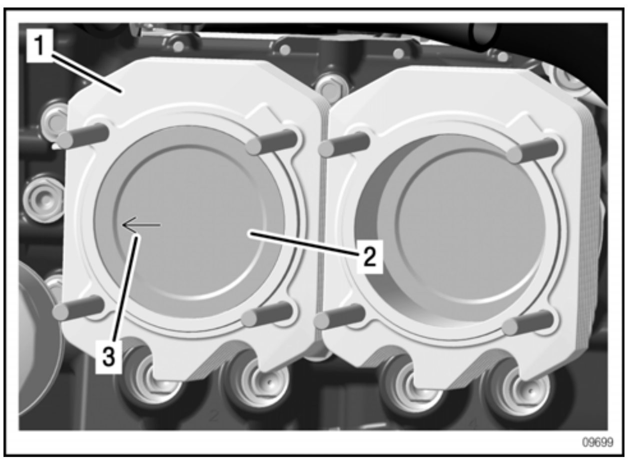


Figure 11.3

1 Cylinders *2 Pistons*

3 Marking arrow

NOTICE

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.

NOTE

2 O-rings 10.82x1.78 are placed under the cylinder on the crankcase.

NOTE

Remove studs M8x200 and M8x186 for easier disassambly of piston and protect from damage of the piston.

⚠ WARNING

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

NOTICE

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.

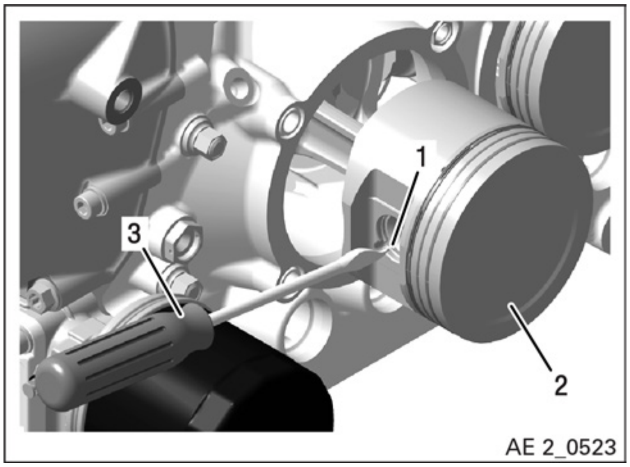


Figure 11.4

1	*Mono hook circlip*	2	*Pistons*
3	*Circlip remover 976380*		

NOTE

Piston pin extractor 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.

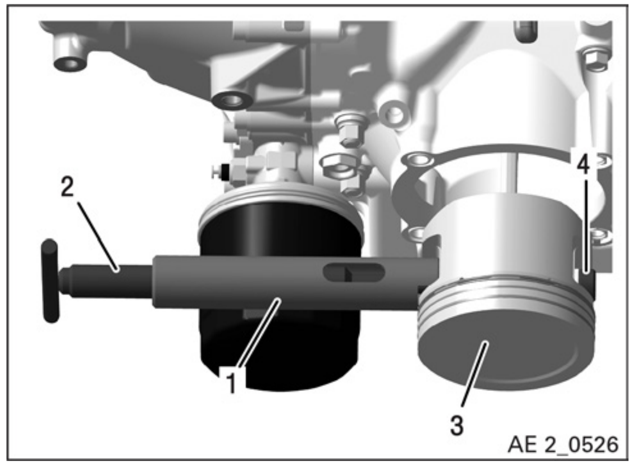


Figure 11.5

1	*Piston pin puller*	2	*Puller spindle*
3	*Pistons*	4	*Extracting nut M6 part no. 877155*

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 a suitable tool.

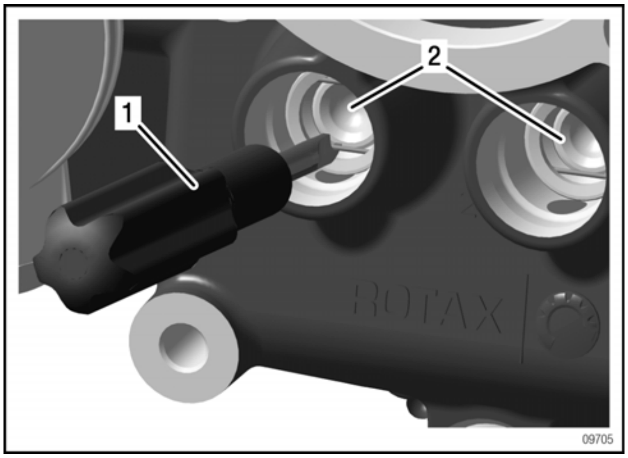


Figure 11.6

1 Suitable tool *2 Hydraulic valve tappet*

INSPECTION

DISPLACEMENT PARTS — INSPECTION

Preparation

Clean all parts carefully.
See current Maintenance Manual Line for the respective engine type, Chapter 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.

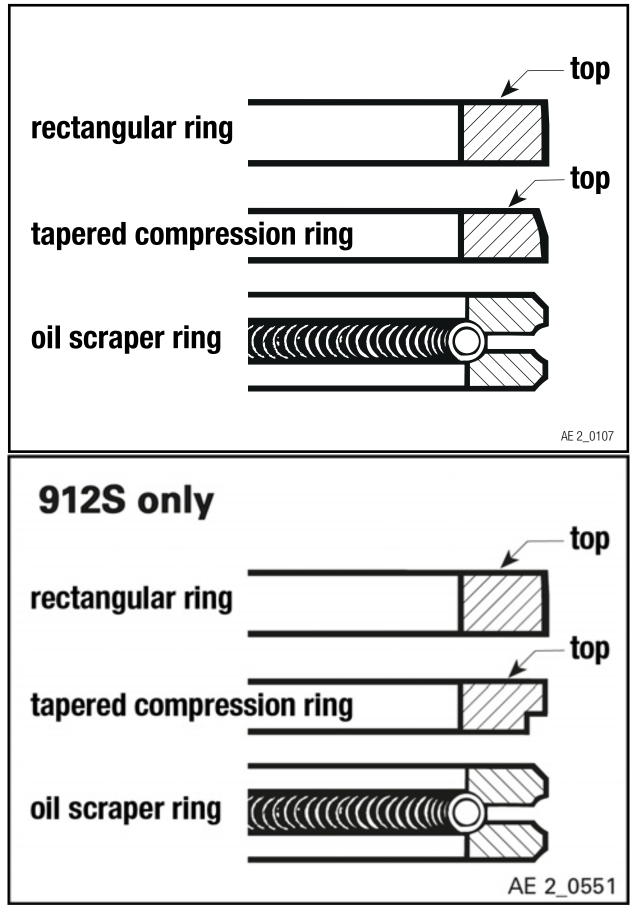


Figure 11.7

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.

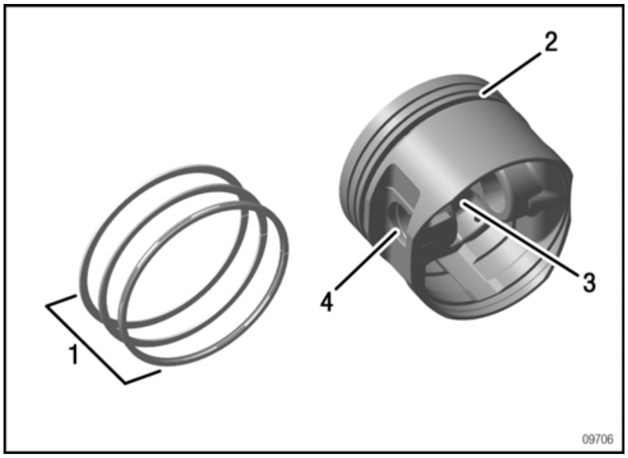


Figure 11.8

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 limit.

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 limit.

NOTE

The flank clearance can be measured on the installed rings using a feeler gauge. Multiple deposits in the spring of the oil scraper ring suggests that AVGAS 100LL has been used.

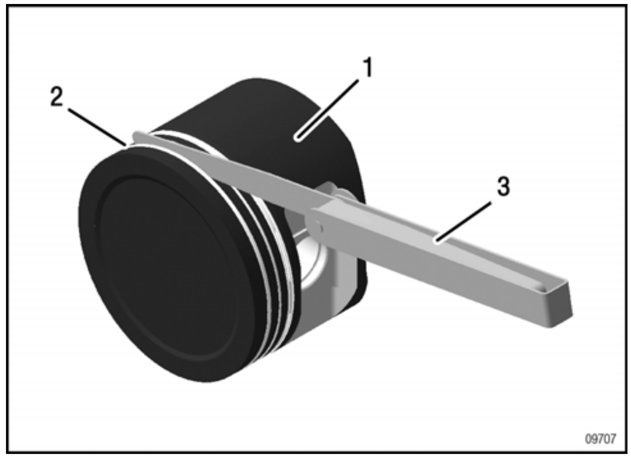


Figure 11.9

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.

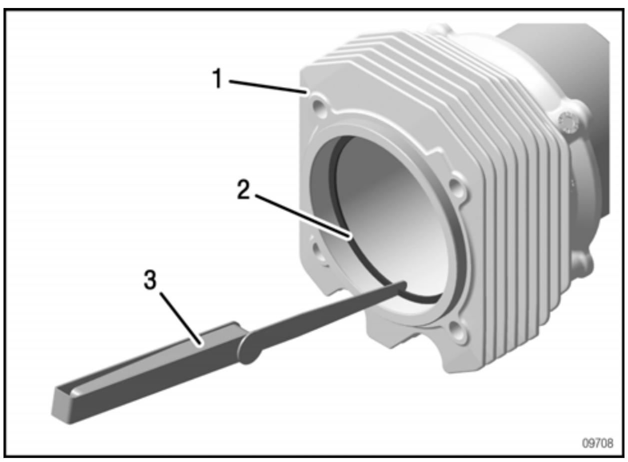


Figure 11.10

1 *Cylinders*
2 *Piston ring*
3 *Feeler gauge*

PISTON PIN — INSPECTION

NOTICE

The mono hook circlips for the 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.

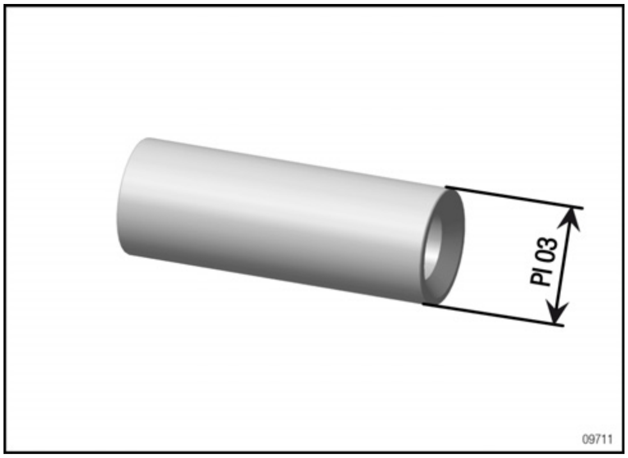


Figure 11.11

CYLINDER — INSPECTION

NOTICE

If an engine overheat is reported, or suspected, 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 and/or cylinder head must be sent to an authorized overhaul facility for repairs.

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.
3	Clean cylinder bore wall with very fine abrasive fleece and suitable cleaning fluid.

NOTICE

Damage to surface.
Honing, abrading and machining is not allowed.

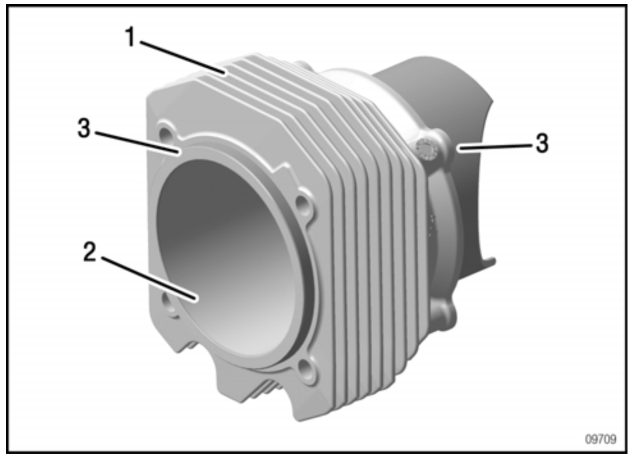


Figure 11.12

1	*Cooling fins*	*2*	*Cylinder bore*
3	*Sealing surface*		

Step	Procedure
4	Measure the cylinder and enter the measurement data (CY01/CY02/CY03). See Chapter 72-30-10 section Wear limits.
5	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.

NOTICE

The hydraulic valve tappet must not be reground on the end!

NOTICE

Disassembly of the hydraulic valve tappet is neither permissible nor necessary.

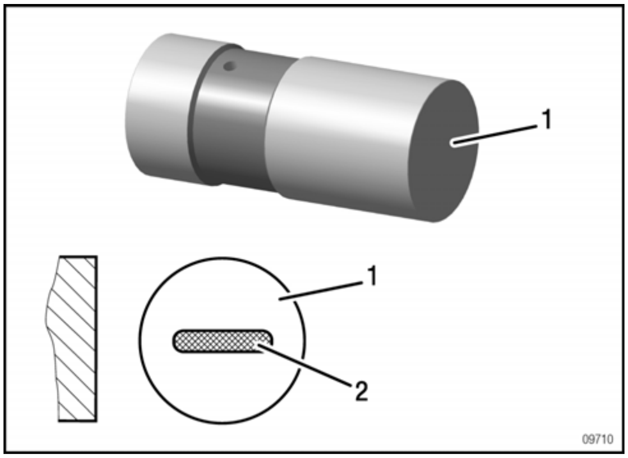


Figure 11.13

1 Cam contact face *2 Uneven wear*

WEAR LIMITS

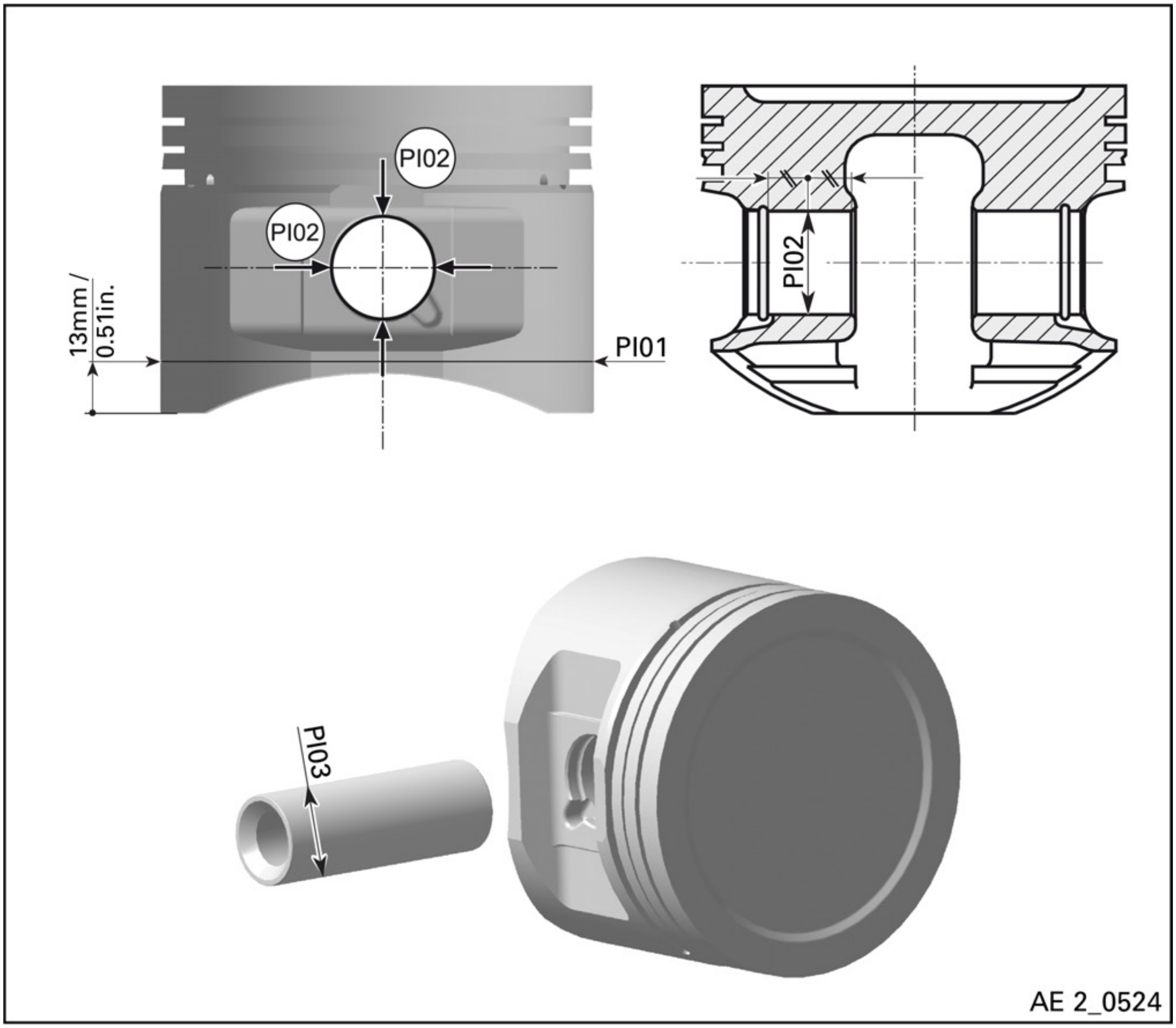


Figure 11.14

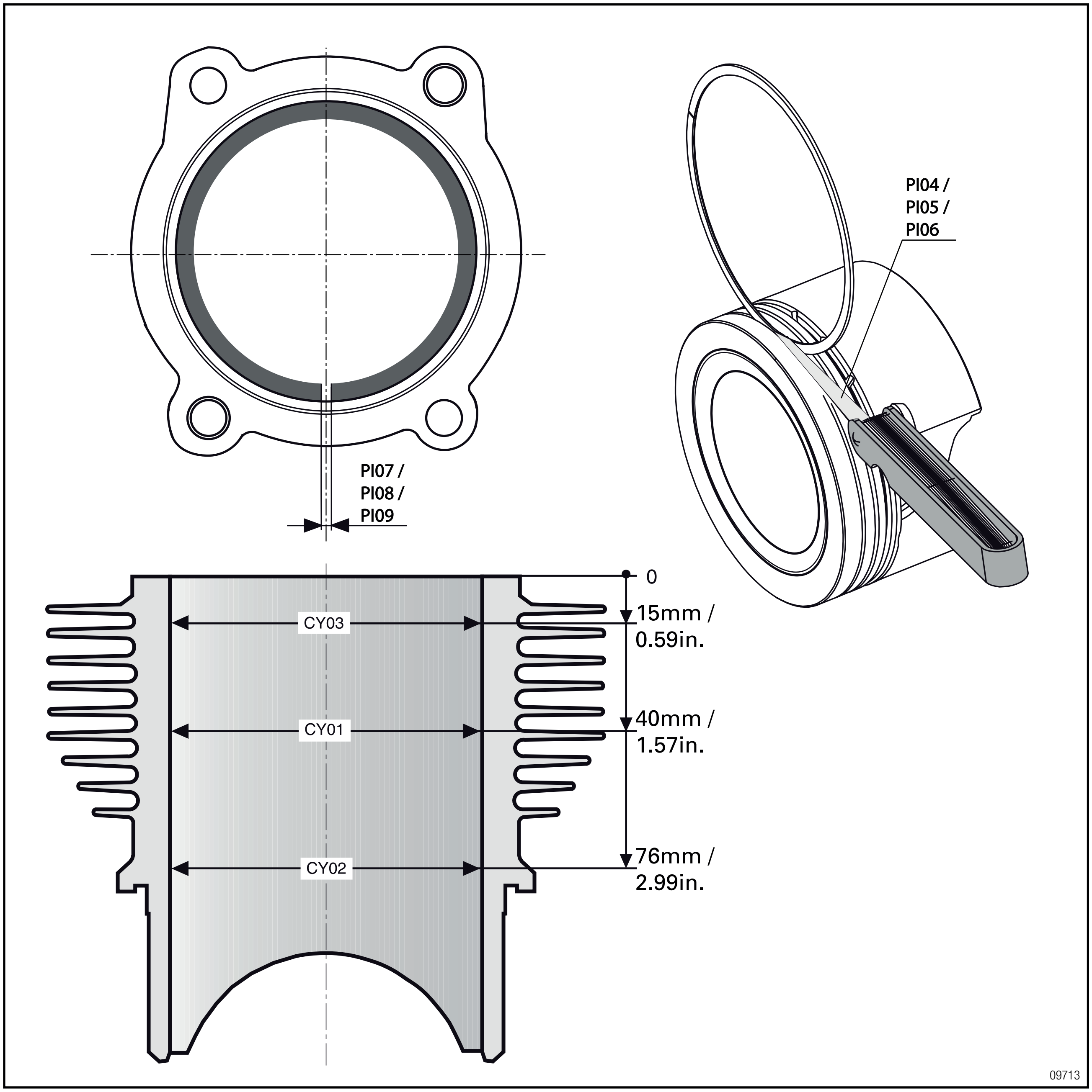

PI04 /
PI05 /
PI06
PI07 /
PI08 /
PI09
0
15mm /
0.59in.
40mm /
1.57in.
76mm /
2.99in.
CY03
CY01
CY02
09713

Figure 11.15

Description	Code	Reading new		Wear limit			Readings			
		min.	max.	100 %	50 %					
Piston						Cyl.	1	2	3	4
Piston, red 79.5mm /3.1 in.	PI01	79.488 mm 3.1294 in	79.502 mm 3.1300 in	79.390 mm 3.1256 in	79.439 mm 3.1275 in	actual				
						renewed				
Piston, green 79.5mm /3.1 in.	PI01	79.488 mm 3.1294 in	79.512 mm 3.1304 in	79.390 mm 3.1256 in	79.444 mm 3.1277 in	actual				
						renewed				
Piston, red 84 mm / 3.3 in.	PI01	83.988 mm 3.3066 in	84.002 mm 3.3072 in	83.890 mm 3.3027 in	83.939 mm 3.3047 in	actual				
						renewed				
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				
						renewed				
Installation clearance, cyl. "A" with "red" piston	CY01 /PI01	0.002 mm 0.0001 in	0.024 mm 0.0009 in	0.130 mm 0.0051 in	0.076 mm 0.0030 in	actual				
						renewed				
Installation clearance, cyl. "B" with "green" piston	CY01 /PI01	0.002 mm 0.0001 in	0.026 mm 0.0010 in	0.130 mm 0.0051 in	0.077 mm 0.0031 in	actual				
						renewed				
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				
						renewed				
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				
						renewed				
Piston pin clearance in piston pin bore	PI02 /PI03	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				
						renewed				
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				
						renewed				
Backlash be- tween piston ring groove and rectan- gular piston ring 1	PI04	0.030 mm 0.0012 in	0.062 mm 0.0024 in	0.100 mm 0.0039 in	0.081 mm 0.0032 in	actual				
						renewed				

Description		Code	Reading new min.	Reading new max.	Wear limit 100 %	Wear limit 50 %		Readings			
Backlash between piston ring groove and conical compression ring 2		PI05	0.030 mm 0.0012 in	0.062 mm 0.0024 in	0.100 mm 0.0039 in	0.081 mm 0.0032 in	actual				
							renewed				
Backlash between piston ring groove and oil scraper ring 3		PI06	0.020 mm 0.0008 in	0.055 mm 0.0022 in	0.100 mm 0.0039 in	0.078 mm 0.0032 in	actual				
							renewed				
Piston ring end, 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				
							renewed				
Piston ring end, conical compression 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				
							renewed				
Piston ring end, 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				
							renewed				
Cylinder							Cyl.	1	2	3	4
Cylinder bore A 79.5 mm / 3.1 in											
	D1	CY01	79.500 mm 3.1299 in	79.512 mm 3.1304 in	79.580 mm 3.1331 in	79.546 mm 3.1317 in	actual				
							renewed				
	D2	CY02	CY01 +0.015 mm CY01 +0.0006 in		CY01 +0.015/-0.008 mm CY01 +0.0006/-0.0003 in		actual				
							renewed				
	D3	CY03	CY01 +/- 0.008 mm CY01 +/- 0.0003 in		CY01 +0.020/-0.008 mm CY01 +0.0008/-0.0003 in		actual				
							renewed				
Cylinder bore B 79.5 mm / 3.1 in											
	D1	CY01	79.512 mm 3.1304 in	79.524 mm 3.1316 in	79.590 mm 3.1335 in	79.566 mm 3.1325 in	actual				
							renewed				
	D2	CY02	CY01 +0.015 mm CY01 +.0006 in		CY01 +0.015/-0.008 mm CY01 +0.0006/-0.0003 in		actual				
							renewed				
	D3	CY03	CY01 +/- 0.008 mm CY01 +/- 0.0003 in		CY01 +0.020/-0.008 mm CY01 +0.0008/0.0003 in		actual				

Description		Code	Reading new		Wear limit			Readings			
			min.	max.	100 %	50 %					
							renewed				
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	84.046 mm 3.3089 in	actual				
							renewed				
	D2	CY02	CY01 +0.015 mm CY01 +0.0006 in		CY01 +0.015/-0.008 mm CY01 +0.0006/-0.0003 in		actual				
							renewed				
	D3	CY03	CY01 +/- 0.008 mm CY01 +/- 0.0003 in		CY01 +0.020/-0.008 mm CY01 +0.0008/-0.0003 in		actual				
							renewed				
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				
							renewed				
	D2	CY02	CY01 +0.015 mm CY01 +.0006 in		CY01 +0.015/-0.008 mm CY01 +0.0006/-0.0003 in		actual				
							renewed				
	D3	CY03	CY01 +/- 0.008 mm CY01 +/- 0.0003 in		CY01 +0.020/-0.008 mm CY01 +0.0008/0.0003 in		actual				
							renewed				
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				
							renewed				
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				
							renewed				
Post-machin-ing of sealing surface/ cyl-inder head			0.0000 mm 0.0000 in	0.0000 mm 0.0000 in	0.10 mm 0.0039 in		actual				
							renewed				

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

NOTICE

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.

NOTICE

If operating faults occur, such as operation with a non-purged hydraulic valve tappet, the internal components of the tappet will be permanently damaged and the hydraulic valve tappet must be replaced.

NOTE

New hydraulic valve tappets are partially emptied depending on the oil pressure and are pumped full of oil during the starting process. The oil passes through the oil 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 oil bore for the hydraulic valve tappet in the crankcase and contact faces with engine oil.
2	Install the lubricated hydraulic valve tappet in the corresponding place in the crankcase.

NOTE

The hydraulic valve tappet must rotate in the crankcase without resistance.

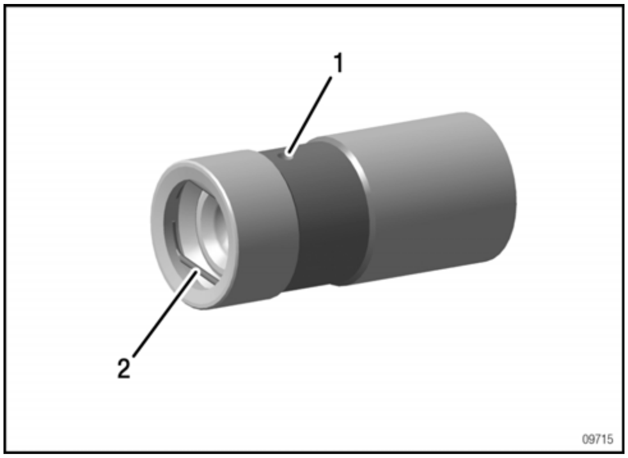


Figure 11.16

1 *Oil bore* 2 *Retaining ring*

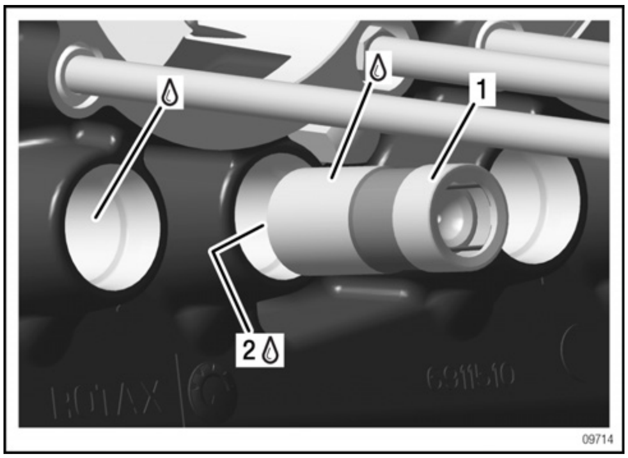


Figure 11.17

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).

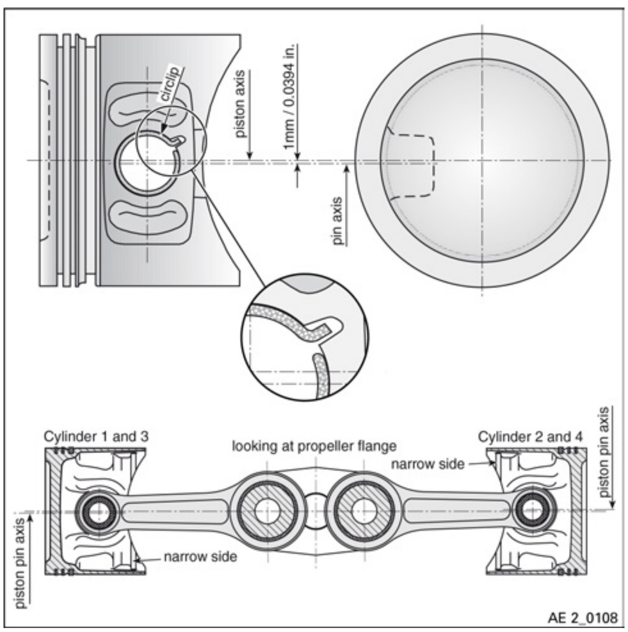


Figure 11.18

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 guide punch, part no. 877802 (slide fit). If this is not possible, the piston pin can be pulled in with the piston pin extractor assy. part no. 877091.

Step	Procedure
3	Push the piston pin to one side in the piston, insert the puller spindle and mount the extracting nut part no. 877155.
4	Turn the spindle clockwise to pull in the piston pin entirely as far as the retaining ring.

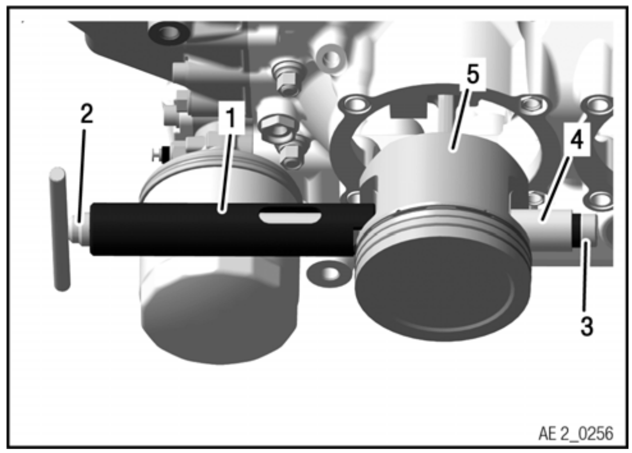


Figure 11.19

1	*Piston pin extractor 877091*	2	*Puller spindle*
3	*Extracting nut 877155*	4	*Piston pin*
5	*Pistons*		

NOTICE

Always use new mono hook circlips.Circlips which are used or have already been installed have insufficient tangential tension, can twist and consequently abrade the groove in the piston.

NOTICE

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.

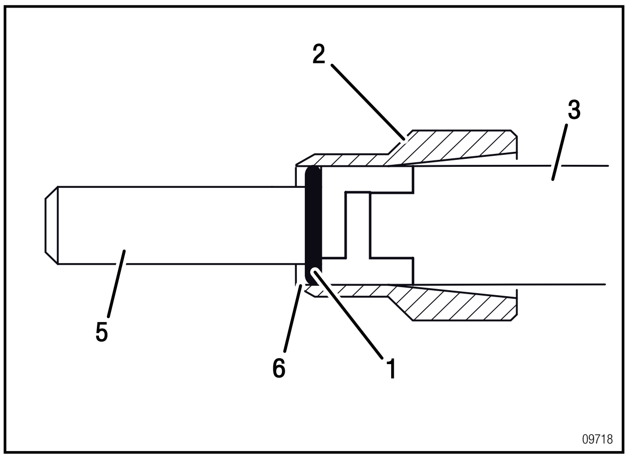


Figure 11.20

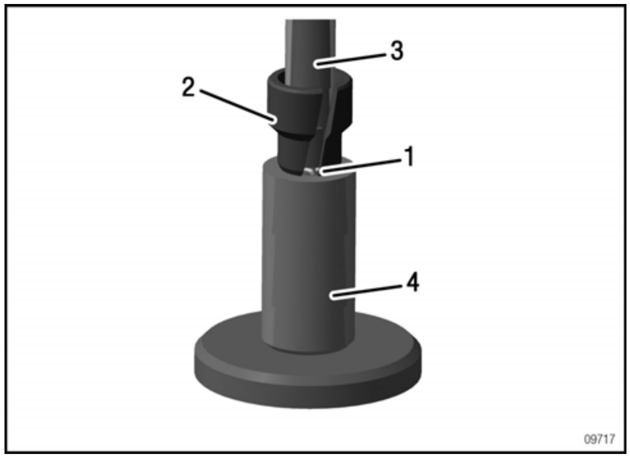


Figure 11.21

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 tap by the other hand on the installation tool.

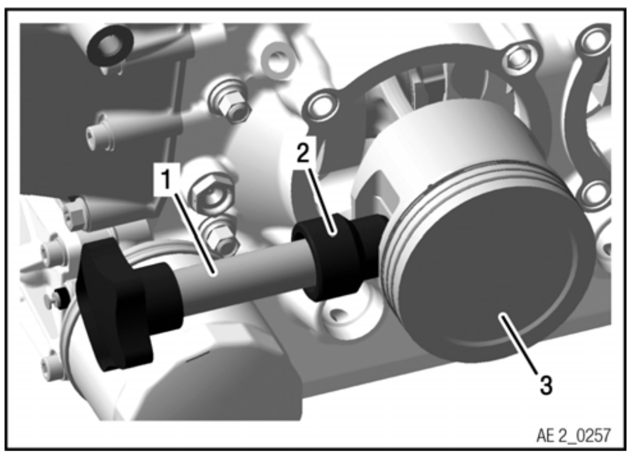


Figure 11.22

1	*Installation tool*	2	*Installation sleeve*
3	*Piston*		

Apply same procedure on the opposite side of the piston.

NOTE

Old style pistons are made for hookless circlips, the mono hook circlip must be reworked as described in SI-21–1997 “Instruction of the mono hook circlip”, latest issue.

CYLINDER INSTALLATION

NOTICE

The suitable piston ring spanner part no. 876978 or 876967 must be used to avoid ring breakages. Ensure that the piston ring joints are in the specified angle range.

NOTE

Install piston rings using piston ring pliers with the marking “TOP” or the dot mark pointing upwards towards the piston crown.
Pay attention to the position of the piston ring gaps.

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°.

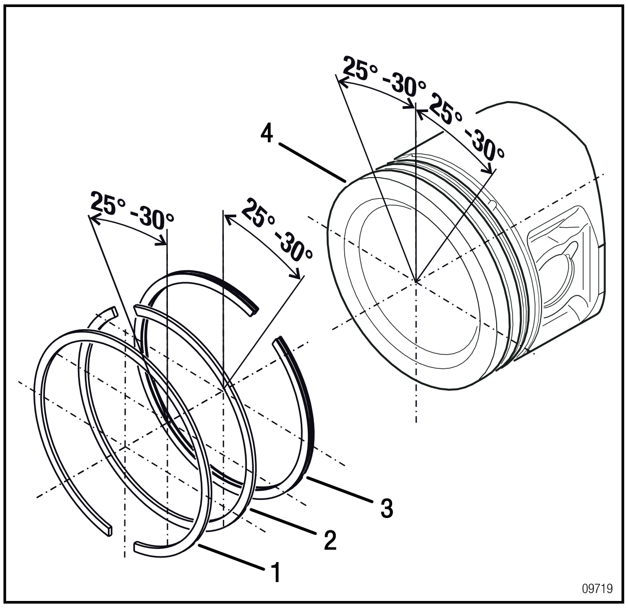


Figure 11.23

1	*Rectangular ring*	2	*Compression ring*
3	*Oil scraper ring*	4	*Pistons*

NOTICE

The ring gap should never come to lie in the region of the piston pin eye.

NOTICE

Double-check that piston pin circlips are installed properly.

Step	Procedure
3	Install 2 O-Ring 10.82x1.78 per cylinder.
4	Install the 87x2 O-ring on the cylinder skirt and lubricate the cylinder bore with engine oil.
5	Lubricate the piston with engine oil, compress the piston rings with piston ring spanner part no. 876967 or 876978 and carefully install the corresponding cylinders.

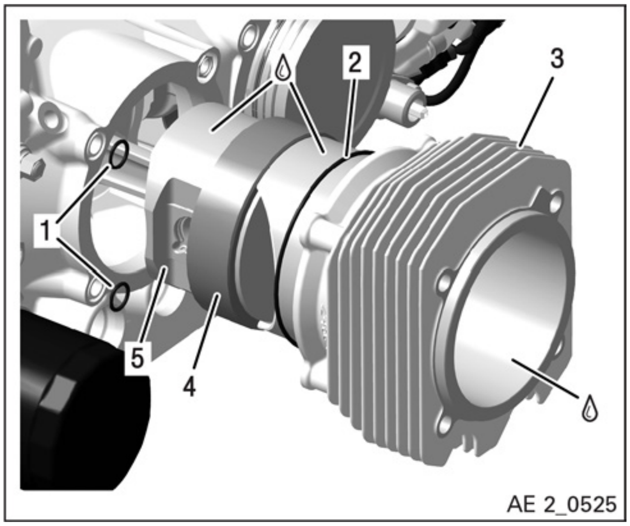


Figure 11.24

1	*O-ring 10.82x1.78*	2	*O-ring 87x2*
3	*Cylinders*	4	*Piston ring spanner 876967 or 876978*
5	*Piston*		

Step	Procedure
6	Install the 2 studs M8x200 and 2 studs M8x186 per cylinder. Hand tighten only!

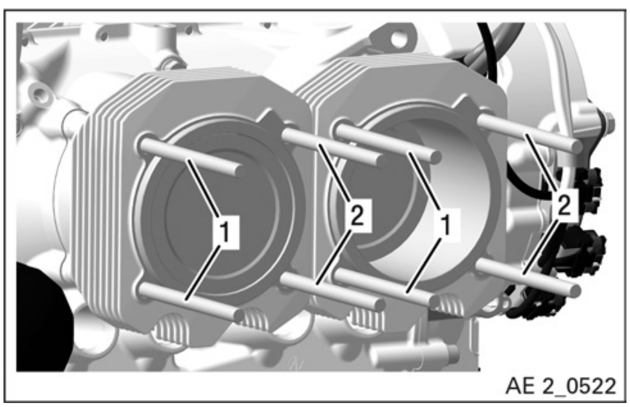


Figure 11.25

1	*Stud M8x200*	2	*Stud M8x186*

NOTE

Repeat this process for the other cylinders.

FINISHING WORK

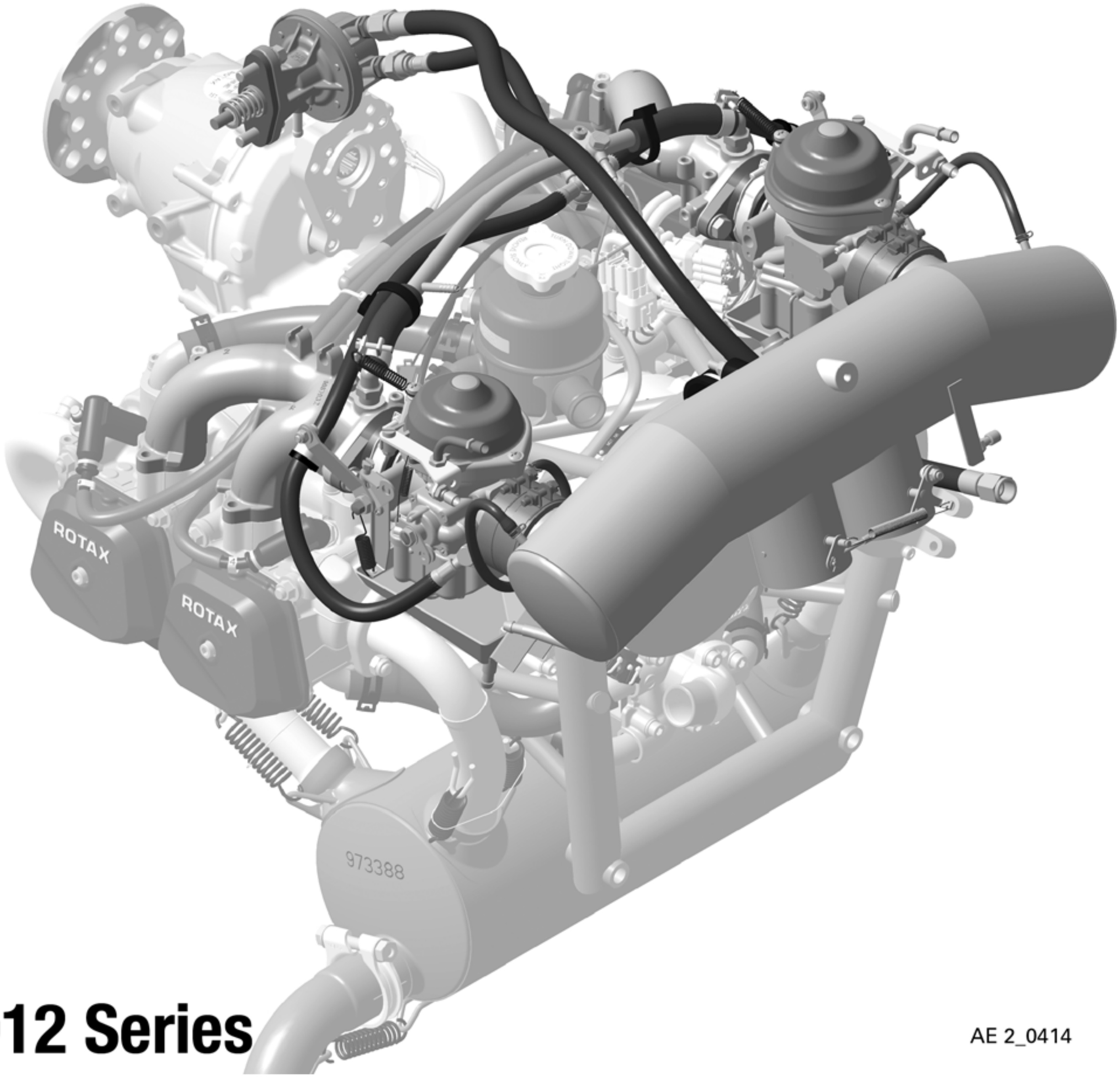
- Install the cylinder head. See Chapter 72-30-00.

NOTE

Before bringing into service, take note of Service Instruction SI-912-018 Purging of lubrication system.

Chapter: 73–00–00
FUEL SYSTEM

TOPICS IN THIS CHAPTER



912 Series

AE 2_0414

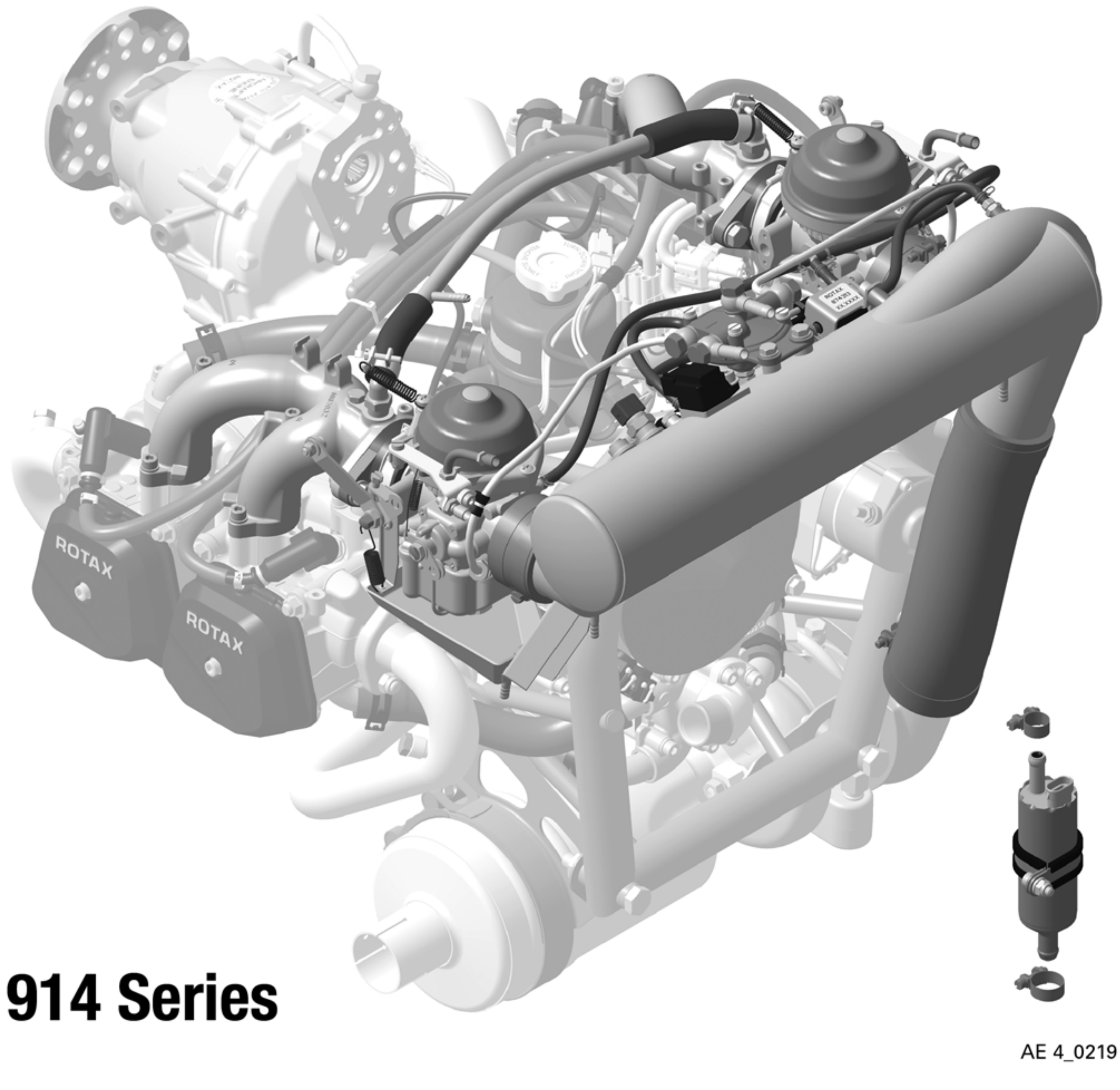


Figure 12.1: Fuel system

SYSTEM DESCRIPTION

912 Series
The fuel passes from the tank with the coarse filter via the fire cock, the water drain cock and the fine filter to the mechanical fuel pump. The latter then pumps the fuel to the two carburetors.
The surplus fuel passes back to the tank or to the suction side of the fuel system via the return line.

NOTE

The return line prevents malfunctions caused by the formation of vapor lock. The return line must be restricted to allow circulation of surplus fuel and air without losing pressure.

914 Series
The fuel flows from the tank via a combination of filter and water trap to the two electric fuel pumps, connected in series, passes on to the fuel pressure regulator and further on to the individual carburetors.
A separate check valve is installed parallel to each fuel pump.

NOTE

The arrangement of the two fuel pumps connected in series yields better reserves against vapor lock at high altitudes and temperatures. The two check valves in the system are necessary to ensure trouble free operation of the fuel system with one pump only.

The surplus fuel passes from the fuel pressure regulator back to the tank via the return line.

NOTE

The fuel pressure regulator serves to maintain the fuel pressure at always approx. 0.25 bar (3.6 psi) above the changing boost pressure in the airbox, thus ensuring proper operation of carburetors.

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.

It is not included in the ROTAX® delivery.

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 fuel) 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

NOTICE

Follow the instructions in the installation manual regarding connections for instrumentation.

AIRBOX AIR TEMPERATURE DISPLAY

only on 914 Series
A connection is provided in the airbox for measurement of the air temperature. On the standard engines, this connection is closed by a plug screw.

BOOST PRESSURE DISPLAY

A connection is provided for an absolute pressure gauge in the compensation tube for the indication of the boost pressure.
If no manifold pressure gauge is installed make sure that the connector is sealed so that no external air can be drawn in.

NOTE

On newer engines the manifold pressure fitting is plugged with a M 3.5 screw. Remove this screw before attaching a manifold pressure hose. See therefor SI-912-020 and SI-914-022 “Running modifications” respectively.

MAINTENANCE

The following sections describe maintenance procedures for engines type 912 / 914 Series. Above and beyond the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type. The description is divided into subsections and descriptions of the function of the various systems.

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Chapter: 73–00–10
CARBURETOR - SINGLE PARTS

TOPICS IN THIS CHAPTER

SPECIAL TOOLS

Description	Part number
Float level gauge assy.	877730

Figure 13.1

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 603	899789
LITHIUM-BASE GREASE	897330

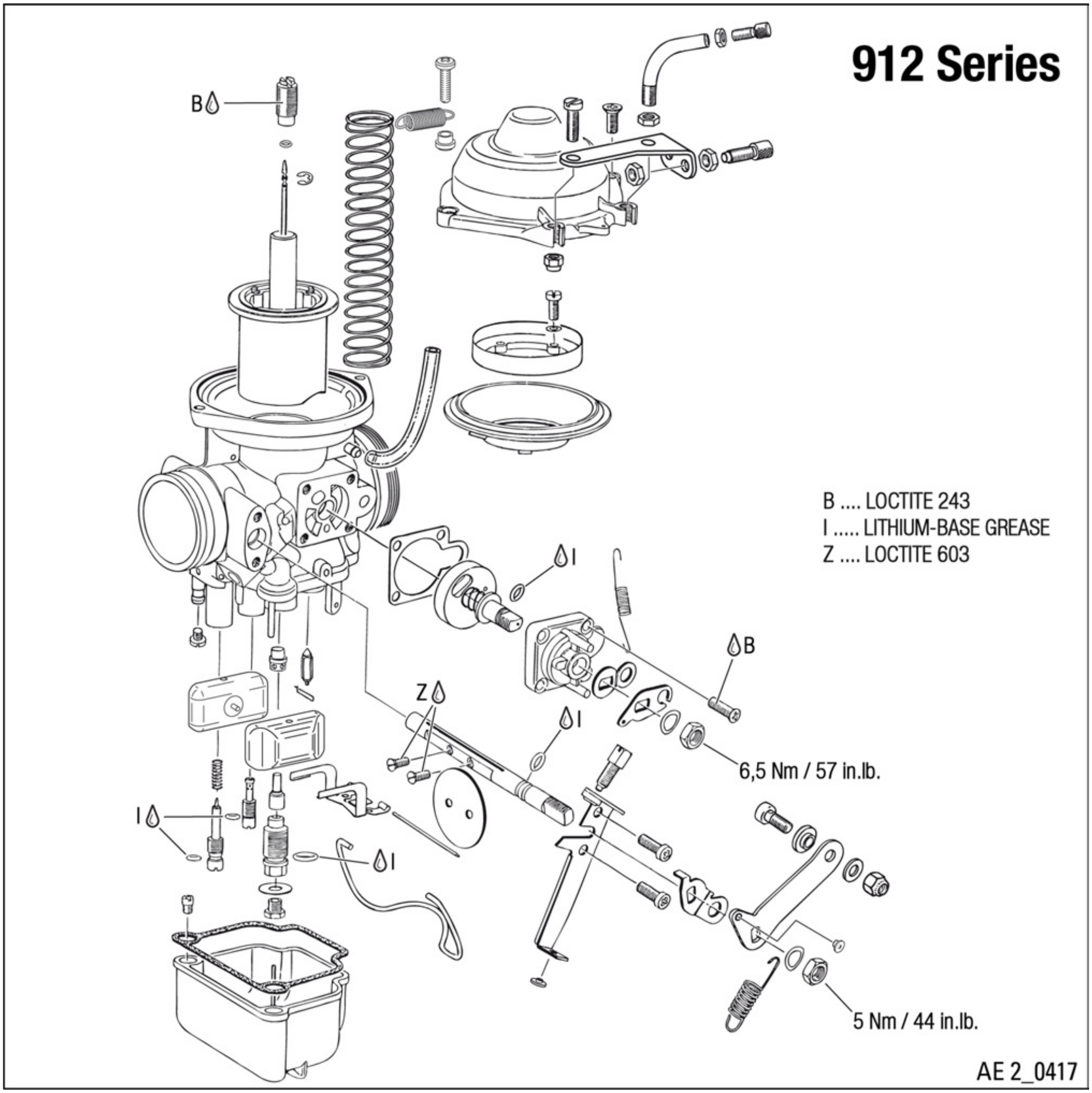
912 Series
B
B
Z
I
I
I
I
B .... LOCTITE 243
I ..... LITHIUM-BASE GREASE
Z .... LOCTITE 603
6,5 Nm / 57 in.lb.
5 Nm / 44 in.lb.
AE 2_0417

Figure 13.2

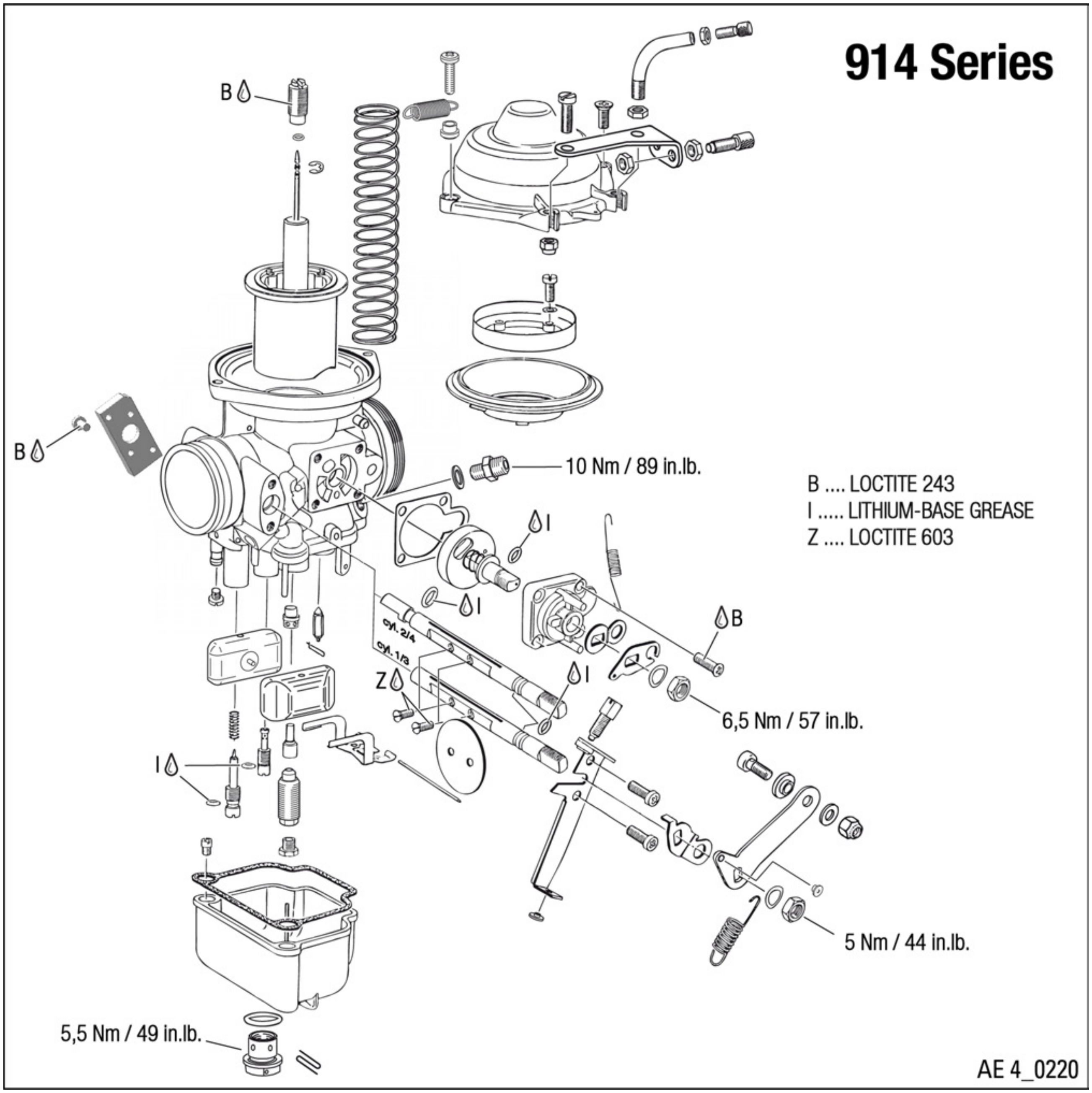
914 Series
B
B
10 Nm / 89 in.lb.
B .... LOCTITE 243
I ..... LITHIUM-BASE GREASE
Z .... LOCTITE 603
I
I
B
cyl. 2/4
cyl. 1/3
Z
I
6,5 Nm / 57 in.lb.
I
5 Nm / 44 in.lb.
5,5 Nm / 49 in.lb.
AE 4_0220

Figure 13.3

CARBURETOR - SYSTEM DESCRIPTION

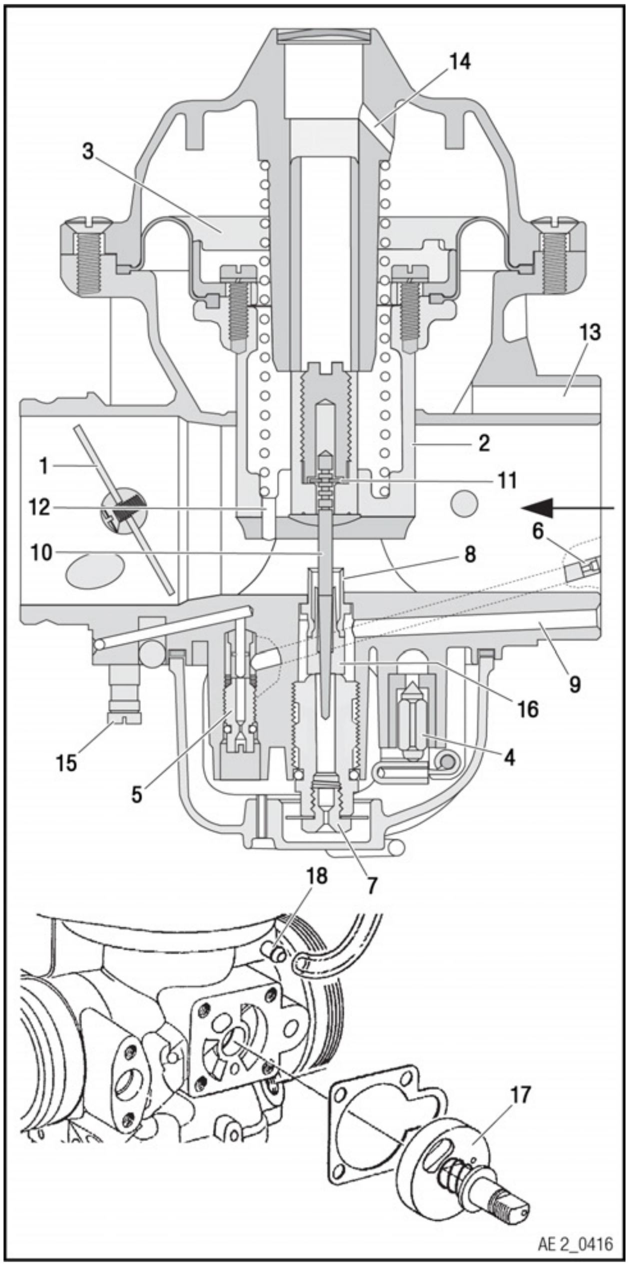

Figure 13.4: Carburetor overview

1	*Throttle valve*	2	*Carburetor piston*
3	*Rubber diaphragm*	4	*Needle valve*
5	*Idle jet*	6	*Idling air jet*
7	*Main jet*	8	*Diffuser tube*
9	*Air duct*	10	*Jet needle*
11	*Retaining clip*	12	*Bore (top side)*
13	*Channel*	14	*Bore (bottom side)*
15	*Slotted head screw*	16	*Outlet of the needle jet*
17	*Rotary disc valve starting carburetor*	18	*Venting nipple*

Structure and function

The BING constant depression carburetor type 64-3 is a cross-draft butterfly valve carburetor with variable venturi, double float system arranged centrally below the venturi, and a rotary disc valve type starting carburetor. Its particular feature is the carburetor piston, which is suspended on a rubber diaphragm and protrudes into the venturi. It adjusts the smallest cross-section (“air funnel”) of the venturi depending on the vacuum is influenced by actuation of the throttle valve and the carburetor piston moves accordingly. The throttle valve diameter is 36 mm (1.42 in). When the fuel has reached the specified level in the float chamber, the floats close the needle valve via the float bracket, thus preventing any further supply of fuel.

NOTE

The atmospheric pressure in the float chamber is decisive for the function of the carburetor and must correspond with the air pressure at entry into the carburetor. Too high pressure enriches the mixture, too low pressure leans down the mixture, possibly leading to engine stop.

The float chamber airspace is connected by a channel with the venting nipple. The channel must be clear. With a hose connected on the venting nipple, the correct pressure in the float chamber is established.
The amount of mixture drawn in by the engine and thus its performance are determined by the cross-sectional area in the venturi, which is opened by the throttle valve. If the throttle valve is opened while the engine is running, the increased airflow in the venturi results in a vacuum building up at the outlet of the needle jet, which draws fuel from the float chamber through the jet system.

The vacuum in the venturi acts on the top side of the diaphragm via the bore in the carburetor piston and attempts to lift the piston against its own weight and the spring. The reference pressure prevailing between air filter and carburetor (e.g. ambient air pressure) is applied to the bottom side of the diaphragm via bore. The bore diameter determines the piston damping.

On its way from the chamber to the venturi, the fuel passes through the main jet, the mixing tube and the needle jet and in the diffuser tube is pre-mixed with air which is brought in from the air filter via the air duct and the atomizer in an annular flow around the needle jet. This air flow assists the atomizing process and favors fuel distribution in the manifold.

The jet needle, which is responsible for part load, is kept in the defined position by the retaining clip.

During idling and low-load operation of the engine, the throttle valve is closed to such an extent that the airflow underneath the carburetor piston no longer forms a sufficient vacuum. The supply of fuel to the intake air is then effected via the idling system, which consists of the idle jet and the idling air jet.

As an aid for starting a cold engine, the BING constant depression carburetor is provided with a rotary disc valve starting carburetor using a Bowden cable.

⚠ WARNING

With the throttle lever not connected, the carburetor will remain in full throttle position. For this reason, never start the engine without first connecting the throttle lever.

Carb heat system and winter operation

The risk of carburetor icing are commonly known. The icing of air humidity in the carburetor may be avoided by preheating the air.

⚠ WARNING

Carburetor icing is a common cause of engine faults. Because of the heating up of intake air due to the boost process (914 Series only), preheating of the intake air might not be necessary. But the option of an alternate air intake from the engine compartment is recommended as, for instance, the filter could be blocked by icing. Preheating of the intake air will result in loss of engine performance because of the reduction in air density.

NOTE

An airbox with a carburetor preheating flap is available for engines of the 912 Series. Engines of the 914 Series normally do not require any preheating device as the intake air is preheated by the turbocharger.

A further measure to reduce the risk of carburetor icing is to keep the water content of the fuel low by proper handling. Also, install a generously dimensioned water trap in the fuel system of the aircraft to prevent the formation of ice in the fuel lines, filters etc.

CARBURETOR - DISASSEMBLY

NOTE

Before the carburetor can be dismantled, carry out the float needle valve leakage test.
See Chapter 73-00-10 Section Carburetor inspection

Preparation
For removal of the carburetor see Chapter 73-10-00.

- The fuel supply must be closed off before the carburetors are removed for closer inspection.

ENVIRONMENTAL NOTE
Observe the safety instructions of the manufacturer of hazardous substances (coolant, oil or fuel) and the applicable regional waste disposal regulations.

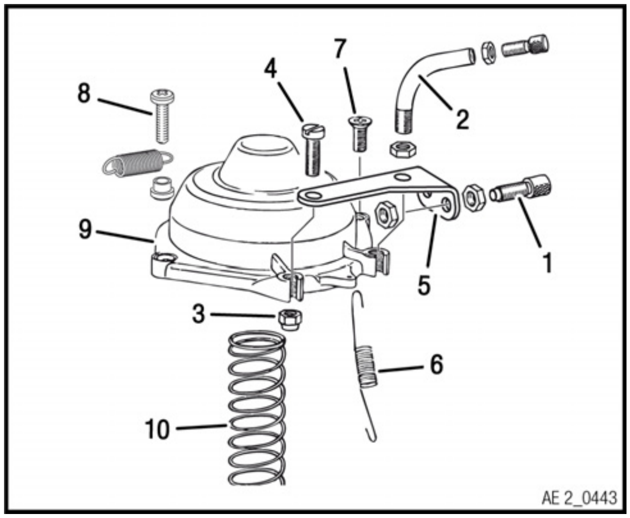

Figure 13.5

1	*Adjustment screw*	*2*	*Bent tube*
3	*Lock nut*	*4*	*Slotted head screw*
5	*Support*	*6*	*Return spring*
7	*Countersunk screw*	*8*	*Oval head screw*
9	*Chamber top*	*10*	*Throttle valve spring*

REMOVE CARBURETOR SUPPORT

Step	Procedure
1	Remove adjustment screw with two hex. nuts.
2	Loosen hex. nut and remove with bent tube.
3	Loosen lock nut and slotted head screw, then remove the support.

REMOVE DIAPHRAGM

Step	Procedure
1	Remove return spring (choke).
2	Remove the counter sunk screw, oval head screw with spring and distance sleeve.
3	Take off the chamber top.
4	Remove the throttle valve spring.
5	Pull carburetor piston with diaphragm out of the carburetor housing.
6	Remove the 4 combined screws.
7	Remove the retaining ring with the diaphragm.

REMOVE JET NEEDLE

Step	Procedure
1	Unscrew the fixation screw.
2	Remove jet needle with circlip and O-ring.

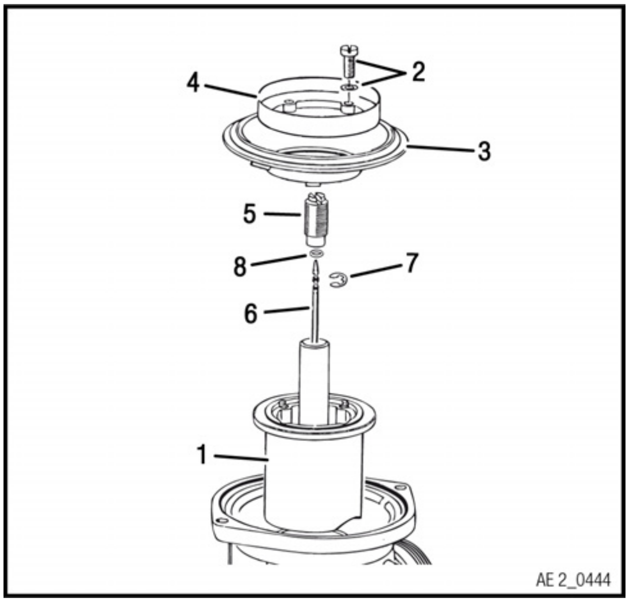

Figure 13.6

1	*Carburetor piston*	2	*Combined screw*
3	*Diaphragm*	4	*Retaining ring*
5	*Fixation screw*	6	*Jet needle*
7	*Circlip*	8	*O-ring*

REMOVE FLOAT CHAMBER AND FLOATS

Step	Procedure
1	On 912 Series: Release the spring clip. On 914 Series: Remove the safety wiring and the attachment screw with the O-ring.
2	Remove the float chamber with gasket and floats.
3	If necessary, remove start jet.

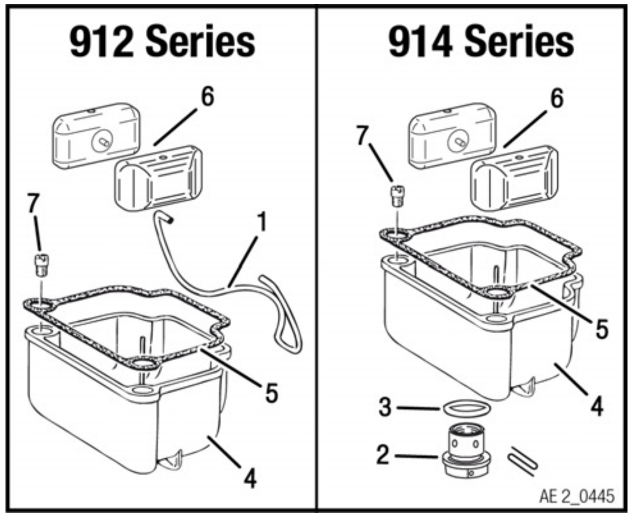

Figure 13.7

1	*Spring clip*	2	*Attachment screw*
3	*O-ring*	4	*Float chamber*
5	*Gasket*	6	*Floats*
7	*Jet*		

REMOVE CARBURETOR JETS AND VALVES

Step	Procedure
1	Remove the idle mixture screw with O-ring and spring. **NOTE** *Before removing the idle mixture screw, screw it in as far as it will go and write down the number of turns. This is required for correct installation.*
2	Remove the idle jet with O-ring.
3	Remove the main jet with shim. (Shim on 912 Series only)
4	Remove mixing tube with O-ring, needle jet and diffuser. (O-ring on 912 Series only)

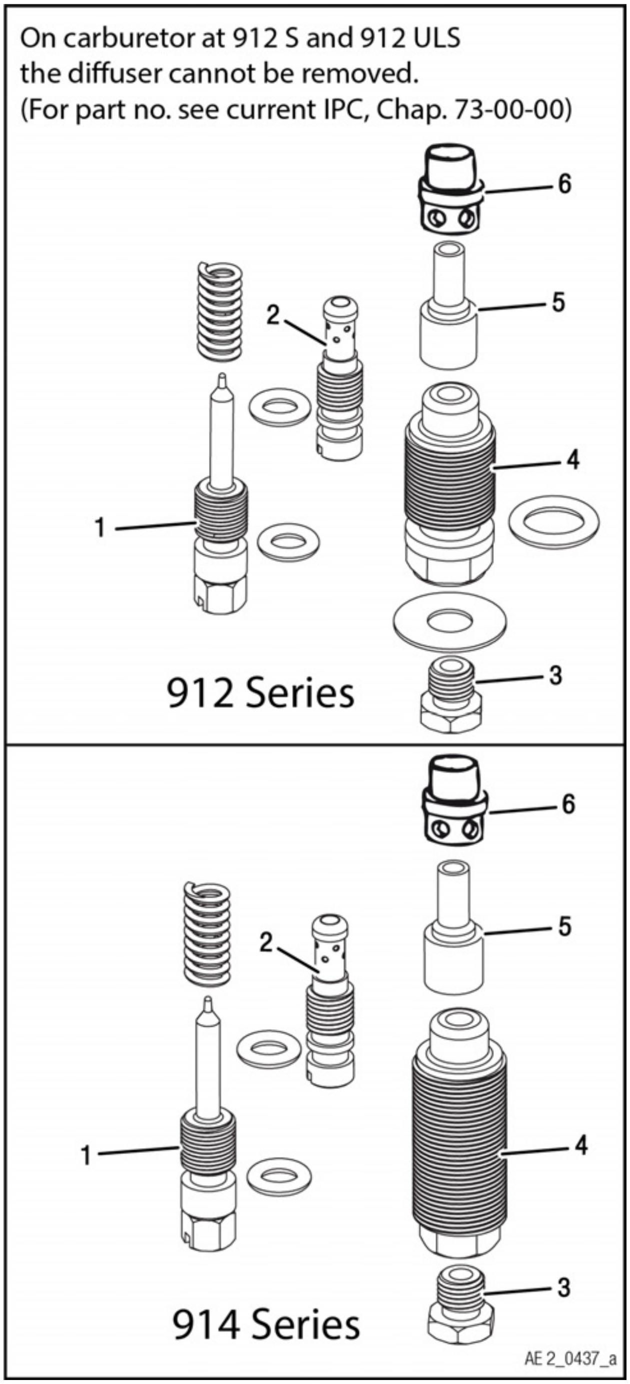

Figure 13.8

1	*Idle mixture screw*	2	*Idle jet*
3	*Main jet*	4	*Mixing tube*
5	*Needle jet*	6	*Diffuser*

NOTICE

Possible damage of carburetor housing.
Pin must be removed in direction of the serrated end.

Step	Procedure
5	Remove the pin of the float bracket.
6	Pull out the float needle valve with clip.

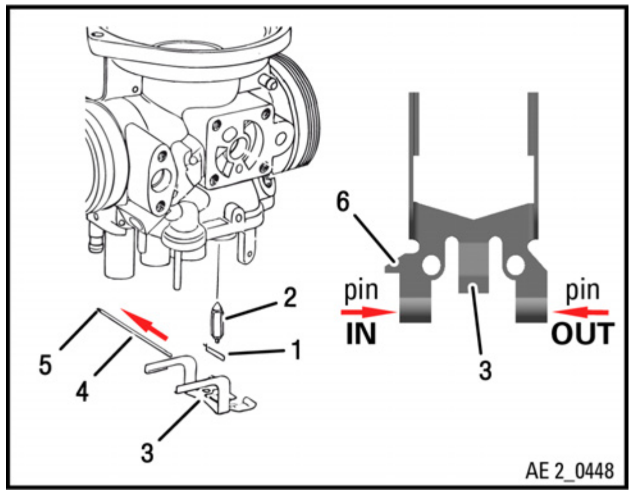

Figure 13.9

1	*Float needle clip*	2	*Float needle valve*
3	*Float bracket*	4	*Pin*
5	*Serrated end*	6	*Tab*

REMOVE STARTING CARBURETOR (CHOKE)

Preparation

- remove return spring

Step	Procedure
1	Remove 4 counter sunk screws.
2	Remove the complete choke housing with gasket.

3	Loosen hex nut, than remove spring washer, choke lever (outside and inside).
4	Pull the complete choke valve assy. from the choke housing.

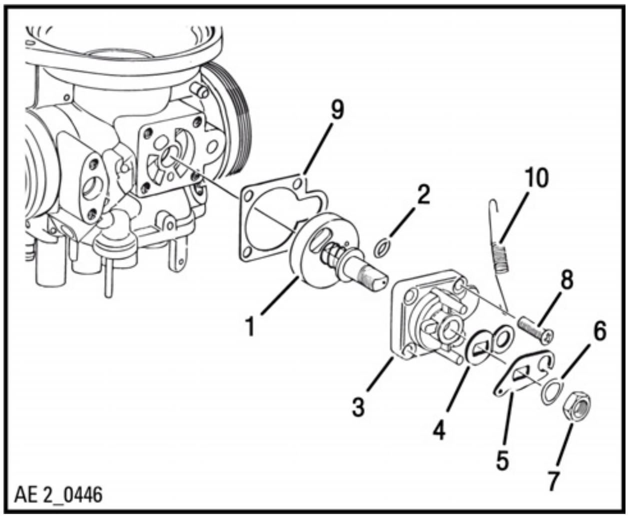

Figure 13.10

1	*Choke valve assy.*	2	*O-ring*
3	*Choke housing*	4	*Choke lever inside*
5	*Choke lever outside*	6	*Spring washer*
7	*Hex. nut*	8	*Slotted head screw*
9	*Gasket*	10	*Return spring*

REMOVE TPS ADAPTOR (914 SERIES ONLY)

Preparation

- Remove throttle position sensor see Chapter 76-70-00 Sensors and actuators

Step	Procedure
1	Remove slotted head screw with adaptor.

REMOVE THROTTLE SHAFT

Step	Procedure
1	Remove return spring with both sleeves.
2	If necessary, loosen lock nut and remove with washer, graduated sleeve and Allen screw from throttle lever.
3	Loosen hex. nut and remove with spring washer, throttle lever and stop lever.
4	Loosen both oval head screws with cable support and throttle lever stop screw.
5	Loosen both slotted head screws and remove with throttle valve. **NOTE** *Mark throttle valve position to make sure that it will be reinstalled in the same position.*
6	(914 Series only) On carburetor cyl.2/4 remove O-ring on throttle shaft on the side of the throttle position sensor (TPS).
7	Push out valve shaft with O-ring.

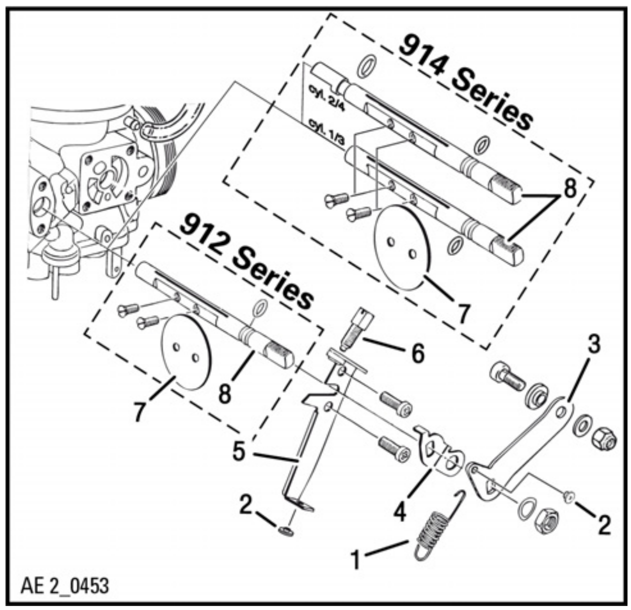

Figure 13.11

1	*Return spring*	2	*Sleeve*
3	*Throttle lever*	4	*Stop lever*

5	*Cable support*	*6*	*Throttle valve stop screw*
7	*Throttle valve*	*8*	*Throttle shaft*

CARBURETOR - INSPECTION

General note

NOTICE

The determination of the main jet is carried out by the manufacturer on at test bed at 300 m (1000 ft.) above mean sea level. Only aeronautical personnel or authorized testers acting on our instructions may carry out modifications to BRP-Rotax® specifications. Values must be recorded in the engine logbook.

CHECK NEEDLE VALVE

Needle valve leakage test

NOTE

This check is carried out to ensure that the float valve seat is not leaking.

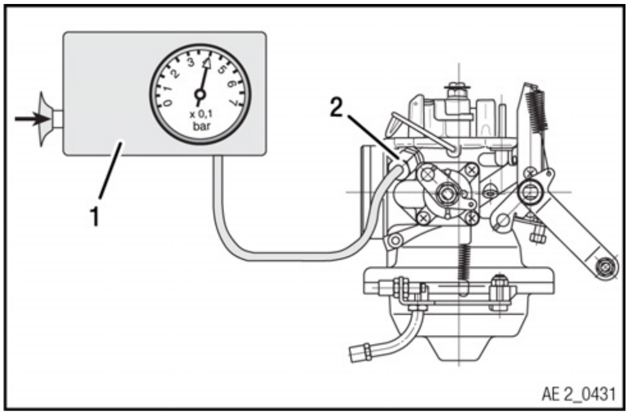

Figure 13.12: Test arrangement

1 *Connection pump* 2 *Fuel supply line*

Step	Procedure
1	Turn the carburetor upside down, as the float needle valve is only closed in this position.
2	Connect air pump to the fuel supply line and apply approx. 0.4 bar (5.8 psi) of pressure.
3	The pressure must be maintained for about 5 seconds.

NOTE

Pressure drop can be caused by debris inside the valve seat. Clean with pressurized air and repeat the test.

NOTE

If pressure drops, this indicates leakage which may cause fuel overflow and in consequence engine damage due to hydraulic shock. Replacement of the float valve seat is not permissible.

FLOAT NEEDLE VALVE - VISUAL CHECK

Step	Procedure
1	Check fuel inlet for free passage.
2	Inspect the viton tip. Inspect clip end for visible wear to the beaded edge of the sprung pin, the valve must be replaced.
3	If the distance becomes less than 0.5 mm (0.02 in), the float level will be affected, leading even to interruption of the fuel flow.

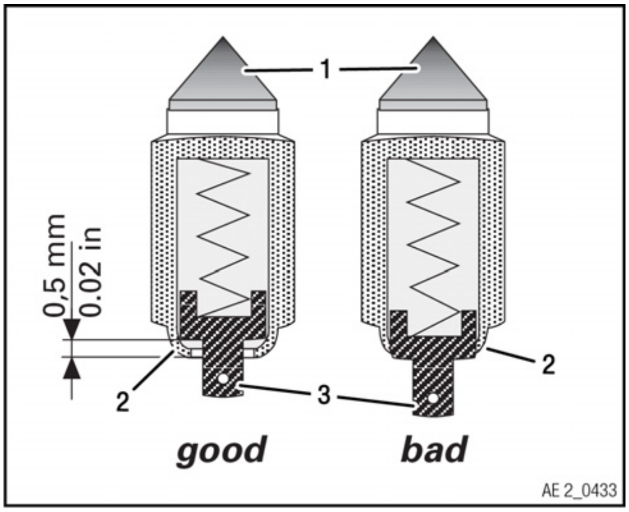

Figure 13.13: Viton tip

1 *Viton tip* 2 *Beaded edge*

3 *Sprung pin*

CHECK DIAPHRAGM OF CARBURETOR

Step	Procedure
1	Check that the cover plate on the chamber top is tightly seated.
2	Wash chamber top with cleaning agent and blowclean the inside venting bore with compressed air. Then carry out a visual inspection.
3	Check diaphragm for cracks or brittleness, replace if necessary.
4	Carry out a visual inspection of the outer diameter of the carburetor piston and the two inside compensation bores.

CHECK NEEDLE OF CARBURETOR

Step	Procedure
1	Check needle with shaft securing and O-ring for signs of wear.
2	Pay attention to the grooves and the taper of the needle. If there is visible wear, the needle must be replaced in the same position. The needle jet must be replaced along with the needle.

CHECK FLOAT CHAMBER AND FLOATS OF CARBURETOR

NOTICE

A stuck float causes the carburetor to flood.

Step	Procedure
1	Check both floats for free movement on the guide pin. When the float is at its lowest position, it still must have radial clearance and must not stick on the float chamber wall.
2	Check the wear on the guide sleeves inserted in the float.
3	Check the pins for the float support for wear caused by excessive vibration.
4	If there is noticeable wear, replace both floats and if necessary also the float brackets.

CHECK FLOAT BRACKETS OF CARBURETOR

Step	Procedure
1	Remove main jet.
2	Attach the float level gauge assy. part no. 877730 to the mixing tube with a hex. screw.
3	Check that the float suspension brackets are parallel.
4	When the needle valve is closed, the two arms of the float brackets must be evenly spaced. Spacing on the 912 Series: 0.4 to 0.5 mm (0.016 to 0.020 in) Spacing on the 914 Series: 5.4 to 5.5 mm (0.21 to 0.22 in)
5	If there is noticeable fault, the float bracket can be bent for correction or be replaced.

NOTE

Always replace float brackets together with the float needle valve.

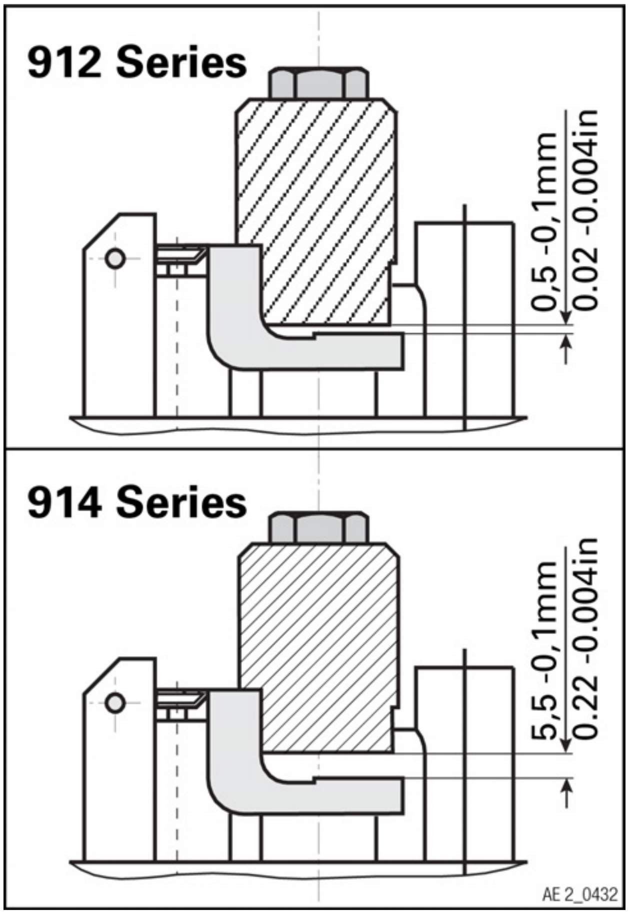

Figure 13.14: Spacing

Step	Procedure
6	Remove the float level gauge assy. part no. 877730
7	Refit the main jet.

CHECK CARBURETOR JETS

Step	Procedure
1	Clean carburetor and jets with gasoline.
2	Carefully blow through all jet channels in the carburetor housing with compressed air and check for free passage.
3	Check oval form of inner diameter of needle jet, replace if necessary.
4	Check for correct jetting, see current Illustrated Parts Catalog (IPC).

⚠ WARNING

Any adjustments to the main and idle jets may only be performed in accordance with ROTAX® instructions, by an aviation facility or an authorized tester.

NOTE

If rough engine running at idle speed occurs and the spark plug is sooted, change the idle jet from LD35 to LD30. All changes must be recorded in the engine logbook.

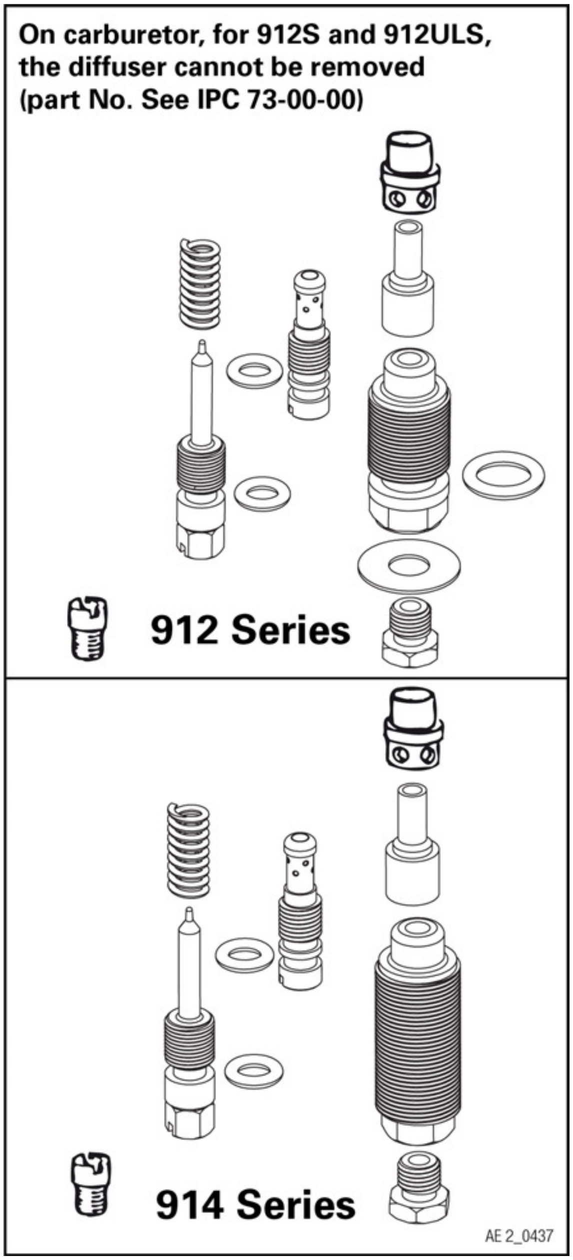

Figure 13.15

CHECK STARTING CARBURETOR (CHOKE)

Step	Procedure
1	Clean all parts and check.

NOTE

The choke shaft is marked with a dot. This mark must point towards the cable engagement or to hole.

Step	Procedure
2	Clean all parts and blow out all bores and ducts with compressed air.
3	Check all parts and replace any defective ones.

SI-03–1998 “Engine start at low temperatures”, latest issue can be carried out to improve cold starting performance.

CARBURETOR - ASSEMBLY

Carburetor calibration
Factory-setting of carburetor jetting and jet needle position. The jet needle position depends on the emission and specific fuel consumption. All other settings must be recorded in the engine logbook.

CARBURETOR CALIBRATION		
912 A/F/UL	**Target**	
	Carburetor 1/3	Carburetor 2/4
Needle jet	2.72	2.72
Idle jet	35	35
Main jet[4)]	155 or 158	155 or 158
Start jet[1)]	85	85
Needle position[3)]	3	3
912 S/ULS/ ULSFR	**Target**	
	Carburetor 1/3	Carburetor 2/4
Needle jet	2.70	2.70
Idle jet	35	35
Main jet	155	155
Start jet [1)]	85	85
Needle position [3)]	3	3
914 F/UL	**Target**	
	Carburetor 1/3	Carburetor 2/4
Needle jet	2.72	2.72
Idle jet	35	35
Main jet [2)]	156 or 160	158 or 164
Start jet [1)]	85	85
Needle position [3)]	1 or 2	2

- [1)] See current SI-03-1998
- [2)] Depending on the airbox version, see current SI-914-013 and SI-914-015
- [3)] Depending on CO measurement value and specific fuel consumption, see current SI-914-013 and SI-914-015
- [4)] On configuration with air filter, see current SB-912-044

NOTE

The carburetor is assembled with new O-rings and gaskets.

INSERT THROTTLE SHAFT

NOTE

Lubricate all O-rings with lithium-base grease.

NOTE

(914 Series only) *There are two different lengths of throttle valve shafts. The longer shaft has to be installed on carburetor cyl. 2/4 and has two O-rings. If this shafts gets mixed up the throttle position sensor (TPS) will not function.*

Step	Procedure
1	Push in new throttle shaft with new O-ring 6x1.9.
2	(914 Series only) On carburetor cyl. 2/4 install second new O-ring 6x1.9 on throttle shaft on the side of the throttle position sensor (TPS)

NOTE

Do not mix up cable support, stop lever and throttle lever from each carburetor.

NOTE

If a new throttle valve must be installed, the marking (dot or number) must point upwards.

Step	Procedure
3	Install cable support with throttle valve stop screw and fix with two oval head screws M4x10.
4	Install throttle valve with 2 new slotted head screws M3x6 secured with

	LOCTITE 603, ensure that it is reinstalled in the same position as marked at removal.
5	Install stop lever and throttle lever with hex. nut M8x1 and spring washer 8.3/13.6/0.4. Tightening torque 5 Nm (44 in. lb.).
6	If necessary, install graduated sleeve with Allen screw M5x12, washer A 5.5 and lock nut M5.
7	Install sleeve with inner diameter 2 mm into throttle lever and sleeve with inner diameter 3 mm into cable support.
8	Install return spring.

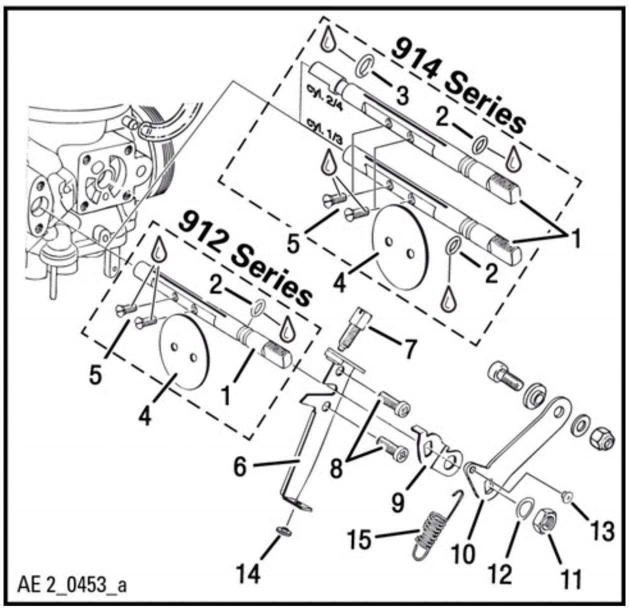

Figure 13.16

1	*Throttle shaft*	2	*O-ring 6x1.9*
3	*O-ring 6x1.9 (914 Series only)*	4	*Throttle valve*
5	*Slotted head screw M3x6*	6	*Cable support*
7	*Throttle valve stop screw*	8	*Oval head screw M4x10*
9	*Stop lever*	10	*Throttle valve lever*
11	*Hex. nut M8x1*	12	*Spring washer 8.3/13.6/0.4*
13	*Sleeve inner dia. 2 mm*	14	*Sleeve inner dia. 3 mm*
15	*Return spring*		

INSERT STARTING CARBURETOR (CHOKE)

NOTE

The shafts for the choke valve assy. have two markings, L and R. The shaft marked R is for the carburetor of cylinder 2/4 and the shaft marked L for the carburetor of cylinder 1/3.

NOTE

The choke shaft is marked with a dot. This mark must point towards the cable engagement hole.

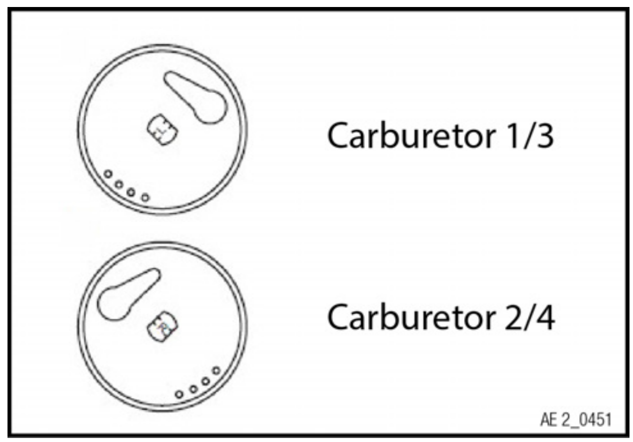

Figure 13.17

Step	Procedure
1	Insert the complete choke valve assy. into the housing with new O-ring 5x1.5, lubricated with lithium-base grease.
2	Install choke lever inside with choke lever outside and spring washer 8.3/13.6/0.4. Now tighten hex. nut M8x1 with 5 Nm (44 in. lb).

3	Install choke housing assy. using a new gasket and 4 slotted head screws M4x14 with LOCTITE 243.
4	Install return spring, if possible.

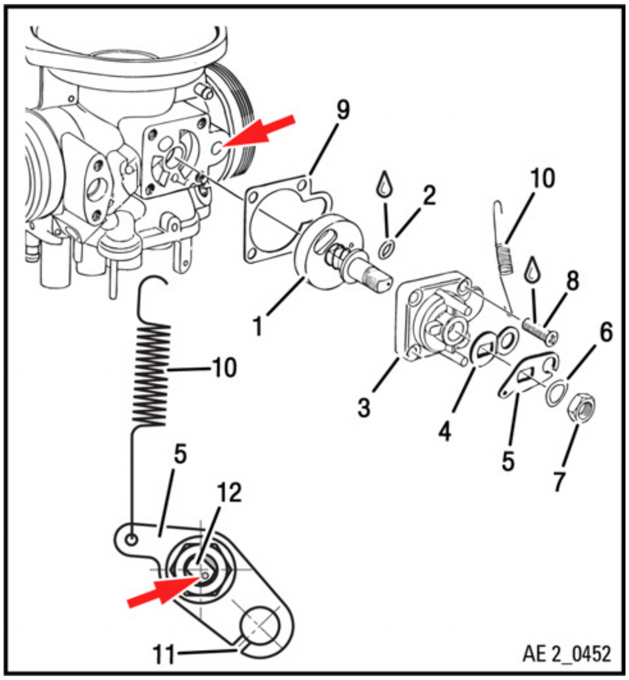

Figure 13.18

1	*Choke valve assy.*	2	*O-ring 5x1.5*
3	*Choke housing*	4	*Choke lever inside*
5	*Choke lever outside*	6	*Spring washer 8.3/ 13.6/0.4*
7	*Hex. nut M8x1*	8	*Slotted head screw M4x14*
9	*Gasket*	10	*Return spring*
11	*Cable engagement*	12	*Choke shaft*

INSERT FLOAT NEEDLE VALVE

In addition to this information, also observe the Service Bulletins SB-912-048 and SB-914-033, "Replacement of pin in carburetor", latest issue.

Step	Procedure
1	Install float needle clip into bore of float needle valve.
2	Engage float needle clip with float needle valve onto the float bracket.
3	Insert the float needle valve into the valve seat and place the float bracket into position. Now fix float bracket with the pin.

NOTICE

Possible damage of carburetor housing.
The pin must be installed in correct direction: First install the side without serrated end.

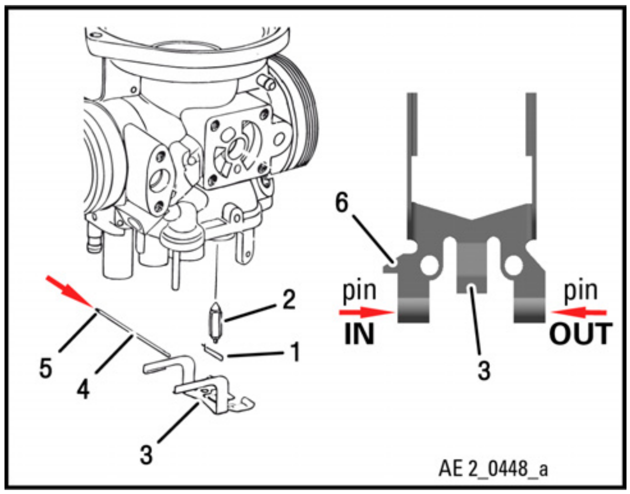

Figure 13.19

1	*Float needle clip*	2	*Float needle valve*
3	*Float bracket*	4	*Pin*
5	*Serrated end*	6	*Tab*

INSERT CARBURETOR JETS

NOTE

Jet settings and calibration, see section carburetor calibration.

NOTE

Lubricate all O-rings with lithium-base grease.

Step	Procedure
1	Install a new O-ring 3.2x1.8 onto idle mixture screw and idle jet with a suitable tool.
2	Turn the idle mixture with O-ring and compression spring as far as it will go then turn it back out to the exact value noted by disassembly.
3	Install the idle jet with O-ring.
4	Install the diffuser.
5	(912 Series only) Install a new O-ring 8x2 onto mixing tube with a suitable tool.
6	Install mixing tube with O-ring and needle jet. (O-ring on 912 Series only).
7	Install the main jet with shim. (Shim on 912 Series only)

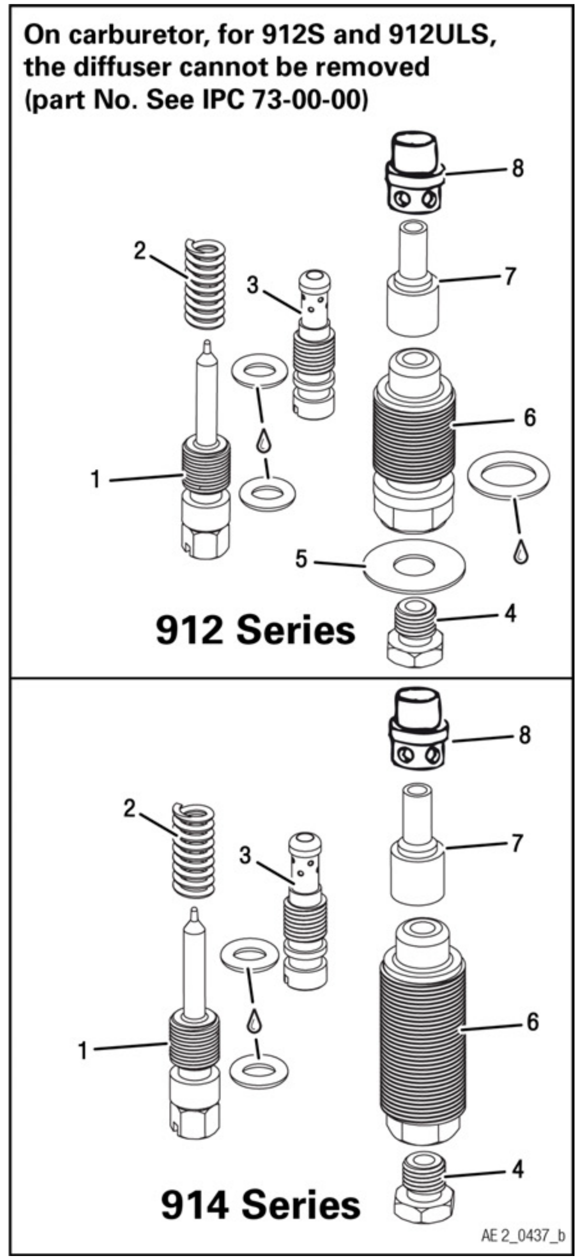

Figure 13.20: Carburetor jets

1	*Idle mixture screw*	2	*Compression spring*
3	*Idle jet*	4	*Main jet*
5	*Shim*	6	*Mixing tube*
7	*Needle jet*	8	*Diffuser*

INSERT JET NEEDLE

NOTE

For jet needle setting, see section carburetor calibration.

Step	Procedure
1	Insert jet needle with circlip and new O-ring 2.5x1.5 into the carburetor piston.
2	Install fixation screw with LOCTITE 243.

NOTE

The installed needle must move freely.

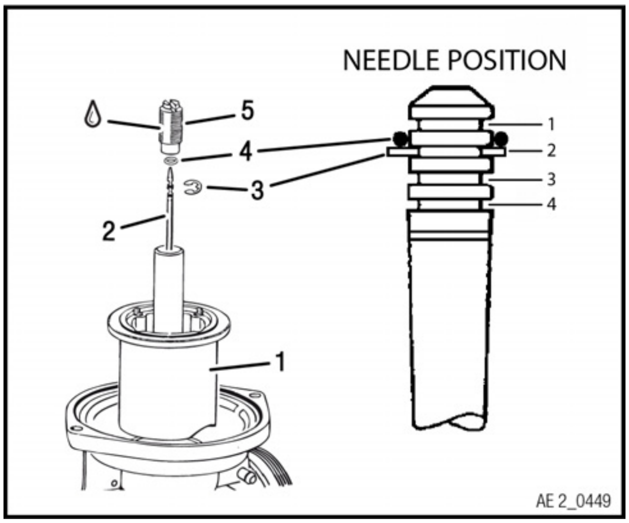

Figure 13.21

1	*Carburetor piston*	2	*Jet needle*
3	*Circlip*	4	*O-ring 2.5x1.5*
5	*Fixation screw*		

INSERT DIAPHRAGM

Step	Procedure
1	Install diaphragm with retaining ring onto the carburetor piston with four combined screws M4x12. **NOTE** *The index tabs on the diaphragm must fit into the indentation of the carburetor piston.*
2	Install the carburetor piston assy. into the carburetor housing. **NOTE** *The position is determined via the index tabs of the diaphragm.*

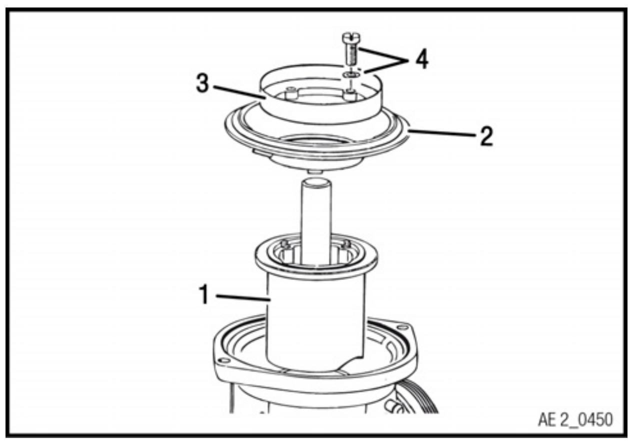

Figure 13.22

1	*Carburetor piston*	2	*Diaphragm*
3	*Retaining ring*	4	*Combined screw M4x12*

NOTICE

While installing the chamber top be careful not to turn the carburetor piston assy. out of position.

Step	Procedure
3	Install the throttle valve spring into the carburetor piston.
4	Fix the chamber top with counter sunk screw M5x12 and oval head screw M5x20 with distance sleeve and spring. **NOTE** *The oval head screw M5x20 with distance sleeve and spring has to be installed on the throttle valve side.* **NOTE** *Visually verify that the carburetor piston is oriented correctly in the throat of the venturi.*
5	Install the return spring.

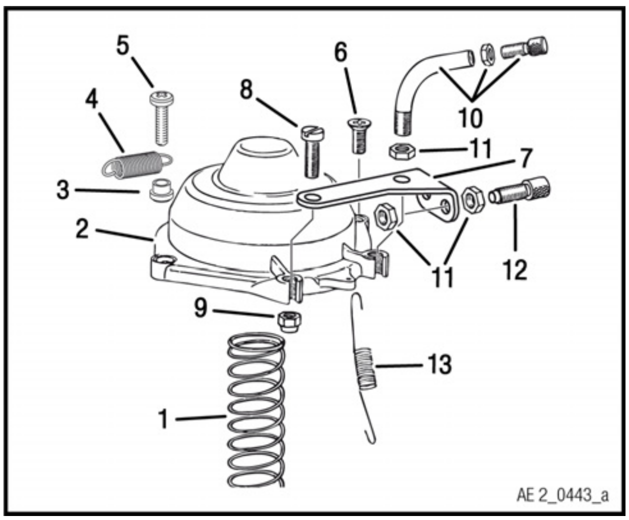

Figure 13.23

1	*Throttle valve spring*	2	*Chamber top*
3	*Distance sleeve*	4	*Spring*
5	*Oval head screw M5x20*	6	*Countersunk screw M5x12*
7	*Support*	8	*Slotted head screw M5x16*
9	*Lock nut M5*	10	*Bent tube assy.*
11	*Hex. nut M6x0.75*	12	*Adjustment screw M6x0.75*
13	*Return spring*		

INSTALL SUPPORT PLATE

Step	Procedure
1	Install the support plate with slotted head screw M5x16.
2	Install hex nut M6x0.75 on bent tube assy.
3	Install bent tube assy. with support plate on carburetor housing and fix with hex nut M6x0.75.
4	Fix slotted head screw M5x16 with new lock nut M5.
5	Install adjustment screw M6x0.75 with 2 hex. nuts M6x0.75.

INSTALL TPS ADAPTOR (914 SERIES ONLY)

NOTE

When assembling the adapter flange, ensure that it is the appropriate model for the respective throttle potentiometer and that it is installed in the correct position (with the cut off edge upwards).

Step	Procedure
1	Install TPS-adaptor using slotted head screws M4x7 with LOCTITE 243 (on carburetor 2/4 only).
2	Install throttle position sensor (TPS) see Chapter 76-70-00 Sensors and actuators.

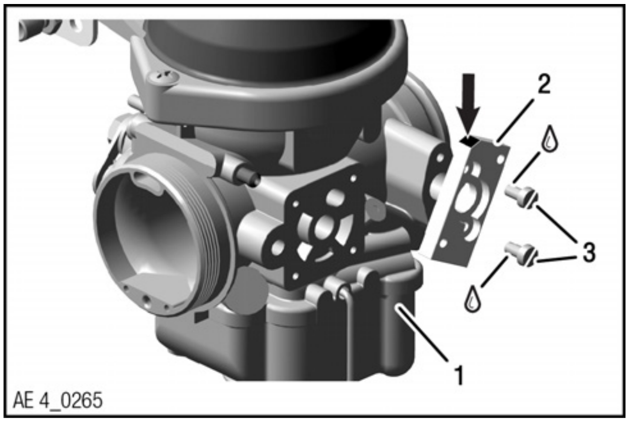

Figure 13.24

1	*Carburetor 2/4*	2	*TPS-adaptor*
3	*Slotted head screws M4x7*		

INSERT FLOAT CHAMBER AND FLOATS

NOTE

Before installing the carburetor onto the engine, carry out the float needle valve leakage test.

NOTE

For start jet setting see section carburetor calibration.

⚠ WARNING

Possible engine stoppage or failure.
A stuck float causes the carburetor to flood.

Step	Procedure
1	If necessary, install start jet.
2	Install floats into float chamber and check if they can move freely.
3	Install float chamber with new gasket onto carburetor housing. **NOTE** *Ensure that the gasket is seated in the groove and not pinched between the float chamber and carburetor housing*
4	On 912 Series: Fix the float chamber with the spring clip. On 914 Series: Fix float chamber with the attachment screw and O-ring 15.6x1.78. Tightening torque 5.5 Nm (49 in. lb). Secure with safety wiring.

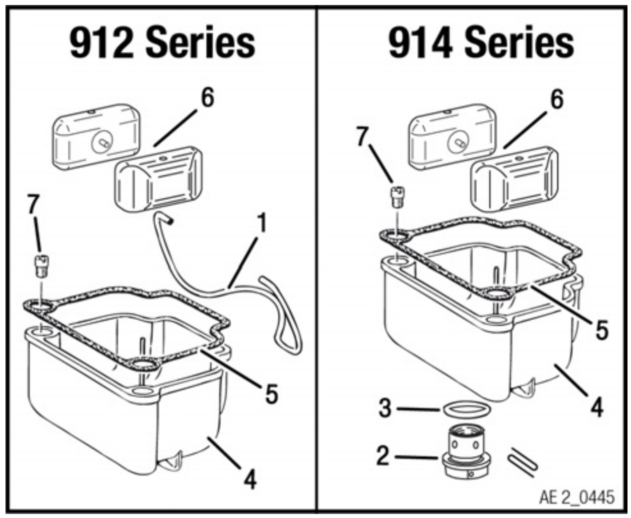

Figure 13.25

1	*Spring clip*	2	*Attachment screw*
3	*O-ring*	4	*Float chamber*
5	*Gasket*	6	*Floats*
7	*Jet*		

Chapter: 73–10–00
FUEL SYSTEM AND DISTRIBUTION

TOPICS IN THIS CHAPTER

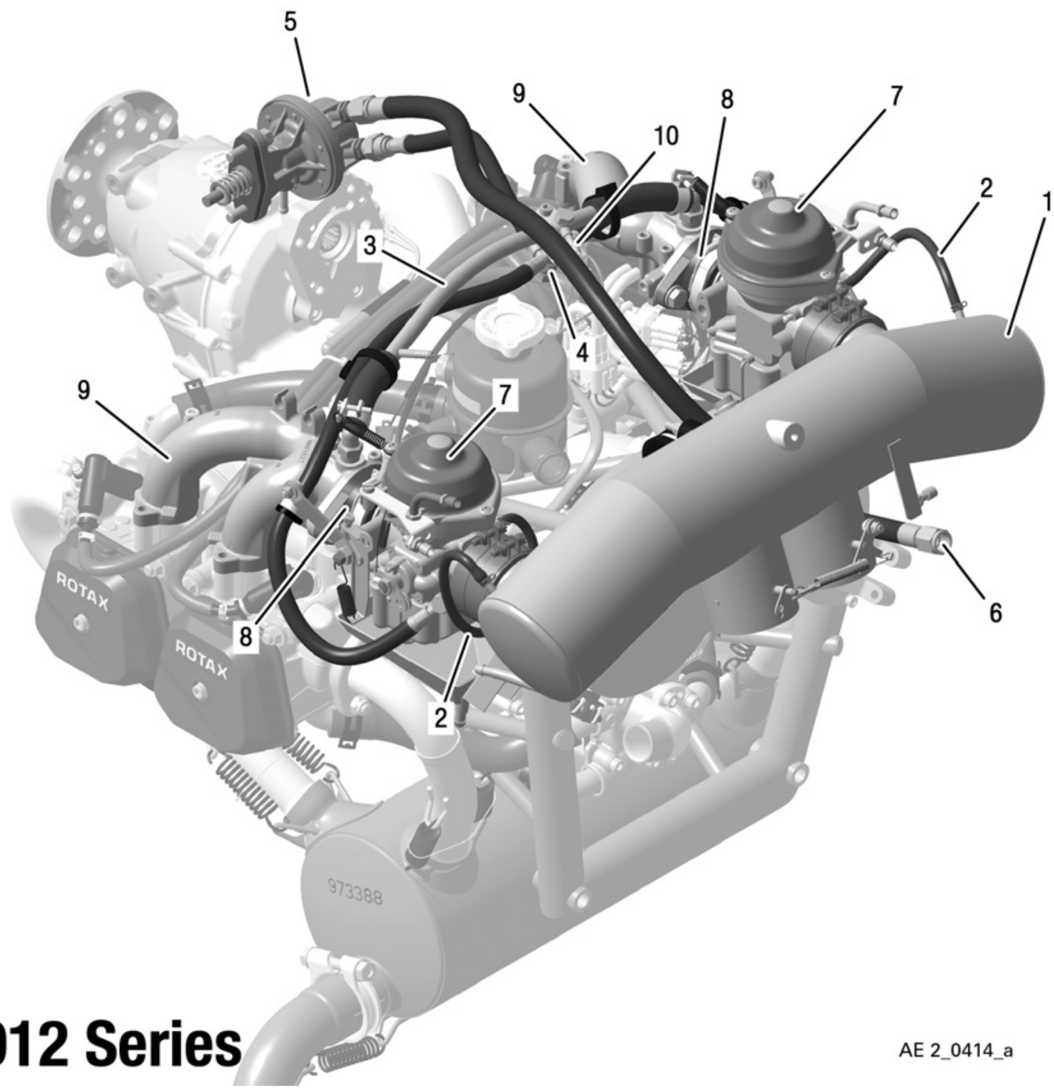

Figure 14.1: Fuel distribution

1	*Airbox.*	2	*Vent hose*
3	*Compensating tube*	4	*Fuel distribution block*
5	*Mechanical fuel pump*	6	*Fuel inlet hose*
7	*Carburetor*	8	*Rubber flange*
9	*Intake manifold*	10	*Fuel return line*

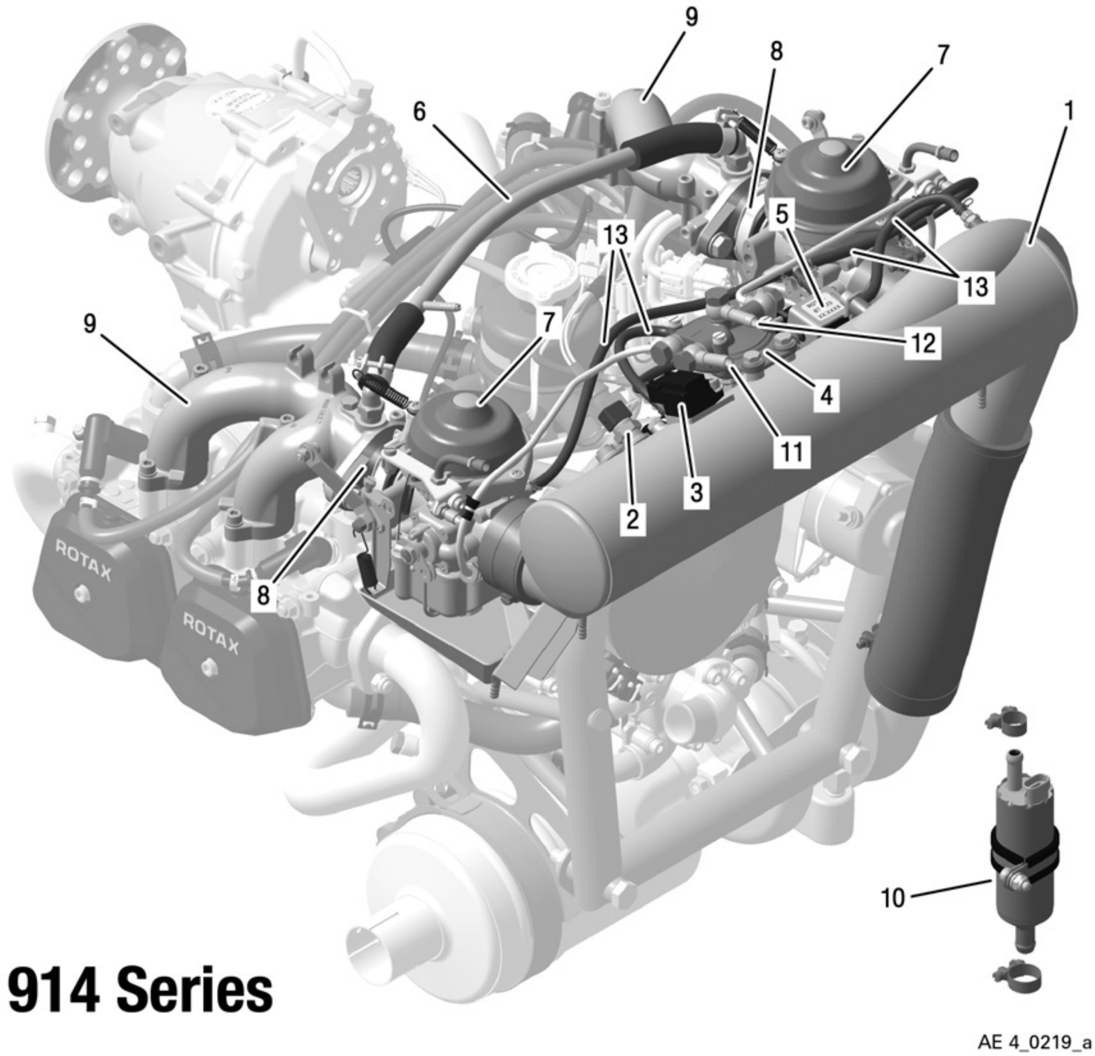

Figure 14.2: Fuel distribution

1	*Airbox.*	2	*Resistance thermometer*
3	*Airbox pressure sensor*	4	*Fuel pressure regulator*
5	*Three-way solenoid valve*	6	*Compensating tube*
7	*Carburetor*	8	*Rubber flange*
9	*Intake manifold*	10	*Electrical fuel pump*
11	*Hose nipple (fuel inlet)*	12	*Fuel return line*
13	*Pressure connection line*		

SERVICE PRODUCTS

Description	Part number
LITHIUM-BASE GREASE	897330
MOLYKOTE G-N SLIDE PASTE	297433
LOCTITE 243	897651
LOCTITE 577	899796
LOCKING PAINT	898570

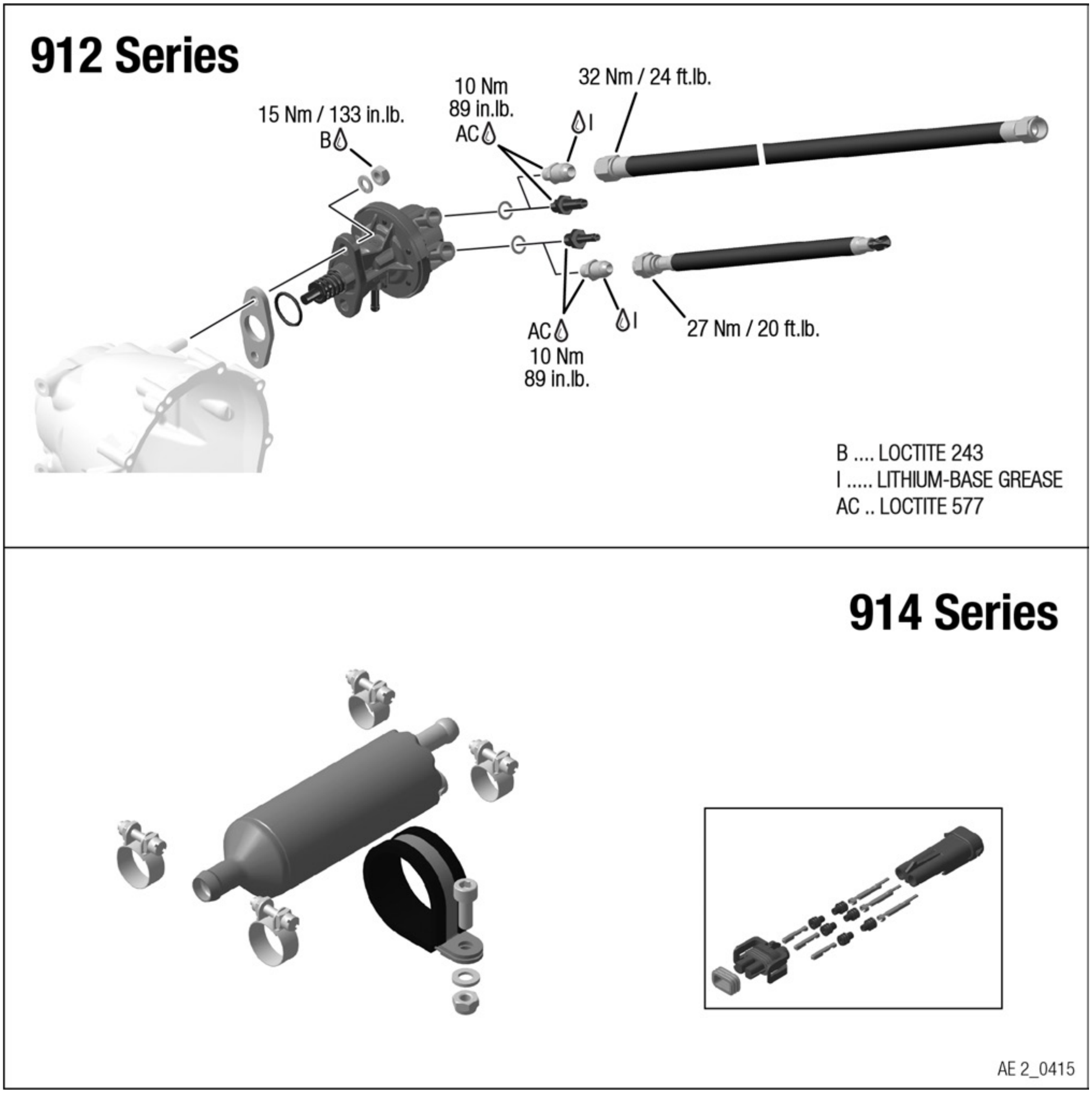
912 Series
15 Nm / 133 in.lb.
B
10 Nm
89 in.lb.
AC
I
32 Nm / 24 ft.lb.
AC
10 Nm
89 in.lb.
I
27 Nm / 20 ft.lb.
B .... LOCTITE 243
I ..... LITHIUM-BASE GREASE
AC .. LOCTITE 577
914 Series
AE 2_0415

Figure 14.3

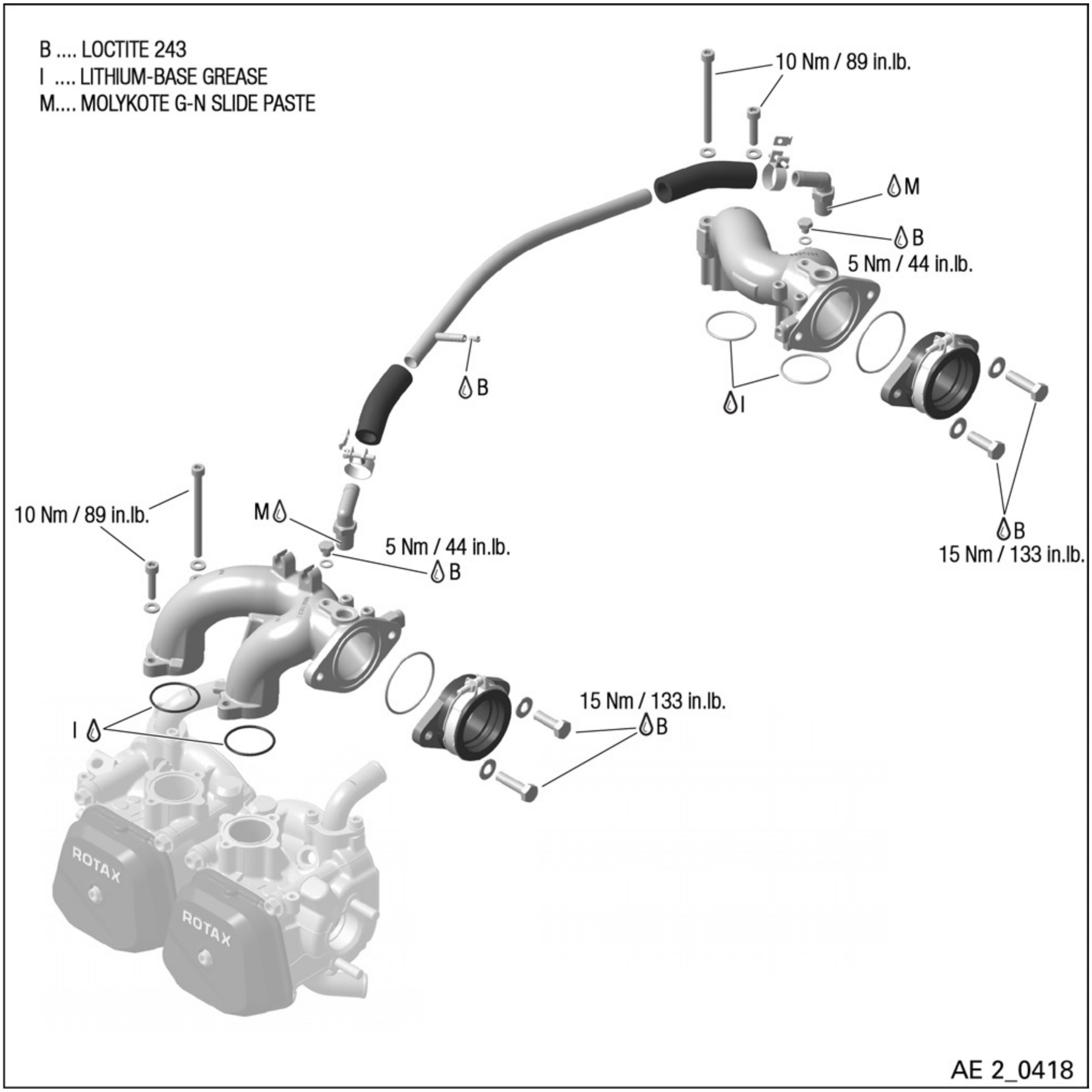
B .... LOCTITE 243
I .... LITHIUM-BASE GREASE
M.... MOLYKOTE G-N SLIDE PASTE
10 Nm / 89 in.lb.
M
B
5 Nm / 44 in.lb.
I
B
15 Nm / 133 in.lb.
10 Nm / 89 in.lb.
M
5 Nm / 44 in.lb.
B
15 Nm / 133 in.lb.
B
I
ROTAX
ROTAX
AE 2_0418

Figure 14.4

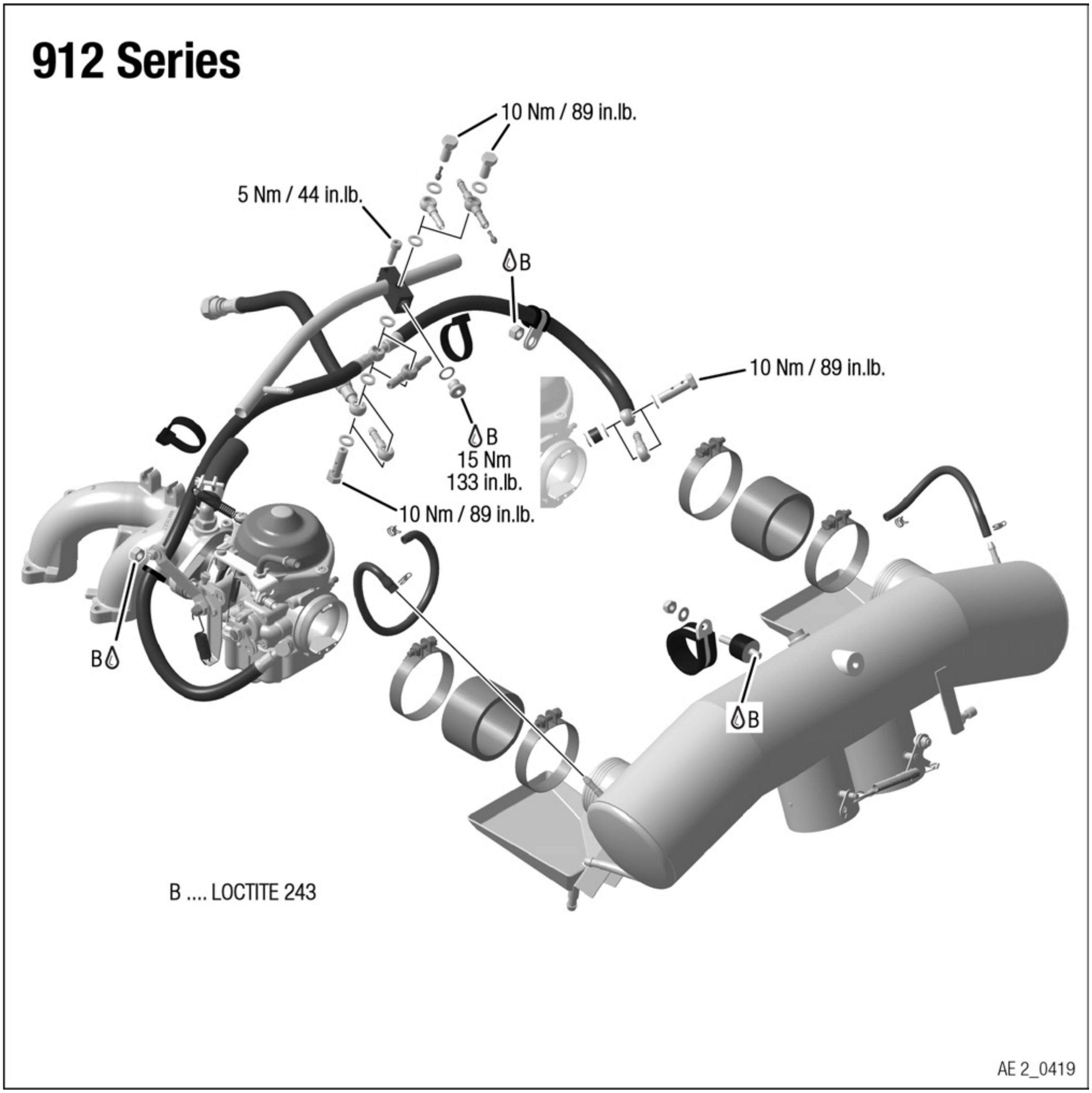
912 Series
10 Nm / 89 in.lb.
5 Nm / 44 in.lb.
B
10 Nm / 89 in.lb.
B
15 Nm
133 in.lb.
10 Nm / 89 in.lb.
B
B
B .... LOCTITE 243
AE 2_0419

Figure 14.5

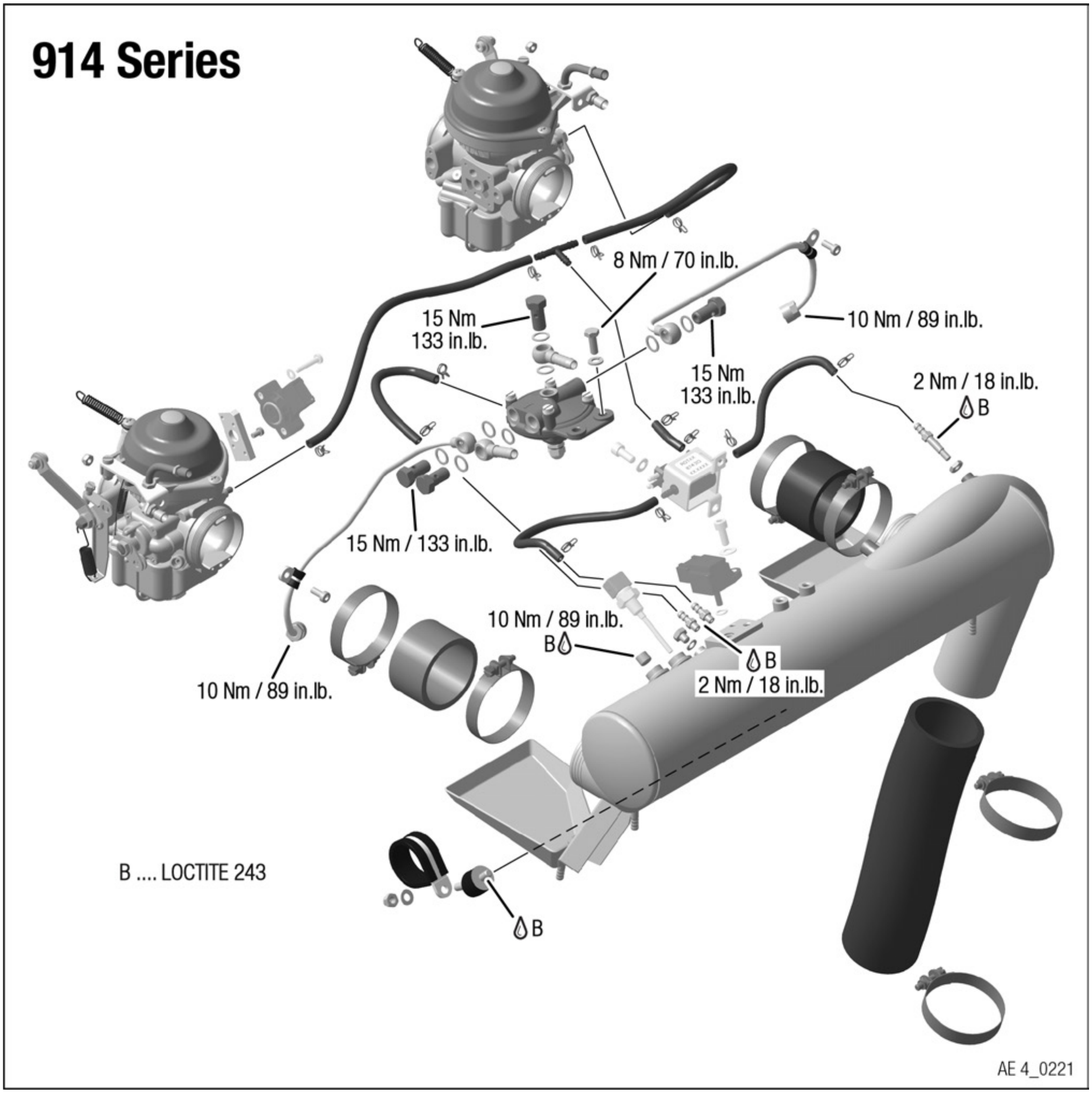
914 Series
8 Nm / 70 in.lb.
15 Nm
133 in.lb.
10 Nm / 89 in.lb.
15 Nm
133 in.lb.
2 Nm / 18 in.lb.
B
15 Nm / 133 in.lb.
10 Nm / 89 in.lb.
B
B
2 Nm / 18 in.lb.
10 Nm / 89 in.lb.
B .... LOCTITE 243
B
AE 4_0221

Figure 14.6

SYSTEM DESCRIPTION

FUEL PUMP

NOTICE

Use only GENUINE-ROTAX®-fuel pumps, as the pump must meet certain requirements.

912
The engines of the 912 Series are equipped with a mechanical fuel pump. It is plunger driven by an eccenter in the propeller gearbox.

914
To warrant safe and adequate operation of the fuel system, two independent self-priming vane pumps are used. The voltage supply to the two pumps must be established completely independently.

NOTE

Voltage supply to main pump (MAIN) directly from internal alternator and supply to the supplementary pump (AUX) from bus bar or battery. For engine operation, the rate of delivery of one pump alone is entirely sufficient.

FUEL DISTRIBUTION

The main elements of the fuel distribution assembly are:

912	914
water drain cock	water trap
fire cock	fire cock
fuel lines	check valves
Airbox (optional)	fuel pressure regulator
	pressure connecting lines
	fuel lines
	Airbox

Fuel pressure regulator
only on 914 Series
The fuel pressure regulator is mounted on the airbox. Fuel pressure control is essential for flawless engine operation because it keeps the fuel pressure permanently at approx. 0.25 bar (3.6 psi) above the varying boost pressure in the airbox.

Design and function
The diaphragm divides the pressure regulator into the top fuel chamber and the air chamber. The force of the pressure spring, which is set by the adjusting screw establishes an equilibrium of forces on the diaphragm at a fuel pressure 0.25 bar (3.6 psi) above the actual airbox pressure on the other side.

NOTE

All fuel pressure regulators are calibrated by the engine manufacturer and need no further adjustment.

NOTE

The arrows cast into the top side of the fuel pressure regulator are of no significance for the usage, as inlet and outlet are directly connected via the chamber.

NOTE

Ensure that the cap nut is securely tightened, as otherwise the fuel pressure may drop.

Part of the fuel flow from the pumps (approx. 100 l/h) is routed back to the fuel tank via the diaphragm controlled cone valve, thus establishing a pressure 0.25 bar (3.6 psi) higher in the top chamber (fuel side) than in lower chamber (air side).
Since the lower chamber is connected with the airbox via the pressure line, the pressure of the fuel entering the carburetor will also be 0.25 bar (3.6 psi) above airbox/float chamber pressure.

Fuel pressure = airbox pressure + 250 hPa
At 1000 m altitude with the prevailing ambient pressure of approx. 900 hPa, the following values will arise at **take-off performance**:
Fuel pressure = 1370 + 250 = 1620 hPa
Therefore the required delivery pressure of the fuel pump will be 1620 - 900 = 720 hPa
Rising airbox pressure will press the diaphragm upwards, thus preventing fuel flow back to the tank, i.e. fuel pressure rises until equilibrium is reached again.

NOTICE

Correct excess fuel pressure is essential for proper functioning of the carburetor.

- too **low** fuel pressure (wrong calibration, malfunction of regulator or fuel pumps ...) leads to a leaner mixture and can result in engine faults or engine failure as not enough fuel or no fuel at all reaches the float chamber.
- too **high** fuel pressure (wrong calibration, malfunction of regulator, increased flow resistance, blockage of return line, ...) leads to a richer mixture till flooding of carburetors occurs, causing engine faults or engine stoppage.

Pressure connecting lines (914 Series only)
The engines are equipped with constant depression carburetors. For the operation of the carburetors it is necessary that

- the atmospheric pressure in the float chamber corresponds with atmospheric pressure at carburetor air intake (airbox)
  With varying airbox pressure (carb air intake) this changing pressure must also act upon the float chamber.
  For this reason, the float chamber venting is connected to the airbox via a pressure connecting line.
- the fuel pressure is approx. 0.25 bar (3.6 psi) above the pressure at air intake (airbox).
  For this reason, the fuel pressure regulator (only on 914 Series) is connected to the airbox via a pressure connecting line.

Enriching of the fuel air mixture at take-off performance
The airbox is furnished with 2 separately located pressure connections connected with the three-way solenoid valve via pressure connecting lines.
Up to maximum continuous performance (approx. 1190 hPa airbox pressure), the float chambers of the carburetors are vented with the static airbox pressure via connection. At an airbox pressure above 1270 hPa, the pressure in the float chambers will be raised by the ram air pressure at airbox (connection) initiated by the TCU via an electric solenoid valve.
As a result, the effective pressure in the fuel bowl will be increased by the same amount.

The purpose of enriching the mixture is to reduce the thermal load on the engine during the shorter takeoff phase and to provide added protection against knocking combustion (detonation).

⚠ WARNING

The pressure connecting lines must function properly to ensure correct engine running. Otherwise engine stoppage can be expected. The lines must therefore be in serviceable condition and free of kinks, secured with clamps and seated securely on their connections.

Fuel lines

NOTE

Models produced from the year 2007 onwards have a flexible fuel line.

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

The following sections describe maintenance procedures for engines type 912 / 914 Series. Above and beyond the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type. The description is divided into subsections and descriptions of the function of the various systems.

REMOVAL

NOTICE

Avoid contamination of the fuel system.
Proceed with great care and cleanliness. It is essential to store carburetors and dismantled parts in a clean area.

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.

NOTE

The fuel supply must be closed off before parts are removed for closer inspection.

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!

NOTICE

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 relevant Maintenance Manual Line for the 912 Series or 914 Series engine type.

Carry out an engine test run. See relevant Maintenance Manual Line for the 912 Series or 914 Series engine type.

- Functional check of the fuel distribution system assy.
- Check that the system is leakproof.
- 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.

NOTICE

When disassembling the fuel lines support them so that tension or additional strain is avoided.

NOTICE

Replace the isolating flange each time when the fuel pump is removed.

FUEL PUMP — REMOVAL (912 SERIES ONLY)

NOTE

If necessary, remove fuel lines.

Step	Procedure
1	Remove the hex. nuts and the lock washer. **NOTE** *(only Version 3) There is an additional cable clamp on the upper stud.*
2	Remove the fuel pump together with the O-ring and isolating flange.

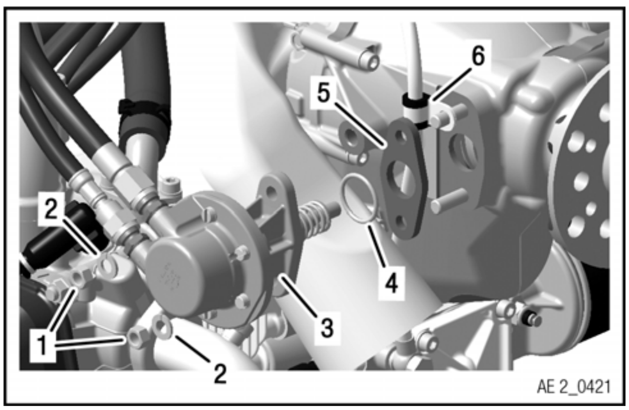

Figure 14.7

1	*Hex. nut*	*2*	*Lock washer*
3	*Fuel pump*	*4*	*O-ring*
5	*Isolating flange*	*6*	*Cable clamp*

FUEL LINE — REMOVAL (912 SERIES)

Step	Procedure
1	Remove both feed lines (fuel pump).

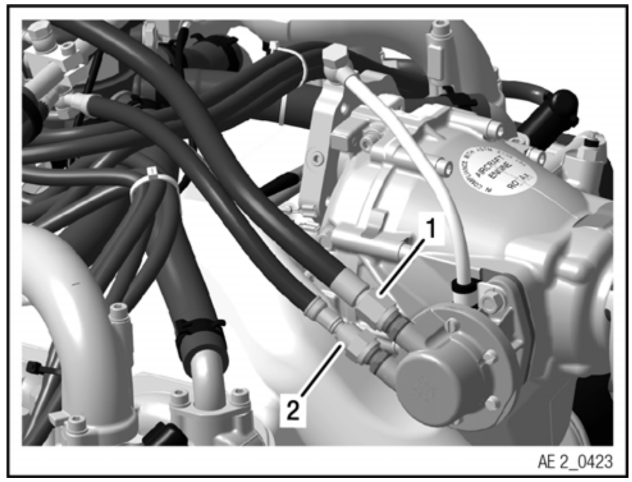

Figure 14.8

1	*Fuel line (from tank)*	*2*	*Fuel feed line (to carburetor)*

Step	Procedure
2	Remove the hex. nut.
3	Remove the cable clamp on the intake manifold.
4	Cut the cable ties to the compensation tube.
5	Loosen the banjo bolt. Then remove the fuel line with distance sleeve and sealing rings.

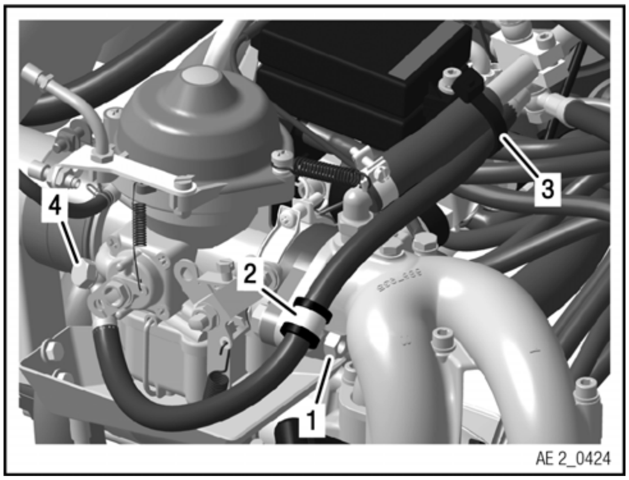

Figure 14.9

1 *Hex. nut*	2 *Clamp*
3 *Cable tie*	4 *Banjo bolt*

Step	Procedure
6	Repeat the same procedure on the other side.
7	Loosen the banjo bolt. Then remove the fuel feed line and the fuel line (carburetors) including the sealing rings.
8	Remove the banjo bolt with the ring hose nipple (connection for fuel return line and pressure gauge) with sealing rings.
9	If necessary, loosen the slotted head screw with the sealing ring.

NOTE

Usually it is not necessary to remove the clamp block. However, if it should become necessary to remove it, ensure that it is refitted in the same position.

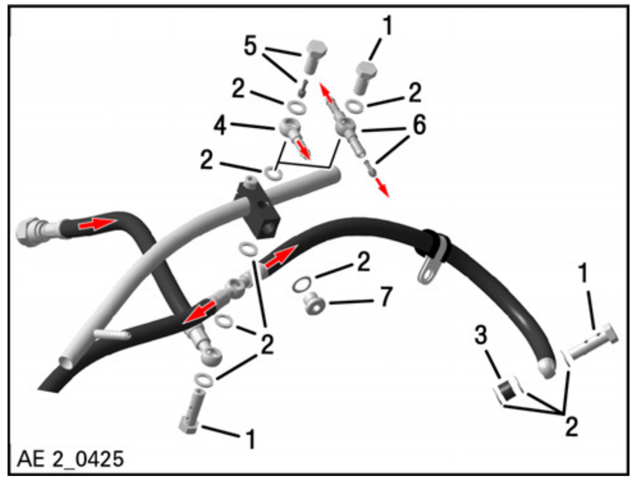

Figure 14.10

1 *Banjo bolt*	2 *Sealing ring*
3 *Distance sleeve*	4 *Ring hose nipple*
5 *Banjo bolt assy.*	6 *Double hose nipple assy.*
7 *Slotted head screw*	

FUEL LINE — REMOVAL (914 SERIES)

Step	Procedure
1	Loosen Allen screw and remove cable clamp.
2	Loosen the collar nut.
3	Remove the fuel line by removing the banjo bolt with sealing rings.
4	Repeat the same procedure on the other side.

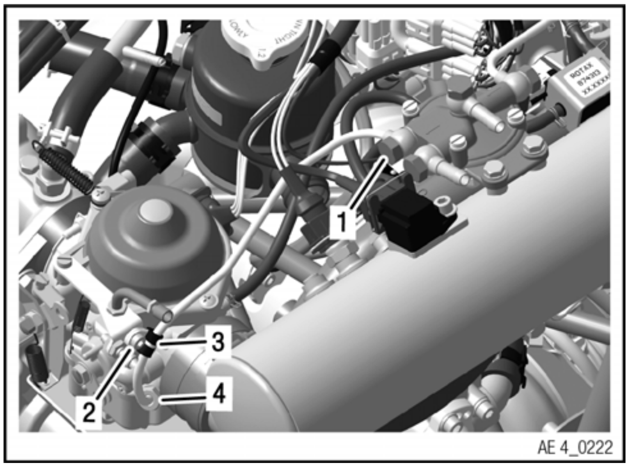

Figure 14.11

1	*Banjo bolt*	2	*Allen screw*
3	*Cable clamp*	4	*Collar nut*

FUEL PRESSURE REGULATOR — REMOVAL (914 SERIES ONLY)

Preparation

- Remove fuel inlet and fuel outlet line
- Remove fuel lines (carburetors)
- Remove pressure line (airbox)

NOTE

If necessary, disassemble banjo bolts with ring hose nipples and sealing rings before removing the fuel pressure regulator.

Step	Procedure
1	Remove the hex. screws M6x16 and lock washer.
2	Remove the fuel pressure regulator.

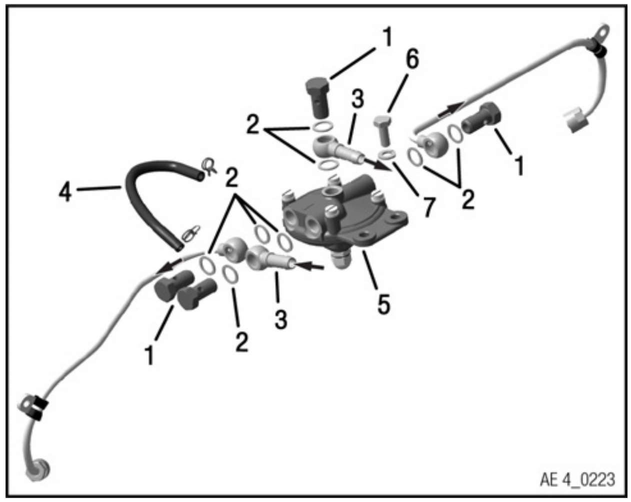

Figure 14.12

1	*Banjo bolt*	2	*Sealing ring*
3	*Ring hose nipple*	4	*Pressure line (airbox)*
5	*Fuel pressure regulator assy.*	6	*Hex. screw*
7	*Lock washer*		

AIRBOX — REMOVAL (912 SERIES)

Step	Procedure
1	Remove pressure connection lines.
2	Loosen the clamps.
3	Loosen the lock nut and remove with washer.
4	Remove airbox.

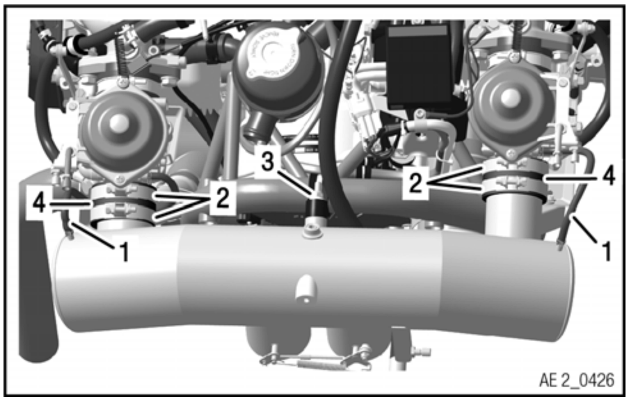

Figure 14.13

1	*Pressure connection line*	2	*Clamp*
3	*Lock nut with washer*	4	*Connection hose*

NOTE

Now the connecting hoses (35 mm / 1.38 in.) can be removed.

AIRBOX — REMOVAL (914 SERIES)

Disassembly of the airbox assy.
Carburetor, rubber flange and intake manifold can be removed.

Step	Procedure
1	Loosen the clamps (carburetor).
2	Loosen the lock nut and remove with washer.
3	Remove banjo bolts with sealing rings.
4	Loosen the clamps and remove pressure connection lines.
5	Pull back the airbox carefully. Then carburetor, rubber flange and intake manifold can be disassembled.

NOTE

Now the connecting hoses (35 mm / 1.38 in.) can be removed.

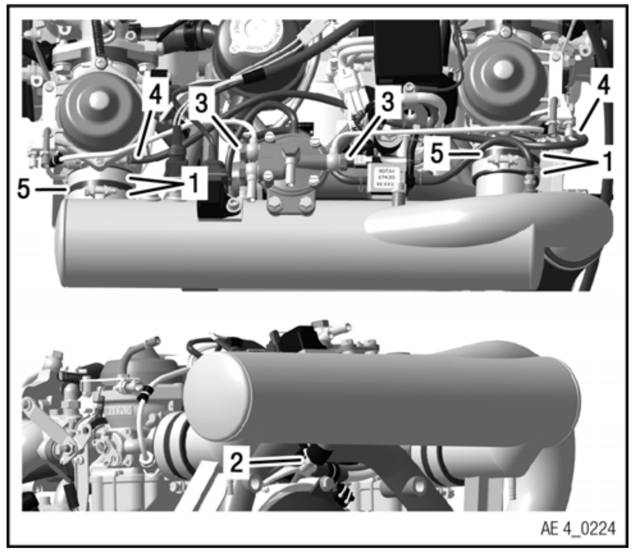

Figure 14.14

1	*Clamp*	2	*Lock nut with washer*
3	*Banjo bolt with sealing rings*	4	*Pressure connection line*
5	*Connecting hose*		

Complete airbox removal

- Remove fuel lines (carburetors)
- Remove fuel pressure regulator
- Disconnect the temperature sensor, airbox pressure sensor and three-way solenoid valve

Step	Procedure
1	Loosen the clamps and remove pressure connection lines.

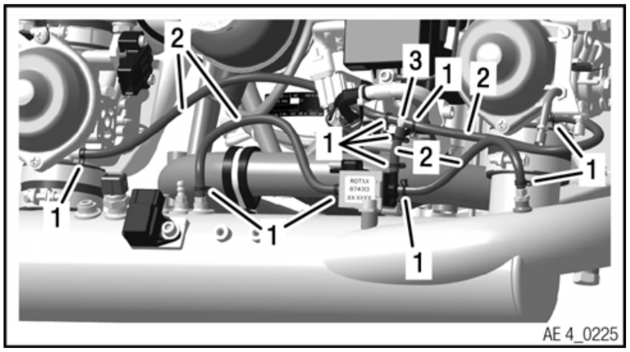

Figure 14.15

1	*Clamps*	2	*Pressure connection lines*
3	*T-piece*		

Step	Procedure
2	Loosen the clamps (carburetor).
3	Loosen clamp (intake).
4	Loosen the lock nut and remove with washer.
5	Remove the airbox.
6	Remove temperature sensor, airbox pressure sensor and three-way solenoid valve, see Chapter 76-70-00 Sensors and actuators.

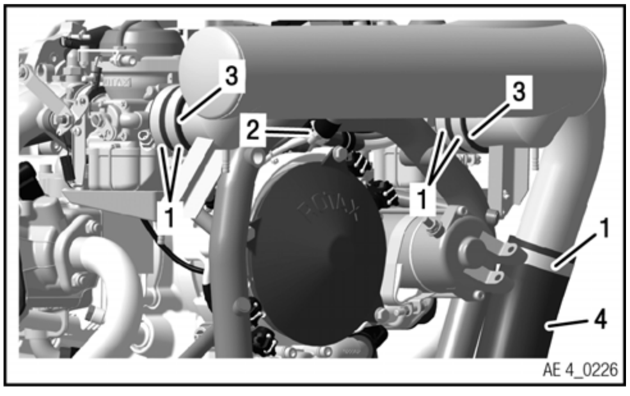

Figure 14.16

1	*Clamp*	2	*Lock nut with washer*
3	*Connecting hose*	4	*Air intake hose*

NOTE

Now the connecting hoses (35 mm / 1.38 in.) can be removed.

CARBURETOR — REMOVAL

See SI-912-012 or SI-914-014, “Routine modification of the BING constant depression carburetor”, latest issue.

Preparation

- Remove Fuel lines
- Remove Airbox
- Disconnect 3-pin plug connection of TPS (914 Series only, Cyl. 2/4)
- Remove choke and throttle Bowden cable actuation see current Installation Manual (IM), Chapter 73-00-00.

Step	Procedure
1	Remove the tension spring for carburetor suspension with a suitable tool.
2	Release the clamp of the carburetor socket.
3	Remove the carburetor with slight turning and swiveling movements.
4	Close off the intake openings to prevent entry of foreign objects.

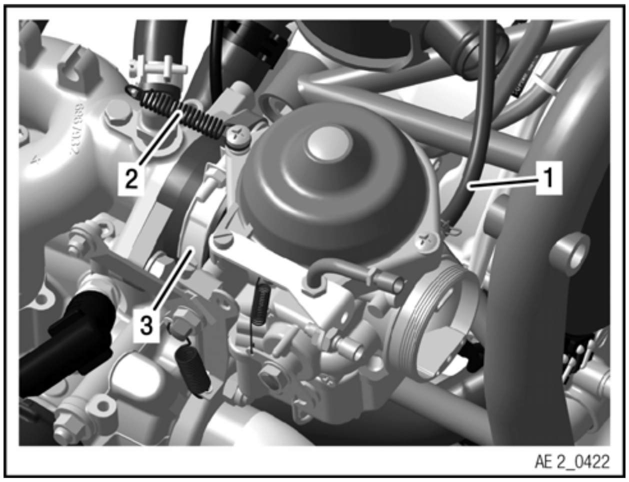

Figure 14.17

1	*Pressure connection line*	2	*Tension spring*
3	*Clamp*		

RUBBER FLANGE ASSY. — REMOVAL

Step	Procedure
1	Remove the hex. screws with washers.
2	Take off the rubber flange assy. with the O-ring.

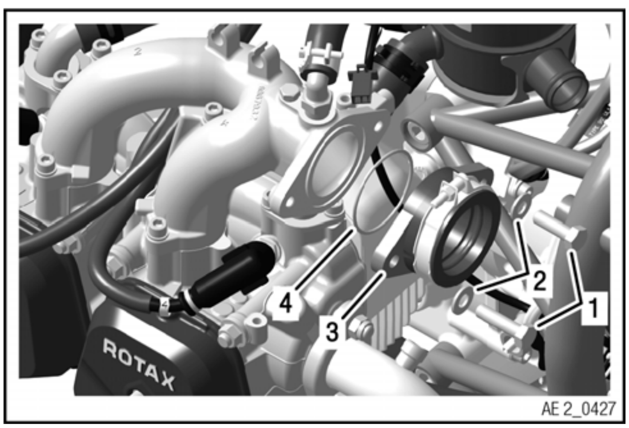

Figure 14.18

1	*Hex. screw*	2	*Washer*
3	*Rubber flange*	4	*O-ring*

COMPENSATION TUBE — REMOVAL

NOTE

Ensure that the angular tube, hoses and the clamp block (912 Series only) are refitted in the same position.

Step	Procedure
1	Loosen clamps.
2	Remove hoses from angular tubes and compensating tube.
3	Remove angular tubes, if necessary. (see also section Intake manifold — inspection.

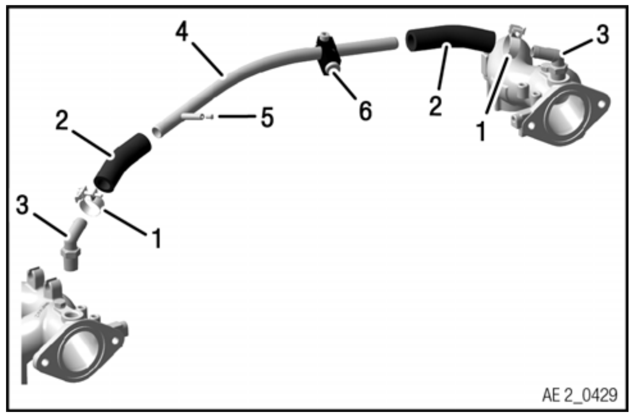

Figure 14.19

1	*Clamp*	2	*Hose*
3	*Angular tube*	4	*Compensating tube*
5	*M3.5 screw*	6	*Clamp block*

NOTE

It is not necessary to disassemble the clamp block and the M3.5 screw from the compensating tube.

INTAKE MANIFOLD — REMOVAL

See Chapter 74-20-00 Ignition assy. – removal.

INSPECTION

NOTE

For carburetor inspection see Chapter 73-00-10 section Carburetor inspection.

FUEL LINE — INSPECTION

Step	Procedure
1	Carry out a visual inspection of all fuel lines for damage and wear. Pay particular attention to the formation of any cracks in the area of the connections.
2	Check the lines for free passage with compressed air and inspect the lines for scuffing marks.
3	Carry out a visual inspection of the clamp block of the fuel manifold, the two banjo bolts and the ring hose nipple.

NOTE

It is not normally necessary to remove the clamp block. However, if it should become necessary to remove it, it must be reattached with an Allen screw M5x16 (tightening torque 6 Nm (53 in.lb). Ensure that it is refitted in the same position.

Step	Procedure
4	Inspect banjo bolts for hairline cracks, deformation or tears in the area of the hole. If the hole is visibly oval-shaped, the banjo bolt has been overstretched and must be replaced.

NOTE

In the event of leaks, the max. permissible torque must never be exceeded.

Step	Procedure
5	Check the drainage line for damage, leaks, hardening from heat, porosity, loose connections, secure attachment and routing without kinks and tight bends.

PRESSURE CONNECTION LINES — INSPECTION (914 SERIES ONLY)

The pressure connection lines are essential importance for safe operation of the engine.
See Chapter 73–00–00 Section Fuel distribution and the corresponding Maintenance Manual (Line) for the respective engine type.

Step	Procedure
1	Check all lines and T-fittings for damage (mechanical, thermal, etc.) and leakage.
2	All lines are secured with clamps. Check them for safety reasons.

FUEL PRESSURE — INSPECTION

Safety

NOTICE

Make sure there is no danger that the pressure gauge and hose will get drawn into the propeller airstream. If necessary, secure with tie wraps.

If the nominal fuel pressure values are not met during the test run, stop the engine and start with the trouble shooting procedure.

⚠ WARNING

Non-compliance can result in serious injuries or death!
No aircraft take-off before an obvious fault has been found and eliminated!

912
The pressure inside the fuel system must not exceed 0.5 bar (7.25 psi). Normally, it will lie between 0.15 bar (2.18 psi) and 0.3 bar (4.4 psi). The fuel pressure tester, part no. 874234, can be used to measure the pressure and check the correct functioning of the fuel system.

Step	Procedure
1	Connect the pressure gauge with the hose to the double hose nipple assy. instead of the fuel return line.
2	Fit the pressure gauge where it can be easily observed by the operator of the ground test run.

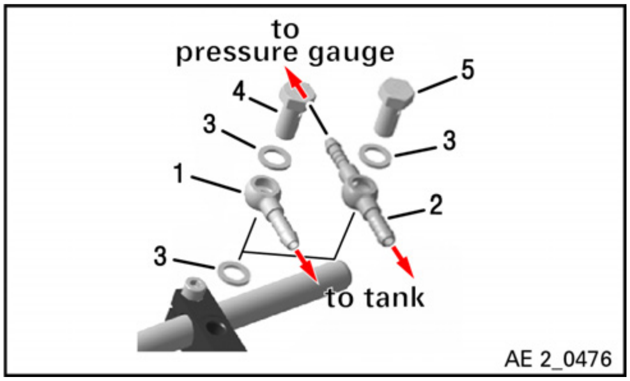

Figure 14.20

1	*Ring hose nipple 3/4*	2	*Double hose nipple assy.*
3	*Sealing ring A8x13*	4	*Banjo bolt assy.*
5	*Banjo bolt M8x1x17*		

914
There is no specific connection on the engine for reading the fuel pressure. However, it makes sense to take fuel pressure readings for monitoring purposes and for troubleshooting.
See latest installation manual for the respective engine type. All necessary items are available as spare parts.

NOTE

The fuel pressure must be approx. 0.25 bar (3.6 psi) above the constantly varying boost pressure in the airbox. Otherwise the perfect functioning of the carburetors is not assured.

See Chapter 73–10–00 Section Fuel distribution

Step	Procedure
1	Fit the pressure gauge where it can be easily observed by the operator of the ground test run.

INTAKE MANIFOLD — INSPECTION

Step	Procedure
1	Check the angular tube screwed into the intake manifold for cracks and tight fit, replace if necessary.

NOTE

Mark the position of the angular tube with a suitable pen (touch-up pen).

Step	Procedure
2	Remove the angular tube.
3	Clean threads of angular tube.

NOTE

If necessary, remove hex. screw with gasket.

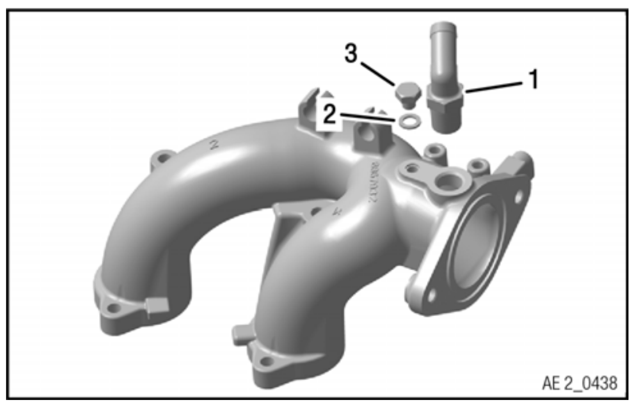

Figure 14.21

1	*Angular tube*	2	*Gasket*
3	*Hex. screw*		

RUBBER FLANGE ASSY. — INSPECTION

Step	Procedure
1	Compress rubber flange assy. in the area of the carburetor connection to allow easier detection of existing cracks.
2	Also pay particular attention to the area of the inner diameter.

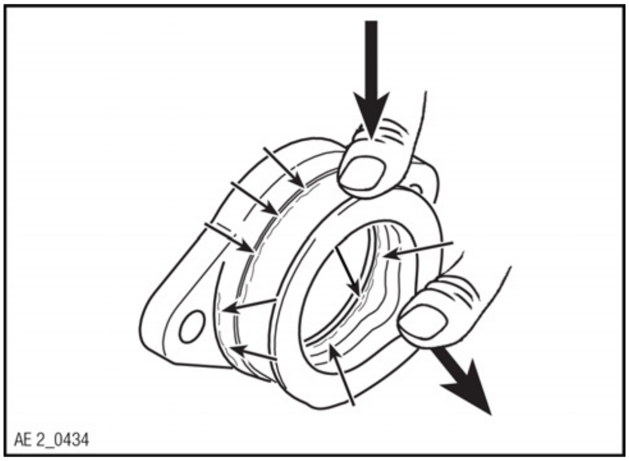

Figure 14.22

NOTICE

If cracks are suspected, fit a new rubber flange assy.

See SB-912-030 and SB-914-019, “Cracks, wear and distortion on the rubber flange”, latest issue.

FUEL PRESSURE REGULATOR — INSPECTION AND ADJUSTMENT (914 SERIES ONLY)

Fuel pressure regulator - visual inspection

Step	Procedure
1	Carry out a visual inspection of the fuel pressure regulator.

NOTE

The fuel pressure regulator must not be disassembled, as there are no spare parts available. If necessary, replace the complete regulator.

NOTICE

All NEW fuel pressure regulators are calibrated by the engine manufacturer and do not need further adjustment.

Fuel pressure regulator - adjustment

Step	Procedure
1	Set ignition switch for both ignition circuits to "OFF" position.
2	Switch on the electric fuel pump.
3	Set to the correct fuel pressure (approx. 250 hPa above the airbox pressure) using the adjustment screw and tighten the cap nut with LOCTITE 243. Tightening torque 5 Nm (45 in. lb).

NOTE

All new fuel pressure regulators are calibrated by the engine manufacturer and should not need further adjustment.

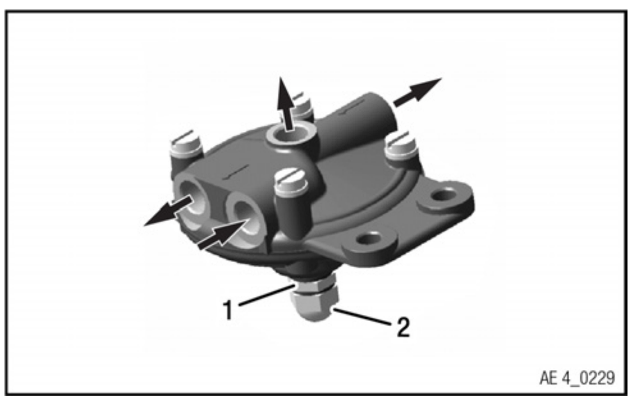

Figure 14.23

1 Adjustment screw *2 Cap nut*

FUEL PUMP — INSPECTION (912 SERIES)

NOTICE
The 5-year replacement is valid for all mechanical fuel pumps (Pierburg, AC, BCD).

NOTICE
The pump cover must not be opened for inspection.

Depending on the engine configuration, it may already have been fitted with a pump with fuel hoses. On engines without fuel hoses, observe the aircraft manufacturer´s instructions.

Step	Procedure
1	Check fuel hoses for scuffing marks and kinks.
2	The markings (locking compound) of the pump cover must be inspected.
3	The hose nipples must be checked for tightness and leakage.

“AC” fuel pump
In the event of damage the old pump, the complete pump with all the hoses must be replaced, as the hoses are pressed in one piece with the pump.

Step	Procedure
1	Check pump flange for flatness.
2	If the pump plunger shows scuff marks, the pump must be replaced and the eccentric in the propeller gearbox inspected.
3	Check the connections of the fuel lines.
4	Pumps working at reduced power, for example as a result of contaminated valves or leaking diagrams, must be replaced.

NOTE

A leaking diaphragm can be detected by the fuel emerging from the ventilation holes.

Step	Procedure
5	If contamination of the fuel pump is suspected, the pump must be inspected on the intake side using an endoscope.

NOTE

The fuel sucked in is filtered by a fine screen integrated in the pump. It is not possible to dismantle the fuel pump.

NOTE

The consecutive (6 digit) serial number is displayed on the pump housing.

Service Bulletins SB-912-049 “Checking eccenters and fuel pump plungers”, latest issue must be observed.

“BCD” fuel pump
In the course of continuous development a new fuel pump has been introduced. The fuel pumps without hoses and with hoses can be configured with corresponding hose nipples and fuel hoses.

FUEL PUMP — INSPECTION (914 SERIES)

NOTICE
It is not possible to disassemble the fuel pump, there are no spare parts available. If necessary the fuel pump has to be replaced.

Step	Procedure
1	Check the pump performance of the fuel pump. With a pressure difference of approx. 0.25 bar (3.6 psi), the fuel pump is pumping at approx. 100 l/min.
2	Check the current input of the fuel pump. The current input is approx. 2 A. (at 100 l/min).

NOTE

This figures are reference values.

Step	Procedure
3	Perform visual check on fuel pump.
4	If the installation specific fine filter shows a lot of dirt then the filter of the fuel pump also have to be inspected.

Cleaning fuel pump integrated filter

NOTICE

Do not damage the intake connection or filter. Always follow the safety regulations when handling with fuel.Make sure that no debris gets into the fuel pump.

Step	Procedure
1	Use a forceps to carefully pull out pre-filter from the intake connection.
2	Use fuel to clean pre-filter.
3	Carefully install the clean filter in the intake connection.

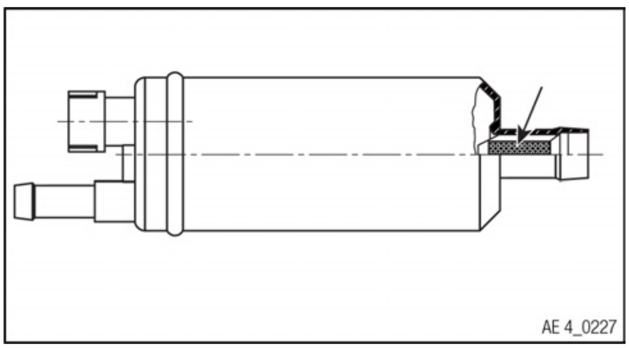

Figure 14.24

INSTALLATION

INTAKE MANIFOLD — INSTALLATION

Step	Procedure
1	Lubricate the 2 O-rings 34x2 with lithium-base grease and insert them at each side between the intake manifold and the cylinder head.
2	Place on the intake manifold.
3	Fix the intake manifold with 4 Allen screws M6 and washers. Tightening torque 10 Nm (89 in. lb).
4	If necessary, install hex. screw M6x6 with new gasket 6x10 and secured with LOCTITE 243. Tightening torque 5 Nm (44 in. lb).

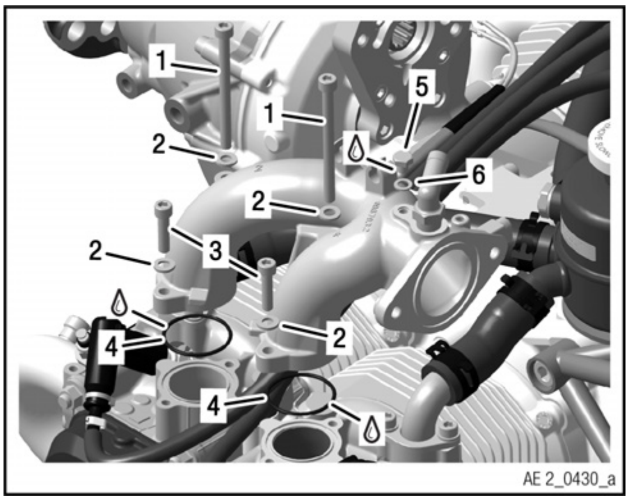

Figure 14.25

1	*Allen screws M6x75*	2	*Washers A6*
3	*Allen screws M6x25*	4	*O-rings 34x2*
5	*Hex. screw M6x6*	6	*Gasket 6x10*

NOTE

On cylinder 1/3 only:
Install both ground cables and the SMD electronic module, see Chapter 74-20-00.

COMPENSATION TUBE — INSTALLATION

NOTE

Ensure that the angular tube, hoses and the clamp block are refitted in the same position.

Step	Procedure
1	Install angular tube with MOLYKOTE G-N on intake manifold.
2	If removed, install M3.5 screw with LOCTITE 243 and clamp block (912 Series only) on compensating tube.
3	Attach hoses, compensating tube and clamps 16/9 with bracket. **NOTE** *The bracket has to be installed in the correct position.*
4	(912 Series only) Tighten clamping block with Allen screw M5x16 at the correct position. Tightening torque 5 Nm (44 in. lb).

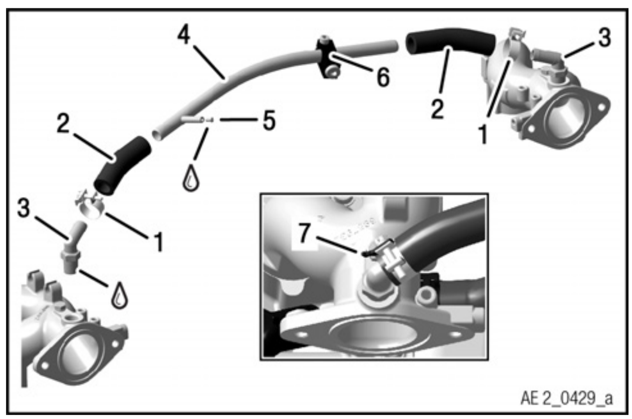

Figure 14.26

1	*Clamp 16/9*	2	*Hose*
3	*Angular tube 1/4-18NPF*	4	*Compensating tube*
5	*Screw M3.5*	6	*Clamp block*
7	*Bracket*		

RUBBER FLANGE ASSY. — INSTALLATION

Step	Procedure
1	Attach rubber flange and new O-ring 47x2 with hex. screws M8x25 and M8x30 with washers. The screws are locked with LOCTITE 243. Tightening torque 15 Nm (133 in.lb).

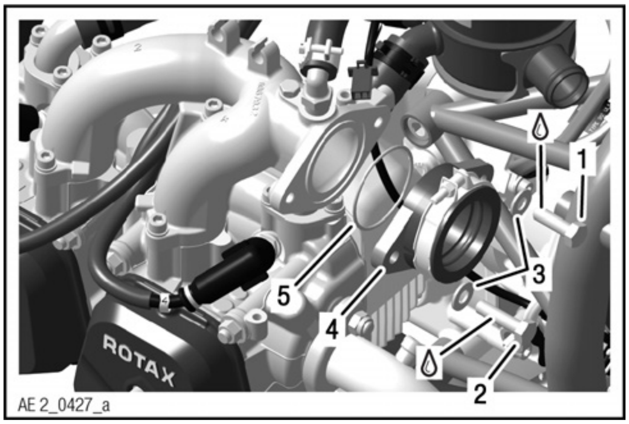

Figure 14.27

1	*Hex. screw M8x25*	2	*Hex. screw M8x30*
3	*Washer*	4	*Rubber flange*
5	*O-ring 47x2*		

See latest Illustrated Parts Catalog (IPC), Chapter 73-10-00.

CARBURETOR — INSTALLATION

NOTE

The screws of the clamp on the rubber flange must point outwards.

Step	Procedure
1	Remove FOD (foreign objects debris) prevention plug or cap from the intake openings.
2	Insert the carburetor into the rubber flange.
3	Fix the carburetor socket with a clamp and tighten clamp till there is no gap between spacer and clamp. **NOTE** *The carburetor must be pushed into the rubber flange without a gap and aligned vertically in a straight line.*
4	Put in the 3-pin plug connection of the throttle potentiometer. (on cyl. 2/4 at 914 Series only)

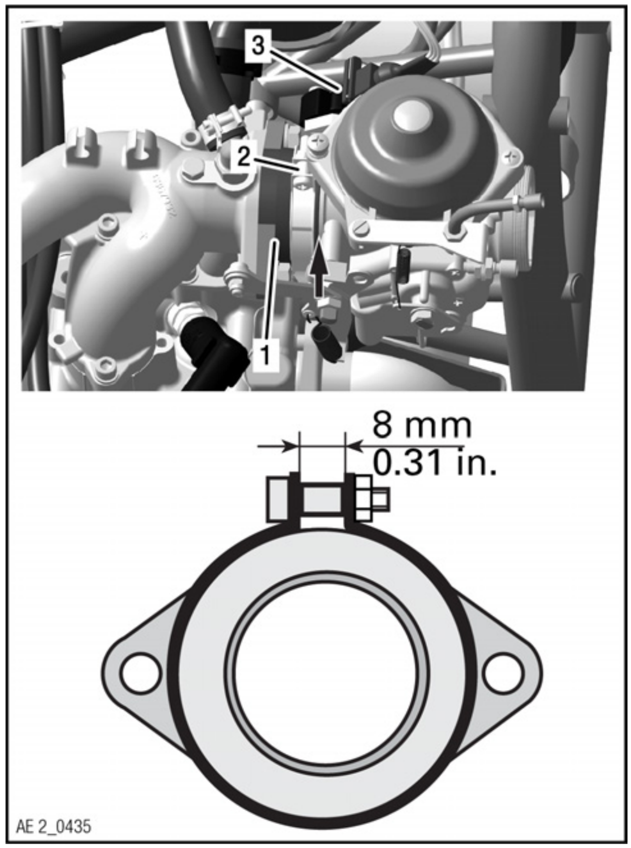

Figure 14.28

1	*Rubber flange*	2	*Clamp*
3	*3-pin plug (914 Series only)*		

Step	Procedure
5	Install the tension spring for carburetor suspension with a suitable tool.

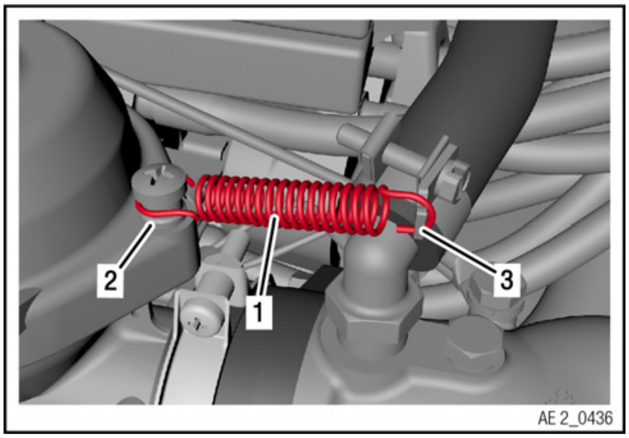

Figure 14.29

1 *Tension spring*	2 *Distance sleeve*
3 *Bracket*	

NOTICE

To ensure efficient carburetor suspension, a distance of 45 - 50 mm (1.77 – 1.97 in.) between the Allen screw and the engagement latch must be respected.

AIRBOX — INSTALLATION (912 SERIES)

Step	Procedure
1	Install the connecting hose 35 mm (1.38 in.) with two clamps. **NOTE** *The screws of the clamps must be on bottom and point outwards.*
2	If necessary, install rubber buffer into airbox with LOCTITE 243.
3	Fit the airbox on the connection hose.

NOTICE

Use the complete slip-on length on the connection pieces.

NOTE

Ensure that the airbox is fitted horizontally and torsion-free. There must be no additional load on the carburetor fixations.

Step	Procedure
4	Put the cable clamp on engine suspension frame. Install new lock nut M6, washer 6/12/1 and cable clamp onto the rubber buffer.
5	Tighten both clamps on connecting hose 35 mm (1.38 in.).
6	Install pressure connection lines with two clamps 8.

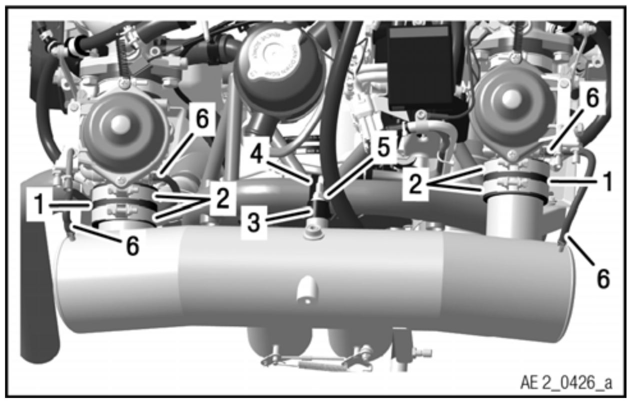

Figure 14.30

1 *Connection hose*	2 *Clamp 59*
3 *Rubber buffer*	4 *Cable clamp*
5 *Lock nut M6 with washer 6/12/1*	6 *Pressure connection line*

AIRBOX — INSTALLATION (914 SERIES)

Pulled off airbox assy. - installation

Step	Procedure
1	Install connecting hose 35 mm (1.38 in.) with two clamps. **NOTE** *The screws of the clamps (airbox) must be on top and point outwards. The screws of the clamps (carburetor) must be on bottom and point outwards.*
2	Install the airbox assy. onto the connecting hoses 35 mm (1.38 in.).

NOTICE

Use the complete slip-on length on the connection pieces.

NOTE

Ensure that the airbox is fitted horizontally and torsion-free. There must be no additional load on the carburetor fixations.

Step	Procedure
3	Now the clamps on the connecting hose and, if necessary, on air intake hose can be tightened.
4	Install pressure connection line with clamps 8.
5	Install fuel line with banjo bolt M10x1x19 and sealing rings 10x14 and tighten with 15 Nm (133 in.lb).
6	Put the cable clamp on the engine suspension frame. Install new lock nut M6, washer 6/12/1 and cable clamp onto the rubber buffer.

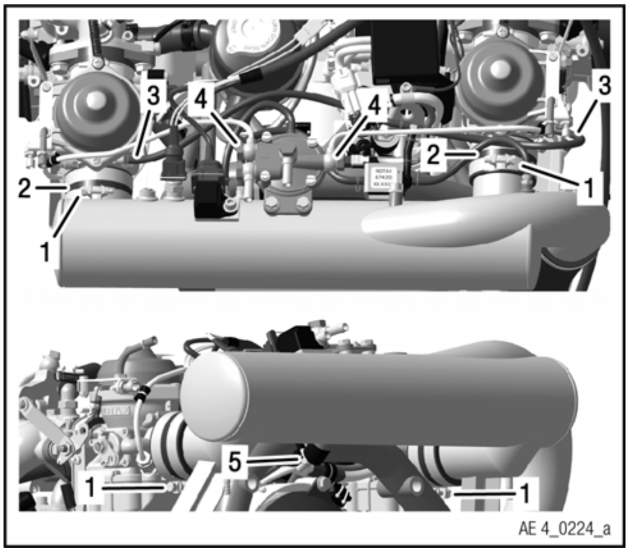

Figure 14.31

1	*Clamp 59*	2	*Connecting hose*
3	*Pressure connection line*	4	*Banjo bolt M10x1x19 with sealing rings 10x14*
5	*Lock nut M6 with washer 6/12/1*		

Complete airbox installation

⚠ CAUTION

Check all connection lines.
All connections are secured with clamps. Check them for safety reasons.

Step	Procedure
1	Install plug screw 1/8-27NPT with LOCTITE 243. Tightening torque 10 Nm (89 in. lb).
2	Install hex. screw M6x6 with sealing ring A6x10.
3	Mount both hose nipples M6 with LOCTITE 243. Tightening torque 2 Nm (18 in. lb).
4	Install hex. nut M6 and hose nipple M6 with LOCTITE 243. Tightening torque 2 Nm (18 in. lb).

Step	Procedure
5	Install temperature sensor, airbox pressure sensor and three-way solenoid valve, see Chapter 76-70-00 Sensors and actuators.
6	All screw connections must be marked with locking paint.
7	Install rubber buffer with LOCTITE 243 into the airbox.

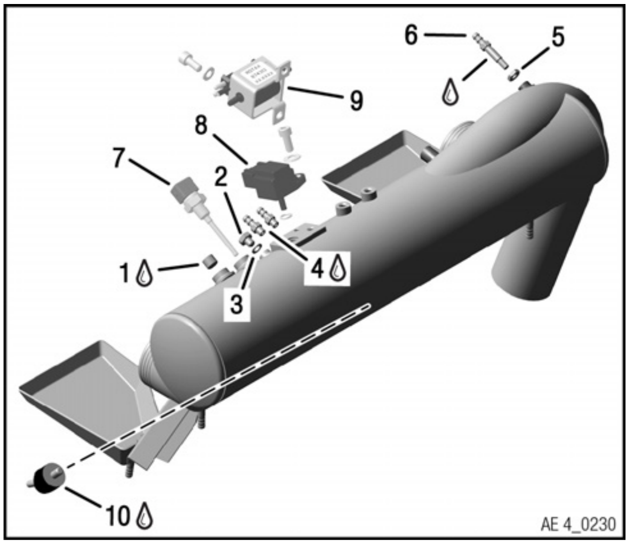

Figure 14.32

1	*Plug screw 1/8-27NPT*	2	*Hex. screw M6x6*
3	*Sealing ring A6x10*	4	*Hose nipples M6*
5	*Hex. nut M6*	6	*Hose nipples M6*
7	*Temperature sensor*	8	*Airbox pressure sensor*
9	*three-way solenoid valve*	10	*Rubber buffer*

Step	Procedure
8	Install air intake hose with two clamps on turbocharger.
9	Install connecting hose 35 mm (1.38 in.) with two clamps. **NOTE** *The screws of the clamps (airbox) must be on top and point outwards. The screws of the clamps (carburetor) must be on bottom and point outwards.*
10	Install the airbox assy. into the air intake hose. Then push it onto the connecting hoses 35 mm (1.38 in.).

NOTICE

Use the complete slip-on length on the connection pieces.

NOTE

Ensure that the airbox is fitted horizontally and torsion-free. There must be no additional load on the carburetor fixations.

Step	Procedure
11	Now the clamps on the connecting hose (carburetor) and air intake hose can be tightened.
12	Put the cable clamp on the engine suspension frame. Install new lock nut M6, washer 6/12/1 and cable clamp onto the rubber buffer.

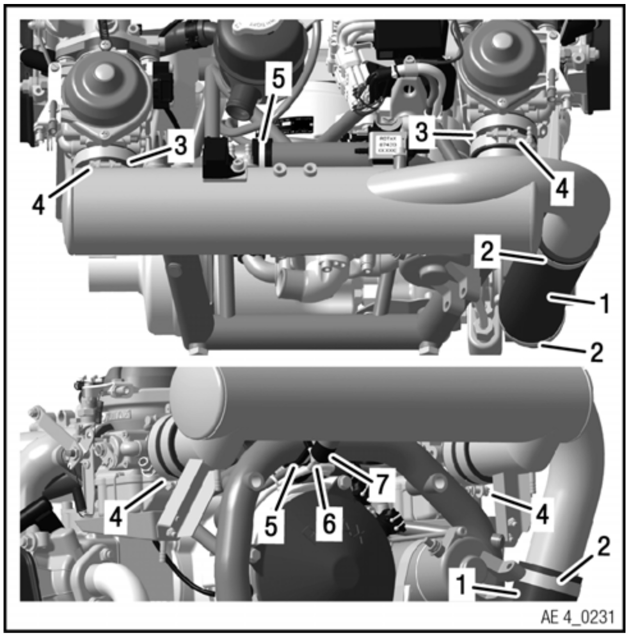

Figure 14.33

1	*Air intake hose*	2	*Clamps (air intake)*
3	*Connection hose 35 mm / 1.38 in.*	4	*Clamps (connection hose to carb.)*
5	*Cable clamp*	6	*Lock nut M6 with washer 6/12/1*
7	*Rubber buffer*		

FUEL PRESSURE REGULATOR — INSTALLATION (914 SERIES ONLY)

Step	Procedure
1	Attach the fuel pressure regulator with hex. screws M6x16 and lock washer A6 to the airbox. Tightening torque 8 Nm (70 in. lb).

NOTICE

Failure to tighten the cap nut will result in a pressure drop in the fuel system, which can cause engine damage.

NOTE

If the cap nut is loosened, see Chapter Fuel pressure regulator — inspection and adjustment (914 Series only).

Step	Procedure
2	Install two hose nipples 4/6 with sealing rings 10x14 and banjo bolts M10x1x19. Tightening torque 15 Nm (133 in. lb).
3	Install pressure connection line 160 mm (6.3 in.) with clamps 8.

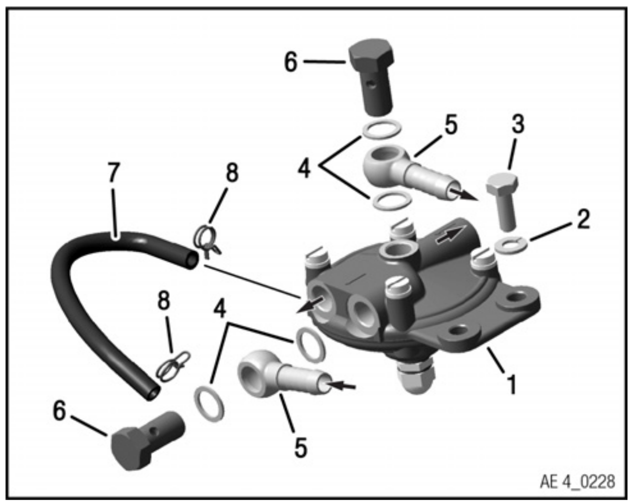

Figure 14.34

1	*Fuel pressure regulator*	2	*Lock washer A6*
3	*Hex. screw M6x16*	4	*Sealing ring 10x14*
5	*Hose nipple 4/6*	6	*Banjo bolt M1x1x19*
7	*Pressure connection line 160 mm / 6.3 in.)*	8	*Clamp 8*

FUEL PUMP — INSTALLATION

General note

NOTE

The fuel lines from the tank to the fuel pump and the return line to the fuel tank must be installed as per the aircraft manufacturer's instructions when installing the engine in the aircraft.

NOTICE

Damage to fuel pump connections may occur. When tightening the fuel lines, observe that no force or torque applies to the fuel pump connections (on 912 Series) or the fuel pressure regulator (on 914 Series).

NOTICE

Observe correct routing of drainage line. Drainage line must be routed into a ram-air and vacuum free zone. The drainage line must not be routed into the slipstream. Ram pressure or vacuum impairs the fuel pressure.

912 Series

- Drainage spigot specs: Ø outside 6 mm (0.24 in.), slip-on length max. 22 mm (0.87 in.)

NOTE

If a new pump was installed, it may occur that during the first time (about 30 minutes) oil weeps from the drainage spigot. This is residual material from manufacturing and does not indicate a fuel or oil leak.

NOTE

Check if studs M8 are firmly in place. If necessary, install studs with the longer threaded end into gearbox. Secure them with LOCTITE 243 and tighten to 6 Nm (53 in. lb).

Step	Procedure
1	Install fuel pump with new insulating flange and new O-ring 23.47x2.62.
2	Install the cable clamp (on version 3).
3	Secure hex. nut M8 with lock washer A8 with LOCTITE 243 and tighten evenly. Tightening torque 15 Nm (133 in.lb)

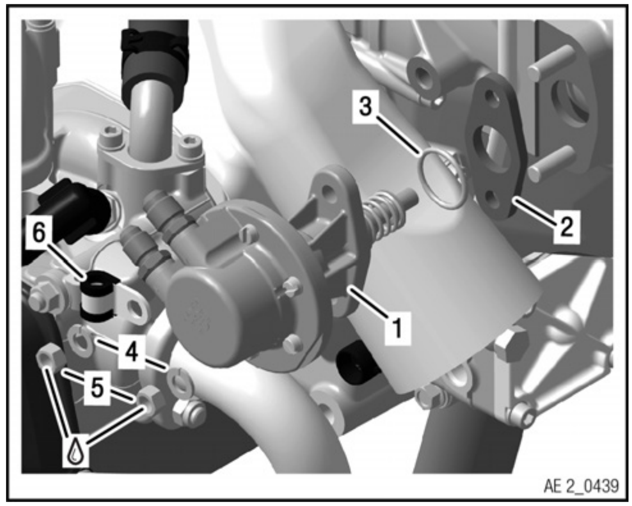

Figure 14.35

1 Fuel pump	*2 Insulating flange*
3 O-ring 23.47x2.62	*4 Lock washer A8*
5 Hex. nut M8	*6 Cable clamp*

Step	Procedure
4	Install nipples or adapters and new gasket rings with LOCTITE 577. Tightening torque 10 Nm (89 in. lb). **NOTE** *When installing the hose nipples or adapters, make sure that they are screwed in the correct position.*

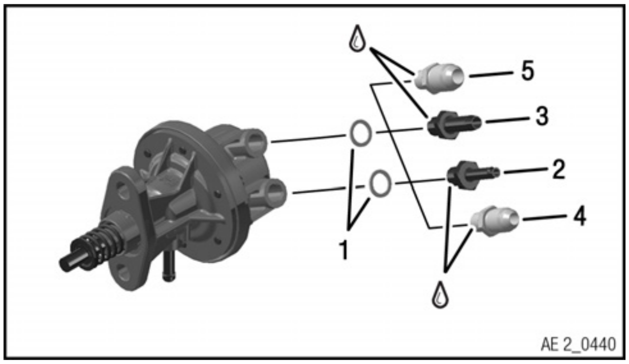

Figure 14.36

1	*Gasket ring 10.2x15x1.5*	2	*Nipple 7/3.8 (outlet)*
3	*Nipple 9/5.7 (inlet)*	4	*Adapter 1/2-20 UNF (AN5)*
5	*Adapter 9/16-18 UNF (AN6)*		

914 Series

See instruction of the aircraft manufacturer.

FUEL LINE — INSTALLATION (912 SERIES)

NOTICE

Ensure correct fit and routing of fuel lines. Utilize max. slip-on length. Secure hoses with suitable screw clamps or crimp. Route all lines without kinks and avoid tight bends.

NOTICE

To prevent locked up stresses, all components should first be screwed on loosely and then tightened to the prescribed tightening torque.

NOTE

If using an additional electric fuel pump, then a check valve (part. no. 874532) with easy opening should be used and installed according to the latest Installation Manual (IM) of the respective engine type.

NOTE

Use the pilot jet (part no. 963820) from the fuel pressure line to the fuel return line, see latest Installation Manual (IM) of the respective engine type.

NOTE

The fuel hose assy. part no. 874337 and 874347 (STRATOFLEX) does not have a 5 year service limit.

Step	Procedure
1	Lubricate both adapters with lithium-base grease.

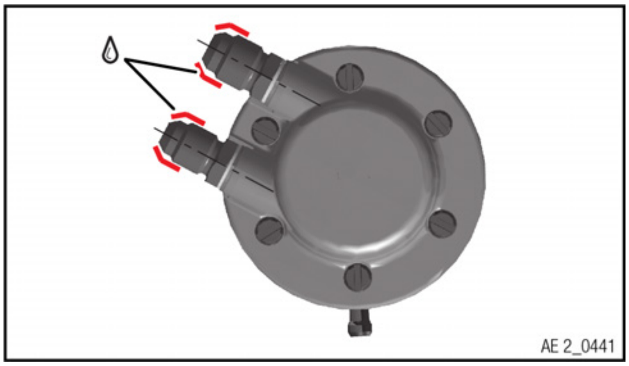

Figure 14.37

Step	Procedure
2	Install fuel line (from tank) and tighten with 32 Nm (24 ft. lb).
3	Install fuel feed line (to carburetor) and tighten with 27 Nm (20 ft. lb).

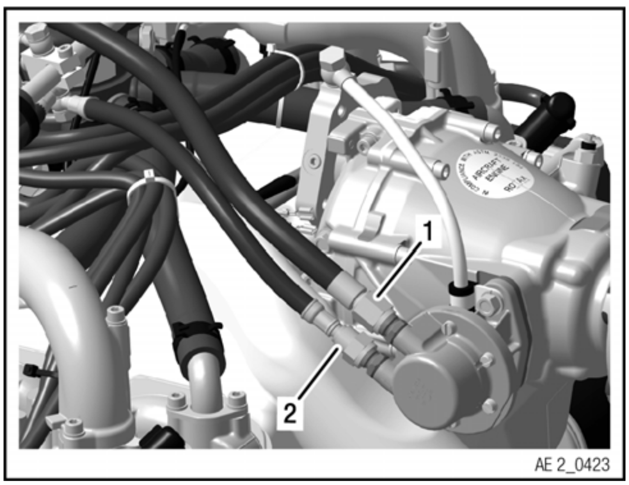

Figure 14.38: Typical

1	*Fuel line (from tank)*	2	*Fuel feed line (to carburetor)*

Step	Procedure
4	Install fuel hose assy. with distance sleeve, sealing rings A8x13 and banjo bolt M8x1x27. Tightening torque 10 Nm (89 in. lb).
5	Install feed line and fuel hose assy. with sealing rings A8x13 and banjo bolt M8x1x27. Tightening torque 10 Nm (89 in. lb).
6	Install slotted head screw M10x1x8 and sealing ring 10x14 with LOCTITE 243. Tightening torque 15 Nm (133 in. lb).

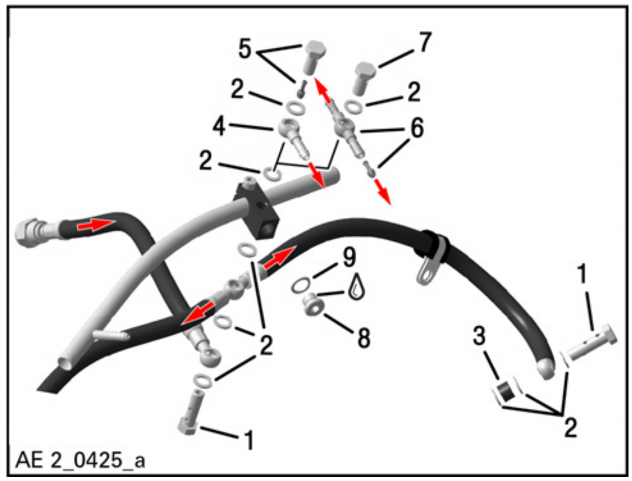

Figure 14.39

1	*Banjo bolt M8x1x27*	2	*Sealing ring A8x13*
3	*Distance sleeve*	4	*Ring hose nipple 3/4*
5	*Banjo bolt assy. with pilot jet*	6	*Double hose nipple assy. with pilot jet*
7	*Banjo bolt M8x17*	8	*Slotted head screw M10x1x8*
9	*Sealing ring 10x14*		

Step	Procedure
7a	without fuel pressure gauge: Install ring hose nipple 3/4 with sealing rings A8x13 and banjo bolt assy. (with integrated pilot jet 0.35 mm / 0.0138 in.) and tighten with 10 Nm (89 in. lb). (= connection for fuel return line). **NOTE** *For recognition the banjo bolt is either marked with yellow color or with the label "FUEL".*
7b	with fuel pressure gauge: Install double hose nipple assy. (with integrated pilot jet 0.35 mm / 0.0138 in.) and sealing rings A8x13 and banjo bolt M8x1x17. Tightening torque 10 Nm (89 in. lb). (= connection for fuel return line and pressure gauge).
8	All screw connections must be marked with locking paint.

- connection for return line to the tank: Ø outside 7 mm (0.28 in), slip-on length: max. 17 mm (0.67 in)
- connection to the pressure gauge: Ø outside 6 mm (0.24 in), slip-on length: max. 17 mm (0.67 in)

NOTE

Do not get the connections mixed up.

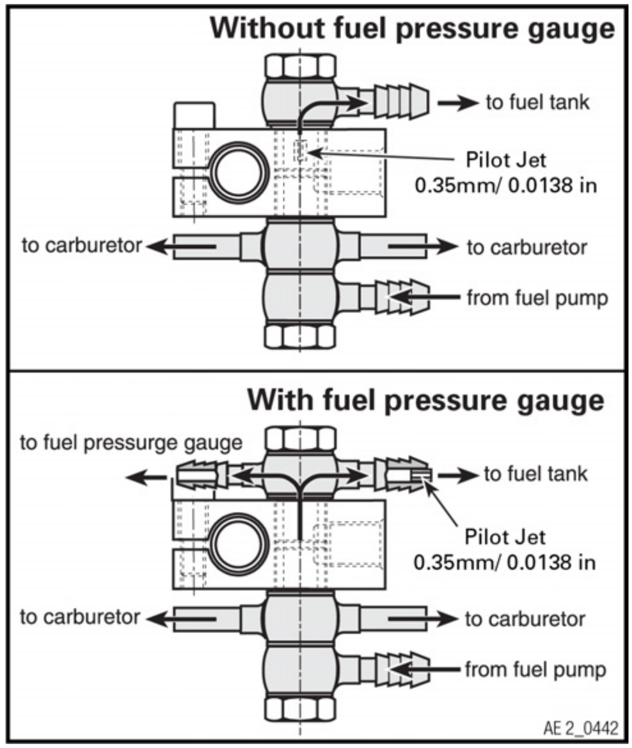

Figure 14.40

Step	Procedure
9	Install fuel hose assy. with cable clamp 12/M8 , hex. nut M8 and LOCTITE 243 on intake manifold (on both sides).
10	Connect fuel line assy. with cable tie on compensating tube (on both sides) so tight, that there is no space between.

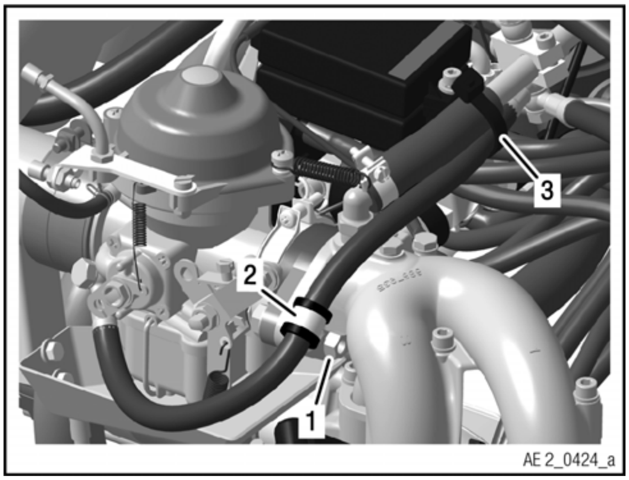

Figure 14.41

1	*Hex. nut M8*	2	*Cable clamp 12/M8*
3	*Cable tie*		

FUEL LINE — INSTALLATION (914 SERIES)

NOTICE

When tightening the fuel lines, observe that no force or torque applies to the fuel pressure regulator.

NOTICE

When fitting fuel lines, support them adequately to avoid strain or additional load.

Step	Procedure
1	If necessary, install fuel line connector with new gasket ring A8x13 onto carburetor (on both sides). Tightening torque 10 Nm (89 in. lb).
2	Attach fuel line to carburetor (fuel inlet) with collar nut.
3	Support the fuel line on carburetor bracket with a cable clamp attached with an Allen screw M5x12 and new lock nut M5.
4	Now, tighten the collar nut. Tightening torque 10 Nm (89 in. lb)
5	Attach the fuel line to the fuel pressure regulator with banjo bolt M10x1x19 and sealing ring 10x14. Tightening torque 15 Nm (133 in.lb)
6	Repeat process on the other side.
7	Reconnect plug connection to the throttle potentiometer. (carburetor 2/4 only)
8	Check plug connection for security reason, see Chapter 76-70-00 Sensors and actuators.

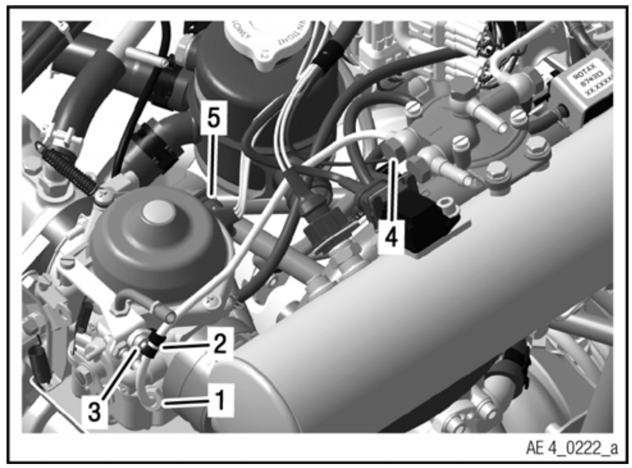

Figure 14.42

1	*Collar nut*	2	*Cable clamp*
3	*Allen screw M5x12 with lock nut M5*	4	*Banjo bolt M10x1x19 with sealing ring 10x14*
5	*Throttle potentiometer*		

PRESSURE CONNECTION LINES — INSTALLATION (914 SERIES ONLY)

⚠ CAUTION

Check for safety reasons.
Check all connection lines and T-fittings for damage and leakage and that all connections are secured with clamps.

NOTE

If the lines have been detached or replaced, connect them correctly.

NOTE

Before mounting the pressure connection lines, install the clamps 8.

Step	Procedure
1	Install T-fitting to three-way solenoid valve with hose 40 mm (1.57 in.). **NOTE** *All connection lines must be routed in such a way, that scuffing and kinks are avoided.*
2	Install T-fitting to float chamber venting of carburetor 1/3 with hose 235 mm (9.25 in.) and spiral hose 225 mm (8.86 in.).
3	Install T-fitting to float chamber venting of carburetor 2/4 with hose 270 mm (10.63 in.) and spiral hose 270 mm (10.63 in.).
4	Install hose 145 mm (5.7 in.) from three-way solenoid valve to hose nipple M6 on air intake hose side and spiral hose 125 mm (4.92 in.).
5	Install hose 190 mm (7.48 in.) from three-way solenoid valve to hose nipple M6 next to the air pressure sensor and spiral hose 165 mm (6.5 in.).

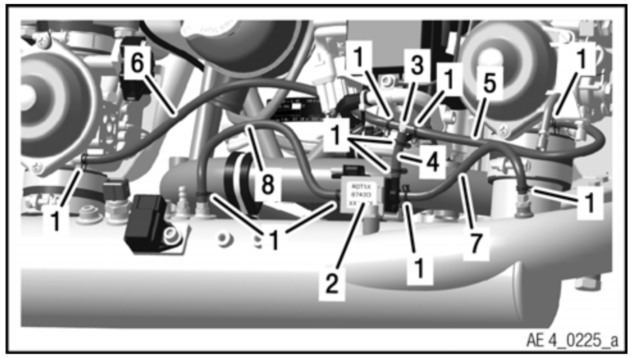

Figure 14.43

1	*Clamp 8*	2	*three-way solenoid valve*
3	*T-fitting*	4	*Hose 40 mm / 1.57 in.*
5	*Hose 235 mm / 9.25 in.*	6	*Hose 270 mm / 10.63 in.*
7	*Hose 145 mm / 5.7 in.*	8	*Hose 190 mm / 7.48 in.*

Step	Procedure
6	If necessary, install hose 160 mm (6.3 in.) from fuel pressure regulator to hose nipple M6 next to the temperature sensor and spiral hose 130 mm (5.12 in.).
7	Ensure that the full slip-on length is used for all pressure connection lines and that the clamps 8 are fixed securely.

FINISHING WORK

- Reconnect plug connections to temperature sensor, pressure sensor and throttle potentiometer.
- Check that the plug connections are attached securely, see Chapter 76-70-00 Sensors and actuators.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Carburetor synchronization.
See current Maintenance Manual Line (MML) for the respective engine type.

Idle speed adjustment.
See current Maintenance Manual Line (MML) for the respective engine type.

Throttle cable and linkage.
See current Maintenance Manual Line (MML) for the respective engine type.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

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Chapter: 74–00–00
IGNITION UNIT

TOPICS IN THIS CHAPTER

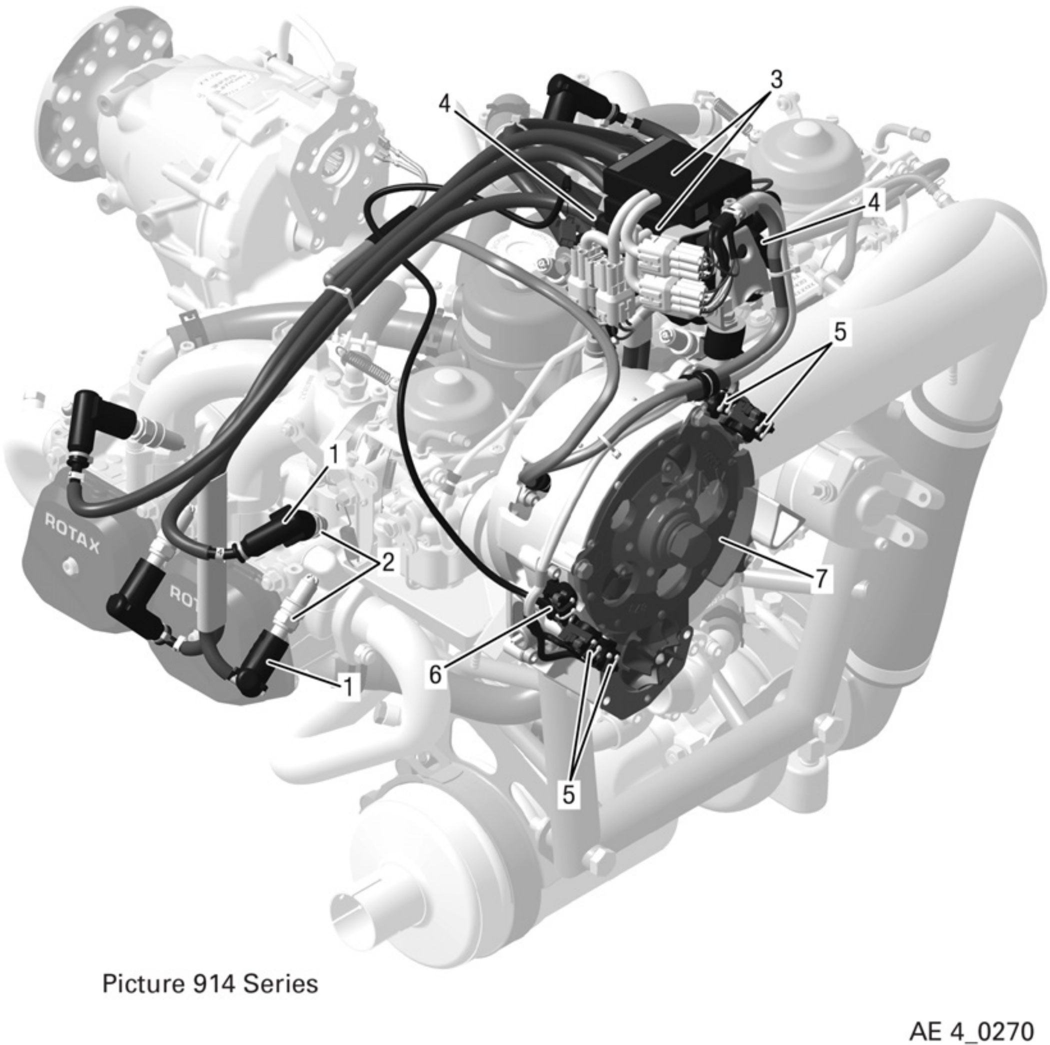

Figure 15.1

1	*Spark plug socket*	*2*	*Spark plug*
3	*SMD- Electronic module*	*4*	*Double ignition coil assy.*
5	*Trigger coil*	*6*	*Trigger coil (rev counter)*
7	*Fly wheel hub with magneto ring*		

SYSTEM DESCRIPTION

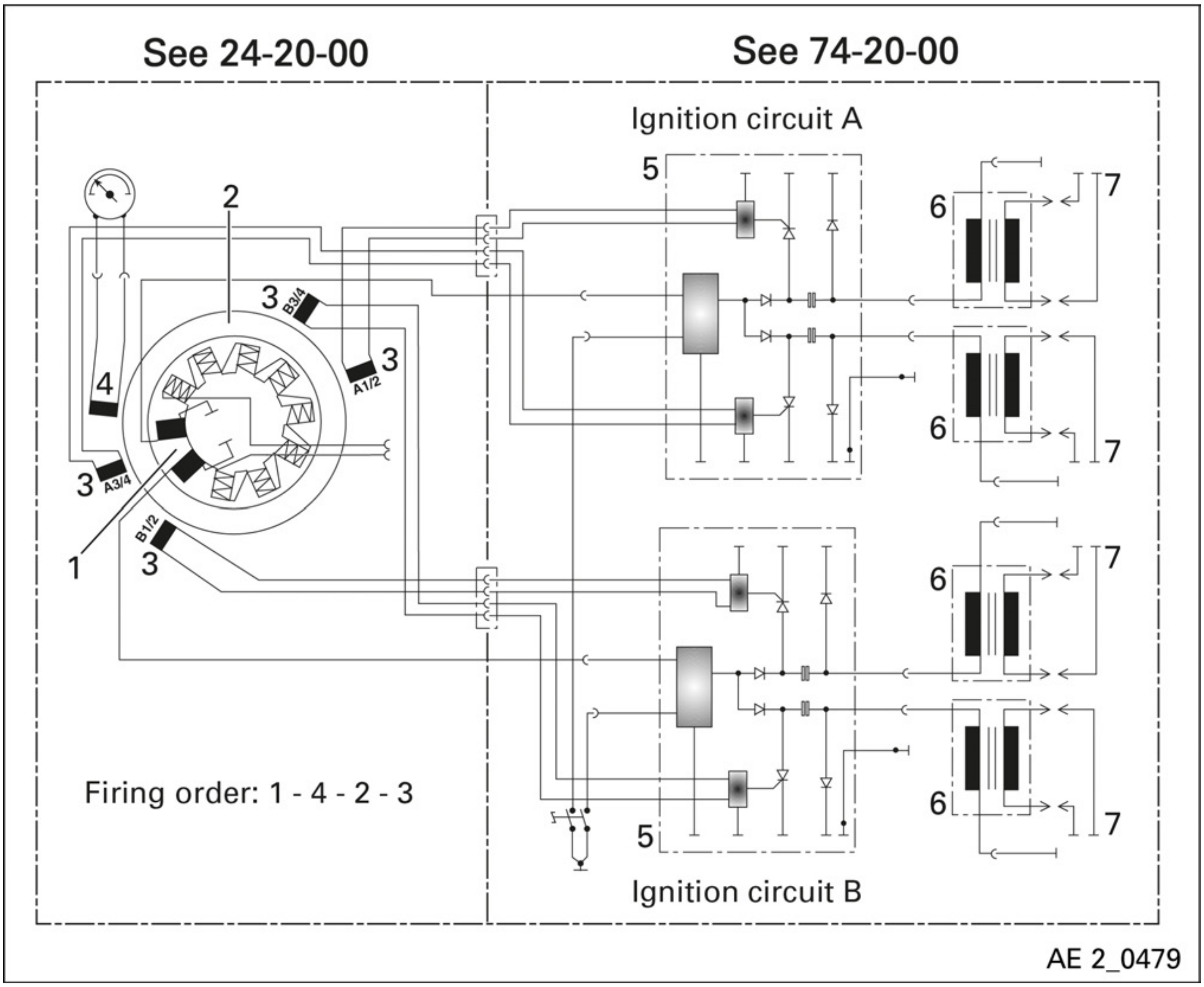

Figure 15.2

1	*Charging coils*	2	*Ignition magneto generator*
3	*Trigger coils*	4	*Electronic rev counter*
5	*SMD- Electronic module*	6	*Double ignition coil assy.*
7	*Spark plug*		

See Chapter 24-20-00 section Internal generator and Chapter 74-20-00 Distribution.

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

NOTICE
Follow the instructions in the installation manual regarding connections for instrumentation.

MEASUREMENTS

CUT-IN SPEED OF IGNITION

NOTE

A precise inspection of the complete ignition unit is only possible on an ignition test bench with an oscilloscope. This is especially important if failure occurs intermittently. In this case, send the complete ignition unit to an authorized overhaul facility.

NOTE

Ignition must cut-in between 150 rpm and max. 220 rpm of crankshaft speed to be checked with stroboscope and inductive pliers.

Step	Procedure
1	Connect stroboscope to battery.
2	Clamp inductive pliers to the ignition cable of cylinder 1 (top) or cylinder 2 (top). These two spark plugs are actuated by the trigger coil A1/2.
3	Engage and increase rpm slowly on the test bench.
4	Aim stroboscope towards trigger coil A1/2 and observe flashing light.

The procedure should be performed on all ignition cables.

IGNITION TIMING CONTROL

- The automatic ignition timing is actuated by the trigger cam of ignition circuit A or trigger cam of ignition circuit B.
- Transition from start ignition timing to operating ignition timing takes place from 650 rpm upwards.
- Inspection is carried out with a stroboscope and induction pliers.
- The ignition timing control must be carried out on all 4 trigger coils, paying attention to the corresponding ignition cable.

Step	Procedure
1	Connect stroboscope to battery.
2	Clamp inductive pliers to the ignition cable of cylinder **1 top**. These spark plug is actuated by the trigger coil **A1/2**.
3	At an engine speed of 150 to max. 1000 rpm, the trailing edge of the trigger cam aligns with the core of the trigger coil.
4	After transition from start ignition timing to operating ignition timing, the leading edge of the trigger cam aligns with the core of the trigger coil.

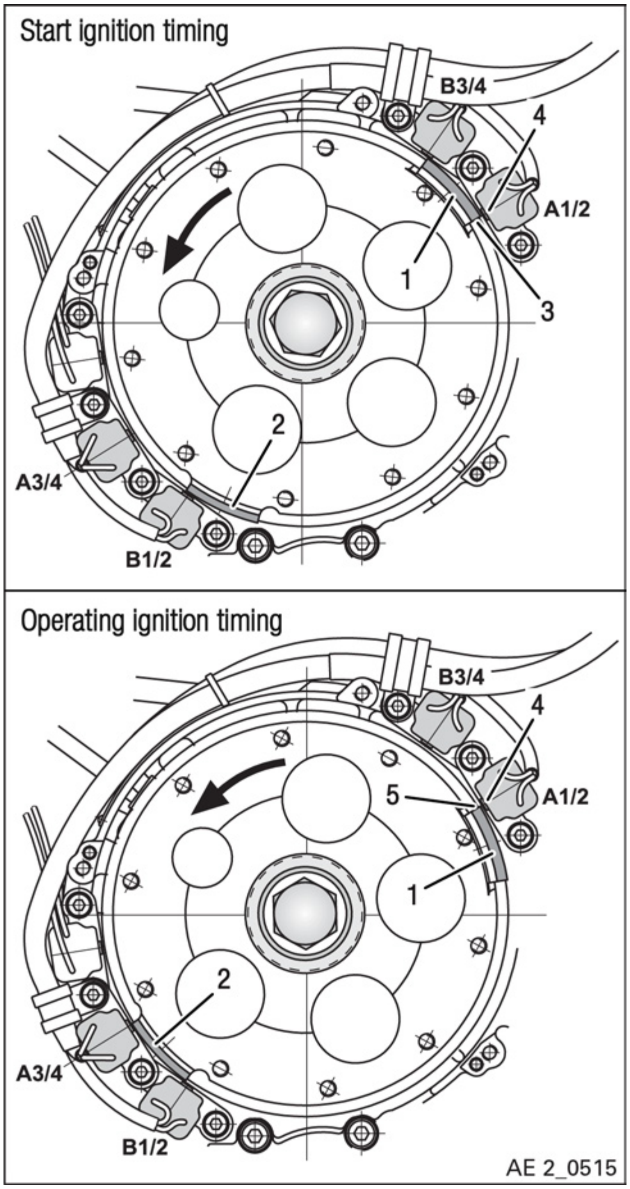

Figure 15.3: Start ignition timing

1	*Trigger cam of ignition circuit **A***	*2*	*Trigger cam of ignition circuit **B***
3	*Edge of the trigger cam*	*4*	*Core of the trigger coil*
5	*Edge of the trigger cam*		

Trigger coil assignation 912 Series

Trigger coil A1/2 serves the top spark plug of cylinder 1 and 2.
Trigger coil A3/4 serves the bottom spark plug of cylinder 3 and 4.
Trigger coil B1/2 serves the bottom spark plug of cylinder 1 and 2.
Trigger coil B3/4 serves the top spark plug of cylinder 3 and 4.

Trigger coil assignation 914 Series

Trigger coil A1/2 serves the top spark plug of cylinder 1 and 2.
Trigger coil A3/4 serves the top spark plug of cylinder 3 and 4.
Trigger coil B1/2 serves the bottom spark plug of cylinder 1 and 2.
Trigger coil B3/4 serves the bottom spark plug of cylinder 3 and 4.

IGNITION CIRCUITS INSPECTION (IGNITION CHECK)

NOTE

The ignition check is performed at an engine speed of approx. 4000 rpm (approx. 1700 propeller speed).

Step	Procedure
1	Let engine warm up.
2	Switch off ignition circuit **A** with ignition switch. This causes only 1 spark plug per cylinder to fire.
3	912 Series only: The speed drop with only one spark plug per cylinder must not exceed 300 rpm. 914 Series only: The speed drop with only one spark plug per cylinder must not exceed 500 rpm.
4	Then perform the same inspection with ignition circuit **B** switched off.

Step	Procedure
5	912 Series only: Here, too, the speed drop must not exceed 300 rpm. 914 Series only: Here, too, the speed drop must not exceed 500 rpm.

Step	Procedure
6	912 Series only: The difference in speed using only circuit A or B must not exceed 115 rpm. 914 Series only: The difference in speed using only circuit A or B must not exceed 150 rpm.

MEASUREMENT VALUES OF THE IGNITION UNIT

The following measurement values can be checked at the appropriate point after detaching the plug connections.

Description	Measuring points	Resistance
Generator coil (on stator)	yellow — yellow	0.1 Ω to 0.8 Ω
Generator coil	yellow — ground	Infinite
Charging coil (on stator)	red — ground	3.2 Ω to 4.5 Ω
Trigger coil	white/yellow — blue/yellow	220 Ω to 240 Ω
Primary side (double ignition coil)	white — blue	0.25 Ω to 0.35 Ω
Secondary side (double ignition coil)	high voltage — high voltage	5.0 kΩ to 7.6 kΩ
Secondary side Primary side	high voltage — blue	Infinite
Spark plug socket	spark plug connection — ignition cable connection	4.0 kΩ to 6.0 kΩ
Spark plug		3.0 kΩ to 9.0 kΩ

WIRING HARNESS

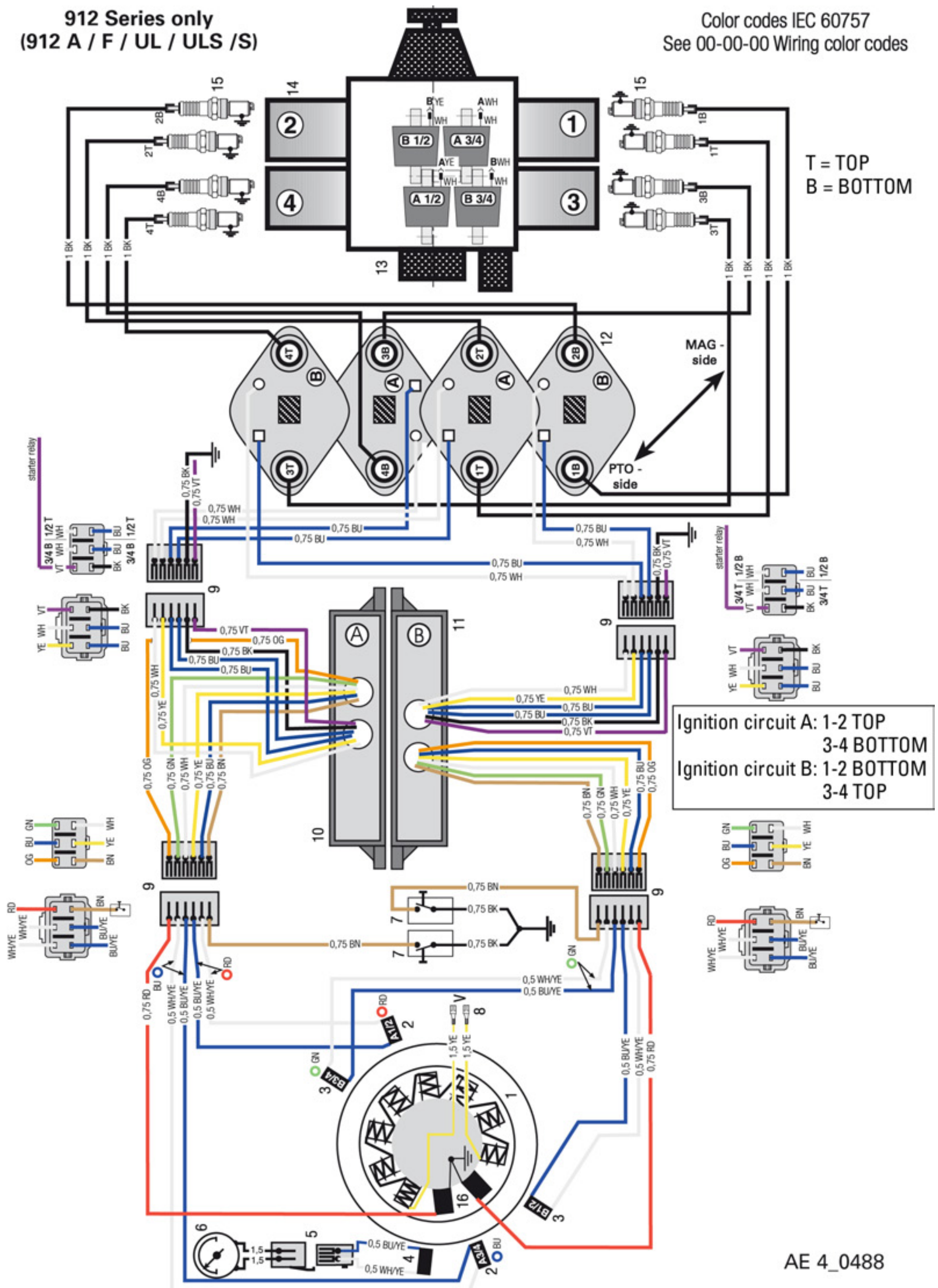

Figure 15.4

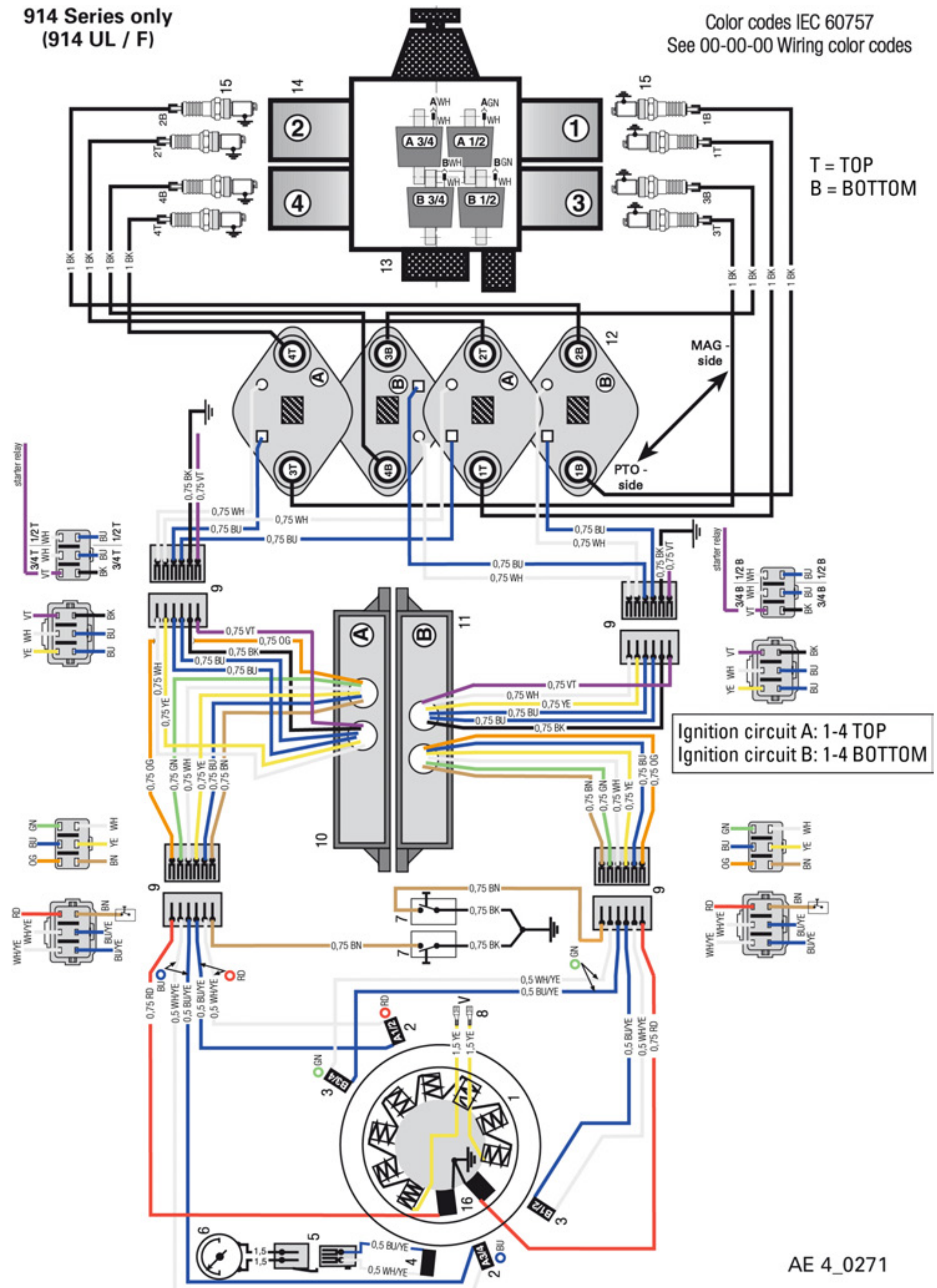

Figure 15.5

1	*Ignition magneto generator*	*2*	*Trigger coil for ignition circuit "A"*	*3*	*Trigger coil for ignition circuit "B"*
4	*Trigger coil for rev counter*	*5*	*Plug receptacle 2–pin*	*6*	*Electronic rev counter*

7	*Grounding switch for ignition circuit “A” and “B”*	8	*Plug receptacle 1–pin*	9	*Plug receptacle 6–pin*
10	*Electronic module for ignition circuit “A”*	11	*Electronic module for ignition circuit “B”*	12	*Double ignition coil*
13	*Engine*	14	*Cylinder 2 – 4*	15	*Spark plugs*
16	*Charging coils*	V	*Consumer connection*	o	*Color code*

Chapter: 74–20–00
DISTRIBUTION

TOPICS IN THIS CHAPTER

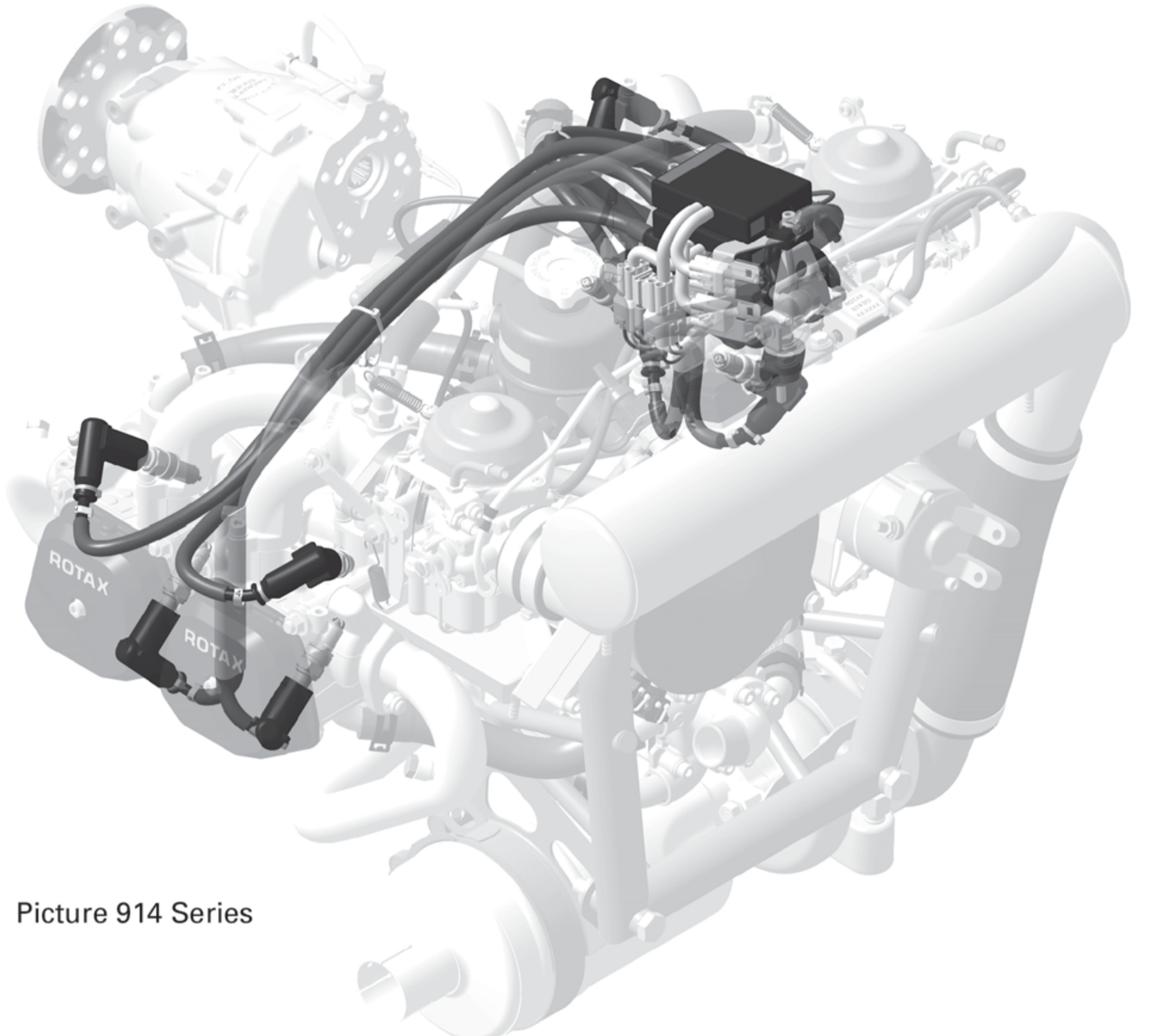

Figure 16.1

SPECIAL TOOLS

Description	Part number
PIN RELEASE TOOL	877500
Pull scale	n.a.
Stroboscope	n.a.

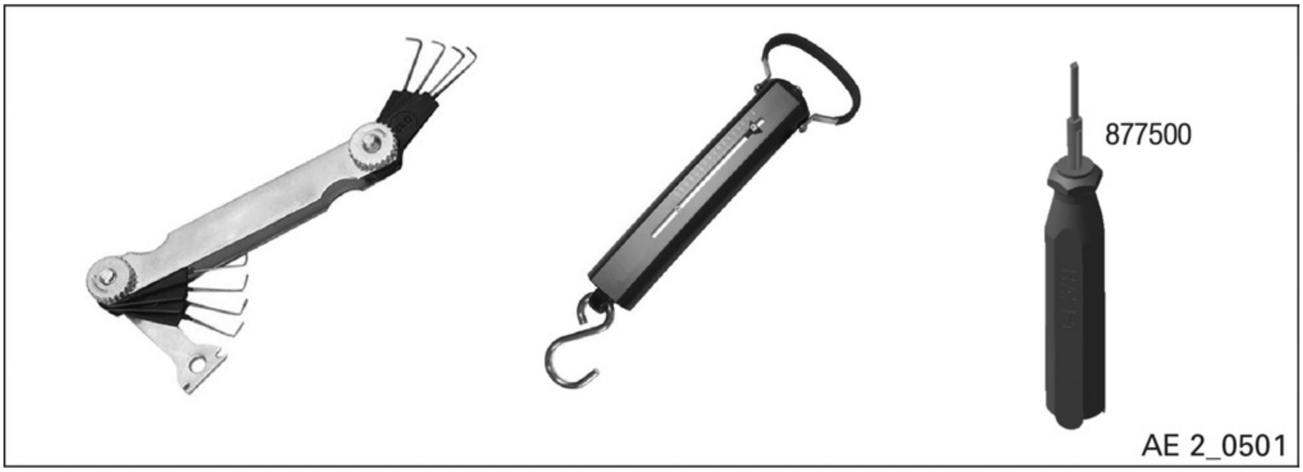

Figure 16.2: Special tools

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LITHIUM-BASE GREASE	897330
SILICONE HEAT COMPOUND WACKER P12	897186

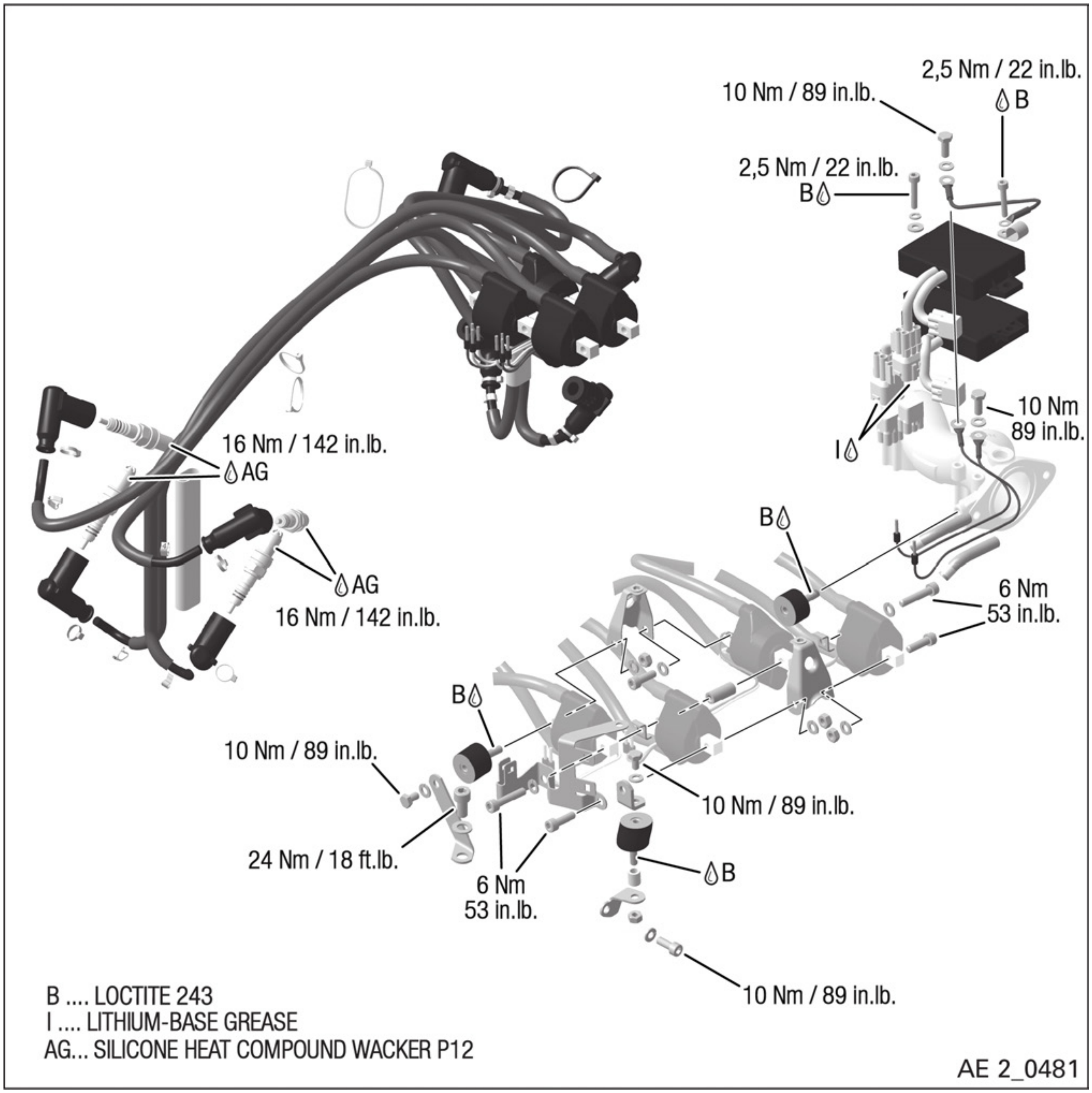
2,5 Nm / 22 in.lb.
B
10 Nm / 89 in.lb.
2,5 Nm / 22 in.lb.
B
10 Nm
89 in.lb.
I
16 Nm / 142 in.lb.
AG
B
AG
16 Nm / 142 in.lb.
6 Nm
53 in.lb.
B
10 Nm / 89 in.lb.
10 Nm / 89 in.lb.
24 Nm / 18 ft.lb.
6 Nm
53 in.lb.
B
10 Nm / 89 in.lb.
B .... LOCTITE 243
I .... LITHIUM-BASE GREASE
AG... SILICONE HEAT COMPOUND WACKER P12
AE 2_0481

Figure 16.3

SYSTEM DESCRIPTION

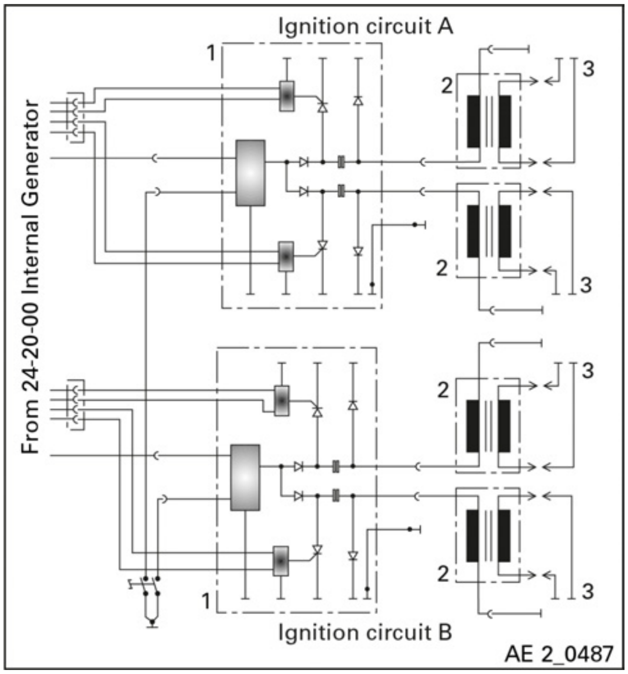

Figure 16.4

1	*SMD-electronic module*	2	*Double ignition coil assy.*
3	*Spark plug*		

The engine is equipped with double ignition of a breakerless capacitor discharge design (DCDI). That means that the ignition unit comprises two independently working ignition circuits (separate trigger coil, electronic module, charging coils, etc.).

NOTE

The SMD-electronic module cannot be disassembled and needs no adjustment.

Each ignition circuit consists of two ignition branches. Ignition occurs on cylinder 1 and 2 simultaneously every 360° as well as on cylinder 3 and 4 but 180° offset.

NOTE

Due to engine design, ignition occurs also at “the TDC of the exhaust stroke”, but this has no effect on engine operation.

The engine is furnished with an automatic ignition timing controlled by the edge of trigger cams on the fly wheel hub and the SMD-electronic modules.

NOTE

For easy engine start, the ignition timing at start is 3° A.T.D.C. for ignition circuit A and B.

As soon as the engine runs, the ignition point will change over automatically to operation ignition.
The transition from start ignition timing to the timing for operation takes place between 650 and 1000 rpm.
see installation manual, chapter 24–00–00 and SI-912–020 of the relevant engine type

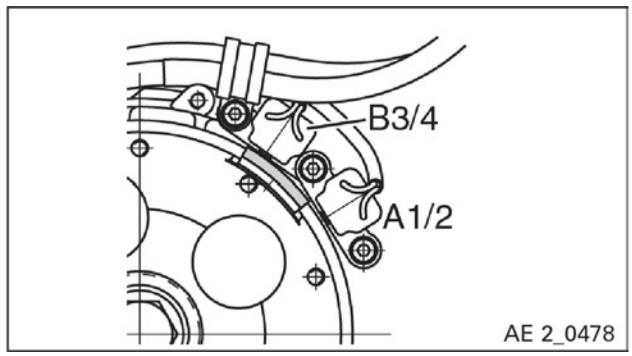

Figure 16.5

912 Series

	without advanced start	electronic module with advanced start
fly wheel hub		
ignition point at start 965444	3° After T.D.C	3° After T.D.C
time delay for ignition at start	none	3 – 8 sec.
switching to advanced ignition	from 650 to 1000 rpm depending on trigger gap	after the expiration of the time delay (3 – 8 sec.)
ignition timing in normal operation	Circuit A: 26° before T.D.C.	Circuit A: 26° before T.D.C.
	Circuit B: 26° before T.D.C.	Circuit B: 26° before T.D.C.

914 Series

	without advanced start	electronic module with advanced start
fly wheel hub		
ignition point at start 965442	3° After T.D.C	3° After T.D.C
time delay for ignition at start	none	3 – 8 sec.
switching to advanced ignition	from 650 to 1000 rpm depending on trigger gap	after the expiration of the time delay (3 – 8 sec.)
ignition timing in normal operation	Circuit A: 26° before T.D.C.	Circuit A: 26° before T.D.C.
	Circuit B: 22° before T.D.C.	Circuit B: 22° before T.D.C.

NOTE

The different ignition points for the top spark plugs and the bottom spark plugs takes into account the differing ignition delays, preventing preignition and detonation.
The difference in the ignition points is achieved by different lengths of the trigger cam on the fly wheel hub.
Trigger cam for ignition circuit A (raised position) is approx. 4 mm (0.16 in.) longer.

FIRING ORDER

1–4–2–3

INTERNAL GENERATORS

See Chapter 24-20-00 section Internal generator.

IGNITION ASSY.

The ignition assy., consisting of 2 electronic modules and 4 double ignition coils assy., is fitted into the engine on 3 rubber buffers.

Double ignition coils assy.
The upper trigger coils A1/2 and A3/4 (raised approx. 5 mm (0.20 in.)) control the top electronic module. I. e.
Ignition circuit A: top trigger coil – top SMD-electronic module
Ignition circuit B: bottom trigger coil – bottom SMD-electronic module
See chapter 74–20–00 Section Ignition timing control.

Ignition cable
The 8 ignition cables on the spark plug connectors are marked with number 1 through 4 for cylinder assignment. 2 cables each for the bottom spark plugs are routed together in a protection hose between the cylinder heads.

NOTE

The bottom ignition cables can only be routed into position without spark plug connector.

The ignition cables are screwed into the dual ignition coil and the spark plug connector, thus enabling easy replacement.

The cable ends are equipped with identification rings. The ignition cables for the bottom spark plugs are protected by a glass fiber/silicone protection hose. Take care not to lose the ignition cable identification rings.

SMD-Electronic module
The modules are interchangeable as they are of the same design.

SPARK PLUGS

The spark plugs are not shielded but use a resistance type suppressor to prevent interference.

SAFETY INFORMATION

⚠ WARNING

Danger of electric shock! Switch off the ignition and pull out the ignition key! Disconnect the negative terminal of the battery.

⚠ 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 Chapter 00-00-00, section Safety Information.

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line for the respective engine type.

REMOVAL

Preparation

General visual inspection.
See Maintenance Manual Line (MML) for the respective engine type.

Engine cleaning.
See Maintenance Manual Line (MML) for the respective engine type.

Carry out an engine test run.
See Maintenance Manual Line (MML) for the respective engine type.

NOTE

Some work can only be carried out on the whole unit!

SMD-ELECTRONIC MODULE — REMOVAL

Step	Procedure
1	Unscrew Allen screws with lock washer and washer and Allen screw with cable clamp and grounding cable for SMD-electronic module.
2	Mark the two plug connection of the trigger coil wires and red charging wires.
3	Remove connectors (SMD-electronic modules) from the connector bracket.
4	Unplug connection between SMD-electronic modules and double ignition coils and trigger coil wires and red charging wires.

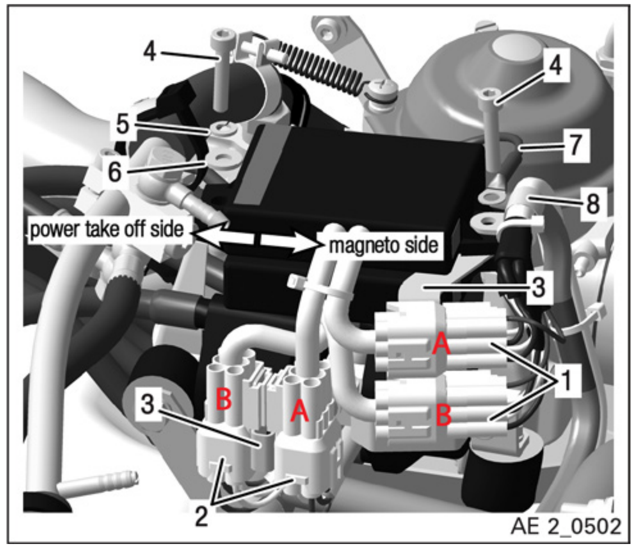

Figure 16.6

1	*Connection between SMD-electronic modules and trigger coil wires and red charging wires.*	2	*Connection between SMD-electronic modules and double ignition coils*
3	*Connector bracket*	4	*Allen screw*
5	*Lock washer*	6	*Washer*
7	*Grounding cable*	8	*Cable clamp*

IGNITION ASSY. – REMOVAL

Preparation

- Remove Fuel lines, see Chapter 73–10–00..
- Remove Airbox, see Chapter 73–10–00.
- Remove Carburetor, see Chapter 73–10–00.
- Remove Rubber flange, see Chapter 73–10–00.

NOTE

Before removal, mark all 8 ignition cables resp. check the correct application of the identification rings (1)-(2)-(3)-(4) of cylinders no. 1 through 4 to avoid mix-up at reassembly.

Step	Procedure
1	Detach all 8 spark plug socket from the spark plugs.
2	Cut the tie wraps for the 4 lower spark plug socket, unscrew the resistance spark plug connectors and draw the ignition cables with protection hose through the cylinder heads.

NOTE

Take care not to lose the ignition cable marking sleeves.

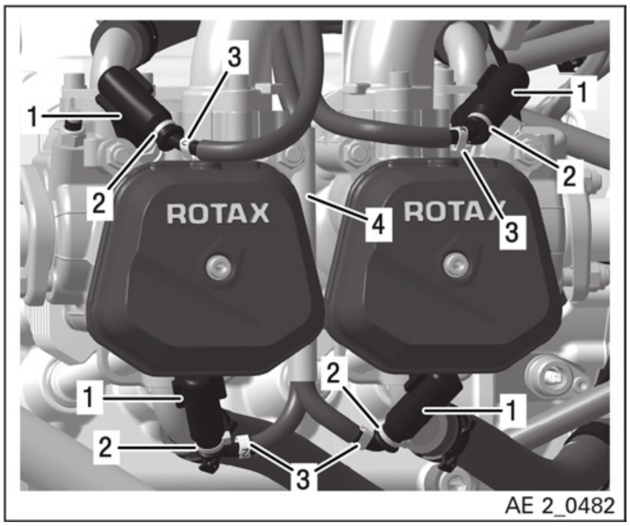

Figure 16.7

1	*Spark plug socket*	2	*Tie wraps*
3	*Marking sleeve*	4	*Protection hose*

NOTE

On engines with hydraulic propeller governor, it is necessary to also remove the resistance spark plug connectors of the 2 upper spark plugs of cylinders 2 and 4 to allow easy removal of the ignition cables.

Step	Procedure
3	Cut all tie wraps for ignition cable attachment.
4	Unscrew Allen screw at the SMD-electronic module and remove cable clamp and grounding cable.

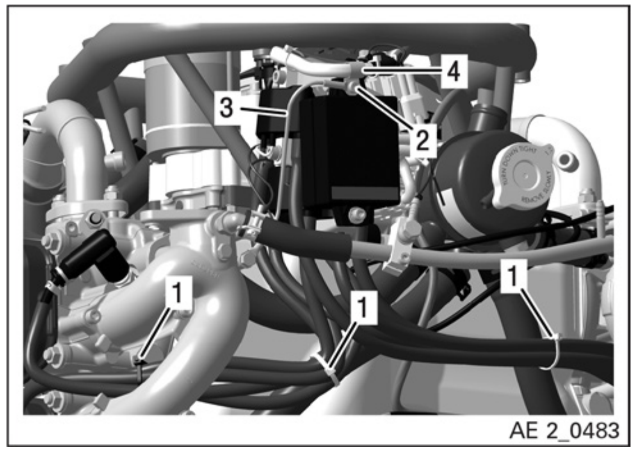

Figure 16.8

1	*Tie wrap*	2	*Allen screw*
3	*Grounding cable*	4	*Cable clamp*

Step	Procedure
5	Mark the two plug connection of the trigger coil wires and plug connection of the red charging cable and remove them from the connector bracket.
6	Unplug connection between SMD-electronic modules and red wires to internal generator.
7	Unscrew hex. nut and remove rubber buffer from the bracket. Remove the spacer.
8	Unscrew Allen screw with lock washer on crankcase.

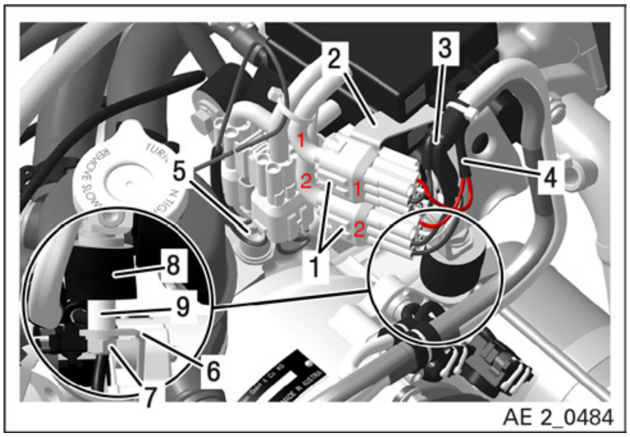

Figure 16.9

1	*Plug connection*	2	*Connector bracket*
3	*Trigger coil wires*	4	*Red charging wire*
5	*Allen screw with lock washer*	6	*Bracket*
7	*Hex. nut*	8	*Rubber buffer*
9	*Spacer*		

Step	Procedure
9	Remove 4 Allen screws M6 with washer from each of the two intake manifolds.
10	Now the 2 intake manifolds with O-rings, compensating tube and ignition assy. can be removed, proceeding with great care.
11	Plug all 4 intake apertures to avoid entry of foreign objects (protection plug part no. 860397)

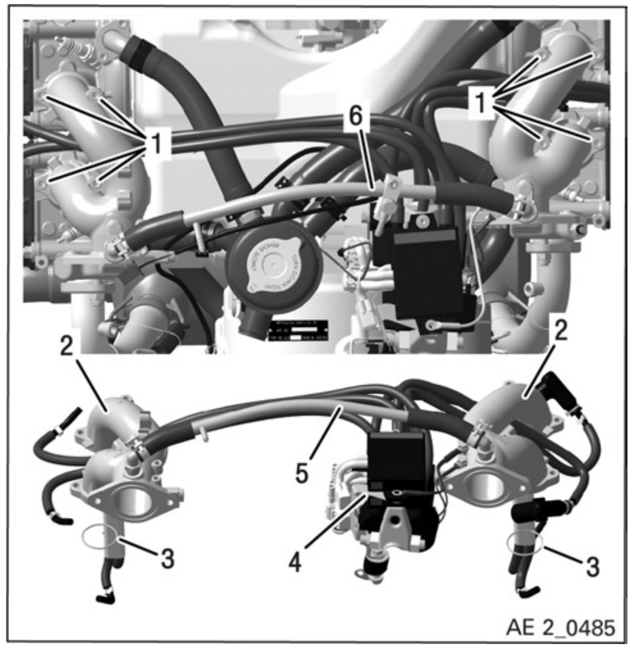

Figure 16.10

1	*Allen screw with washer*	2	*Intake manifold*
3	*O-ring*	4	*Ignition assy.*
5	*Compensating tube (914 Series)*	6	*Compensating tube (912 Series)*

SPARK PLUG — REMOVAL

Preparation

- Detach spark plug socket from the spark plug

NOTE

Before removal, mark all spark plug.

Step	Procedure
1	Remove spark plugs from the cylinder head.

NOTICE

Risk of damage to spark plugs!
The spark plugs must only be removed with a spark plug wrench!

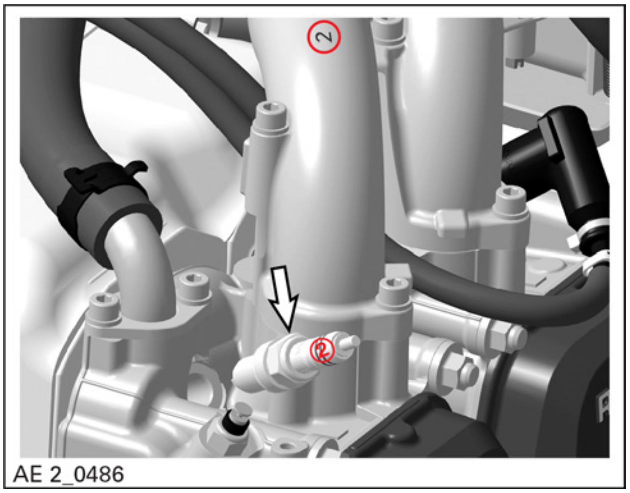

Figure 16.11

DISASSEMBLY

DOUBLE IGNITION COILS — DISASSEMBLY

NOTE

With the exception of the double ignition coil for spark plug 3 and 4 bottom, all are fitted in the same position, with boss upwards.

Preparation

- Remove SMD-electronic module

Step	Procedure
1	Cut the remaining tie wraps of the spark plug connectors.
2	Unscrew the spark plug connectors.
3	Remove hex. screws and lock washers from the intake manifold and the grounding cables of SMD-electronic modules and from the double ignition coils.

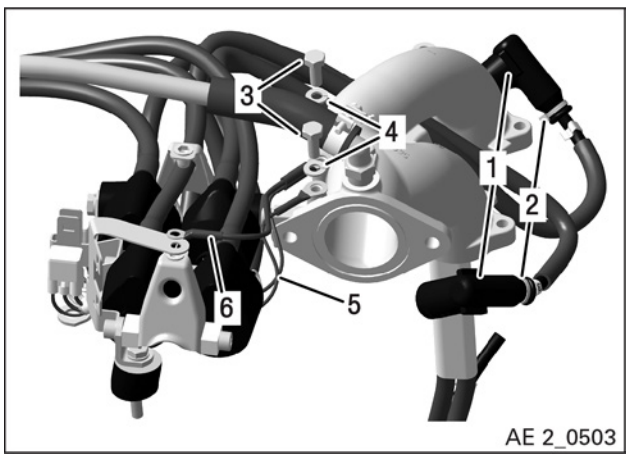

Figure 16.12

1	*Spark plug connector*	2	*Tie wrap*
3	*Hex. screw*	4	*Lock washer*
5	*Grounding cables (double ignition coils)*	6	*Grounding cable (SMD-electronic module)*

Step	Procedure
4	Remove hex. nut with lock washer and rubber buffer with bracket.
5	If necessary remove hex. screw with lock washer and bracket from rubber buffer.
6	Remove the Allen screw with lock washer from the rubber buffer on intake manifold.
7	Remove the ignition coil bracket assy.

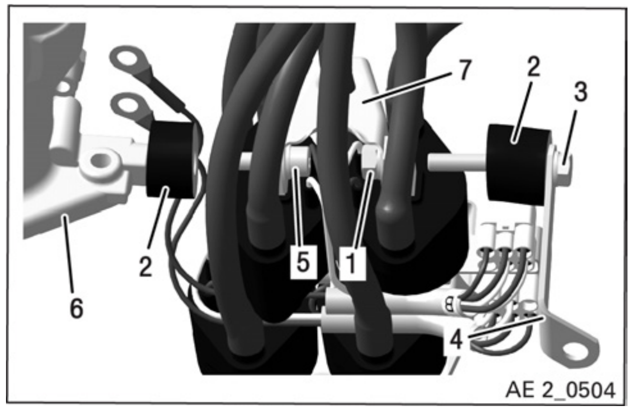

Figure 16.13

1	*Hex. nut with lock washer*	2	*Rubber buffer*
3	*Hex. screw with lock washer*	4	*Bracket*
5	*Allen screw with lock washer*	6	*Intake manifold*
7	*Ignition coil bracket assy.*		

Step	Procedure
8	If necessary remove hex. screw with lock washer and rubber buffer from ignition coil bracket.
9	Remove both Allen screws and ignition coil bracket assy. as well as lock washer and hex. nut.

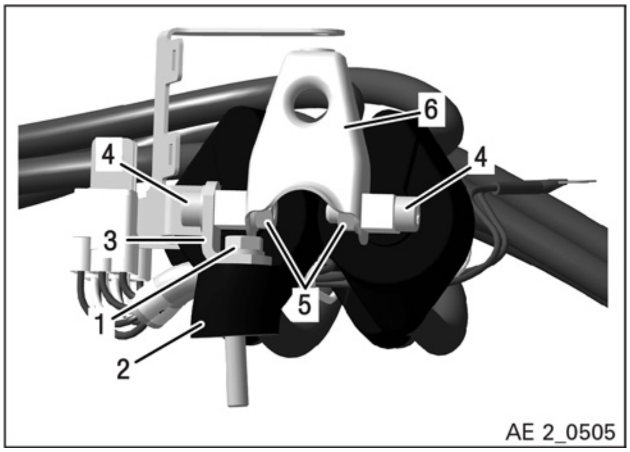

Figure 16.14

1	*Hex. screw with lock washer*	*2*	*Rubber buffer*
3	*Ignition coil bracket*	*4*	*Allen screw*
5	*Hex. nut with lock washer*	*6*	*Ignition coil bracket assy.*

Step	Procedure
10	Remove both Allen screws with lock washer from the distance nut and remove the connector bracket.
11	After detaching the double ignition coils with the separating plates the dual ignition coils can be replaced.
12	Release the corresponding cables (white/blue) from the connector housing using special pin release tool part no. 877500.

NOTE

The ignition cables are screwed in and therefore are replaceable.

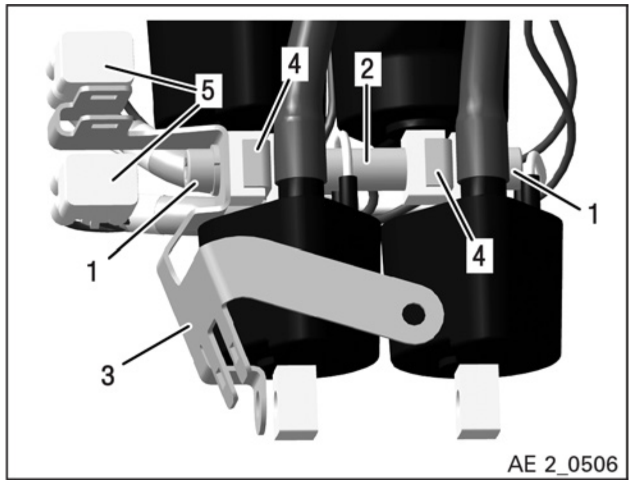

Figure 16.15

1	*Allen screw with lock washer*	*2*	*Distance nut*
3	*Connector bracket*	*4*	*Separating plate*
5	*Connector housing*		

INSPECTION

Components can only be replaced, not repaired. If the ignition spark fails, search systematically for the possible cause of the fault.

NOTE

A check of the complete ignition unit is only possible on an ignition test bench with an oscilloscope. This is especially important if failure occurs only intermittently. In this case, send the complete ignition unit to an authorized overhaul facility.

SPARK PLUG — INSPECTION

See Maintenance Manual Line for the engine type 912/914 Series Chapter 12-20-00 Inspection of spark plugs.

See Service Instruction SI-912–027/SI-914–028. current issue.

SPARK PLUG SOCKET AND IGNITION CABLES — INSPECTION

NOTICE

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 socket for corrosion and damage.
2	Check tight fit of spark plug socket on the spark plugs as shown in the maintenance overview. Assure security of the spark plug socket. Spark plug socket which are seated too loosely must be replaced.
3	Check minimum pull-off force of **30 N (7 lbf)**.
4	Check screw connection with the ignition cable and the tie wrap. If there is visible damage, replace spark plug socket.
5	Check correct connection of the ignition cables against the wiring diagram. See Chapter 74–00-00 Wiring harness
6	All ignition cables are covered by a protection hose — replace if there is visible damage.
7	Check all cables and their plug connections for damage, oxidation and tight fit.
8	Check MAG-switch wires and ignition switch.

⚠ WARNING

Proceed with particular care, because the ignition is not switched off.

Step	Procedure
9	Assure sufficient grounding between engine, battery and fuselage. Observe the fuselage manufacture’s wiring diagram.
10	Measure the resistance between spark plug connection and ignition cable connection.

Measuring points	Resistance
Spark plug connection – ignition cable connection	5 kΩ +/- 1 kΩ

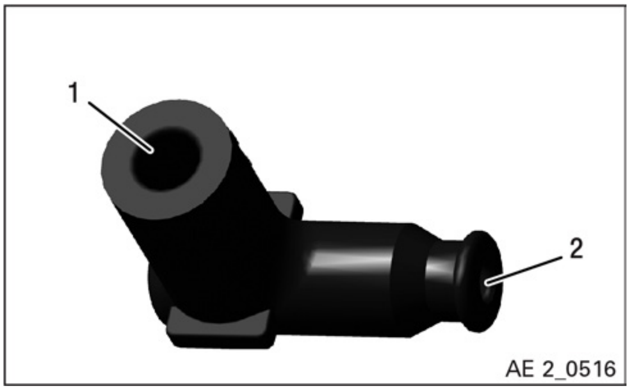

Figure 16.16

1	*Spark plug connection*	2	*Ignition cable connection*

SMD-ELECTRONIC MODULE — INSPECTION

NOTICE

On the 914 Series, the ignition points for circuit A and B differ from that on ROTAX® engine 912! For the troubleshooting on ignition circuit of the 914 Series, the two 6-pin plug connectors of the pick-up cables may be swapped over for localization of the fault, only for the purpose of testing and at low throttle, never at full throttle.

Step	Procedure
1	If the affected SMD-electronic modules is replaced without success, there is a fault in the charging coil or the trigger coils for this ignition circuit.
2	If the malfunction in the ignition circuit appears again when the SMD-electronic modules have been interchanged, there is a fault in the SMD-electronic modules.

DOUBLE IGNITION COIL — INSPECTION

Preparation

Carry out a general visual inspection:

- Corrosion or damage to the wiring, connector contacts or connections

Step	Procedure
1	Carry out visual inspection
2	Measure resistance on the primary side.
3	Measure resistance on the secondary side.
4	Measure resistance between primary and secondary side.

Measuring points	Resistance
Primary side	0.3 Ω +/- 0.05 Ω
Secondary side	6.3 kΩ +/- 1.3 kΩ
Between Primary side and Secondary side	Infinite

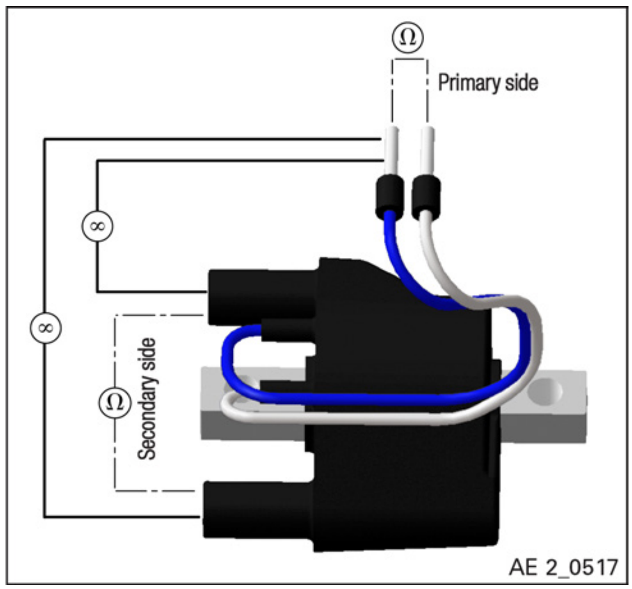

Figure 16.17: Connection double ignition coil

WEAR LIMITS

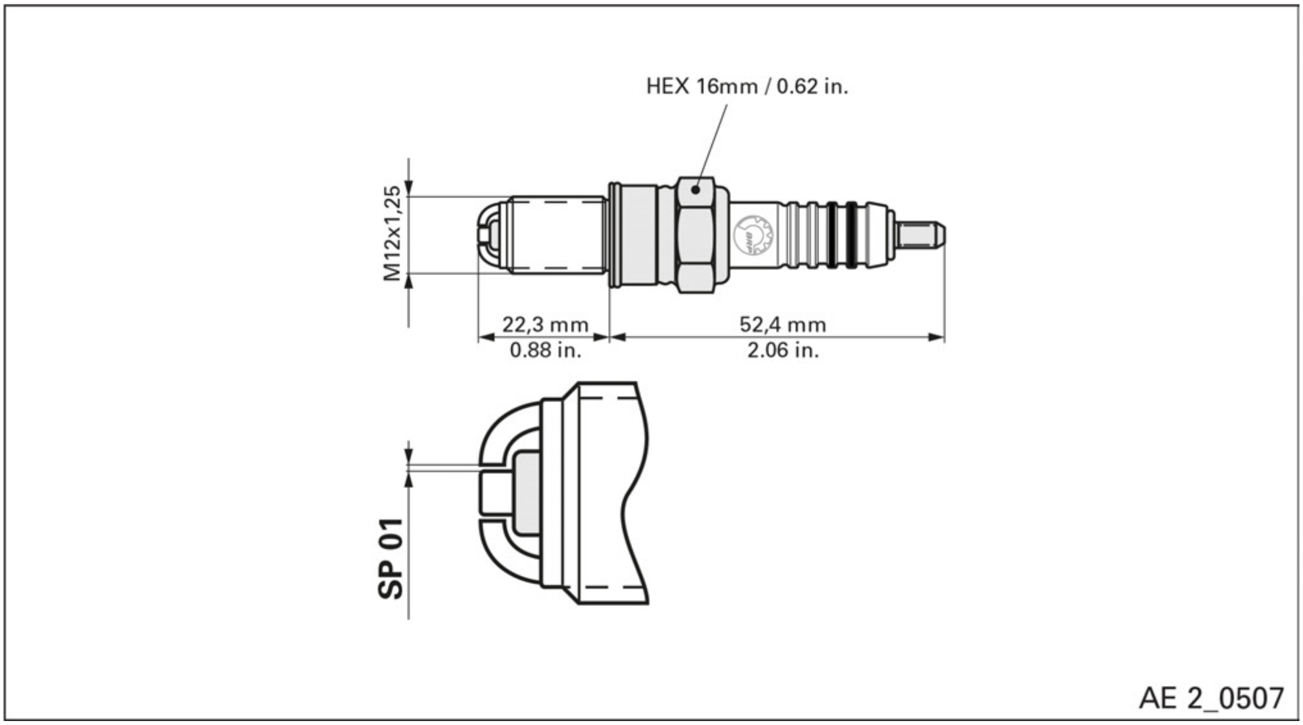

Figure 16.18: Spark plug

Description	Cod-e	Reading new		Wear limit		Readings	
		min	max	100 %	50 %		
Electrode gap	SP01	0.8 mm 0.031 in.	0.9 mm 0.035 in.	1.1 mm 0.043 in.	1.0 mm 0.039 in.	actual re-newed	

ASSEMBLY

IGNITION ASSY. — ASSEMBLY

NOTE

With the exception of the double ignition coil for spark plug 3 and 4 bottom, all are fitted in the same position, with boss upwards.

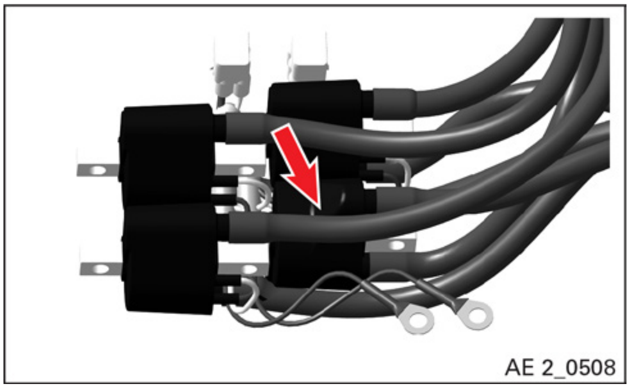

Figure 16.19

The correct cable lengths can be seen in the latest Illustrated Parts Catalog (IPC).

Step	Procedure
1	Screw corresponding ignition cables with protection hose onto the double ignition coils.
2	Attach the double ignition coils offset and in the correct position with separated plate and connector bracket slightly tightening, with the two Allen screws M6x30 and lock washers A6 with distance nut M6.

NOTE

Pay attention to the double ignition coil for spark plugs 3B and 4B. It must be fitted turned by 180° compared with the 3 other double ignition coils.

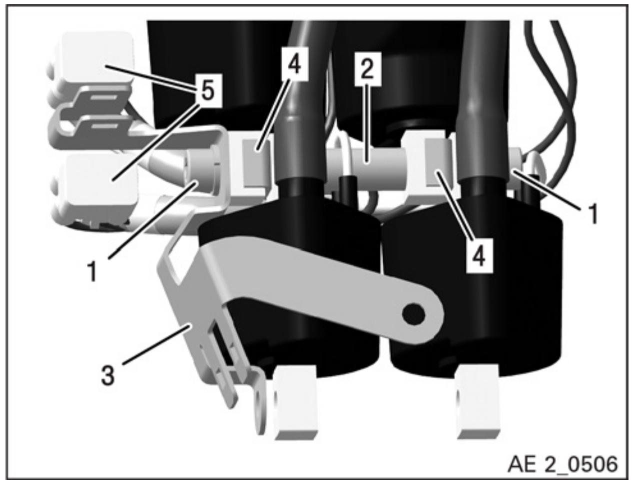

Figure 16.20

1	*Allen screw M6x30 with lock washer A6*	2	*Distance nut M6*
3	*Connector bracket*	4	*Separating plate*
5	*Double ignition coil (3B/4B)*		

Step	Procedure
3	Install the ignition coil bracket onto the rubber buffer with Hex screw M6x10 and lock washer A6. Tightening torque 10 Nm /89 in.lb. and LOCTITE 243.
4	With the two Allen screws M6x20, lock washer A6 and hex. nut M6 reassembly, first only slightly tightening, the ignition coil bracket assy., the ignition coil bracket, and the double ignition coils.

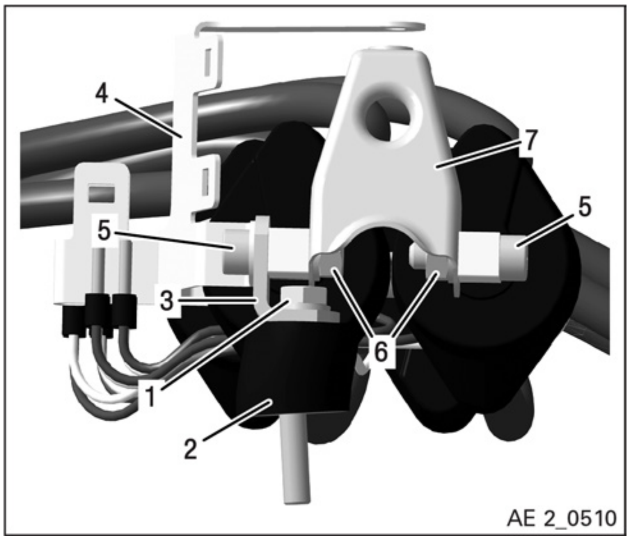

Figure 16.21

1	*Hex. screw M6x10 with lock washer A6*	2	*Rubber buffer*
3	*Ignition coil bracket*	4	*Connector bracket*
5	*Allen screw M6x20*	6	*Hex. nut M6 with lock washer A6*
7	*Ignition coil bracket assy.*		

NOTE

When replacing the rubber buffer, secure it on the intake manifold with LOCTITE 243.

Step	Procedure
5	Insert ignition cable (2T) into the ignition coil bracket assy. and fit the double ignition coils slightly tightening on rubber buffer with the Allen screw M6x16 and lock washer A6.
6	Tighten ignition coil bracket assy. and rubber buffer with hex. nut M6 and lock washer A6. Apply LOCTITE 243.

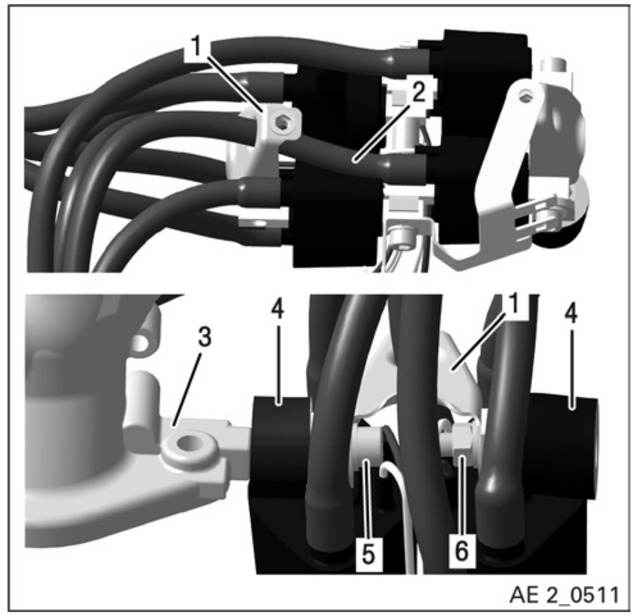

Figure 16.22

1	*Ignition coil bracket assy.*	2	*Ignition cable (2T)*
3	*Intake manifold*	4	*Rubber buffer*
5	*Allen screw M6x16 with lock washer A6*	6	*Hex. nut M6 with lock washer A6*

Step	Procedure
7	To achieve the correct distance, fit the two SMD-electronic modules on the ignition coil brackets assy. with Allen screws M5x25.
8	Now all attachment screws M5 for double ignition coils can be tightened. Tightening torque 6 Nm /53 in.lb..

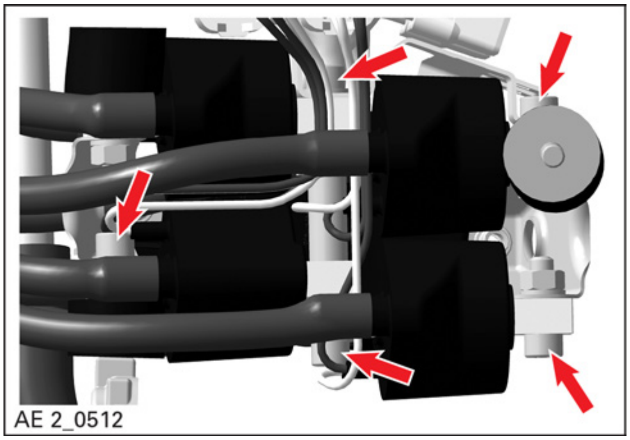

Figure 16.23: : Bottom view of double ignition coils

Step	Procedure
9	The Pins of the white/blue primary cables from the double ignition coils must be connected into the connector housing. See Chapter 74-00-00 Wiring harness.
10	Connect the black grounding cables into the connector housing, than route the grounding cables towards the intake manifold.

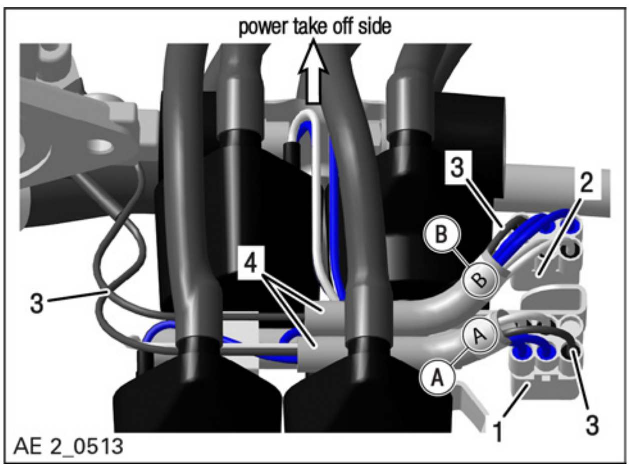

Figure 16.24: : Bottom view of double ignition coils

1 *Plug connection A*
2 *Plug connection B*
3 *Grounding cable*
4 *Sleeve*

Step	Procedure
11	Now engage the two 6–pin connector receptacles of the SMD-electronic modules in the connector bracket and fit the connector housing of the double ignition coils. Apply LITHIUM-BASE GREASE on connector.

NOTE

Pay attention to the correct attachment position A/B and the position on the connector bracket!

Plug connection A —> magneto side position
Plug connection B —> power take off side position

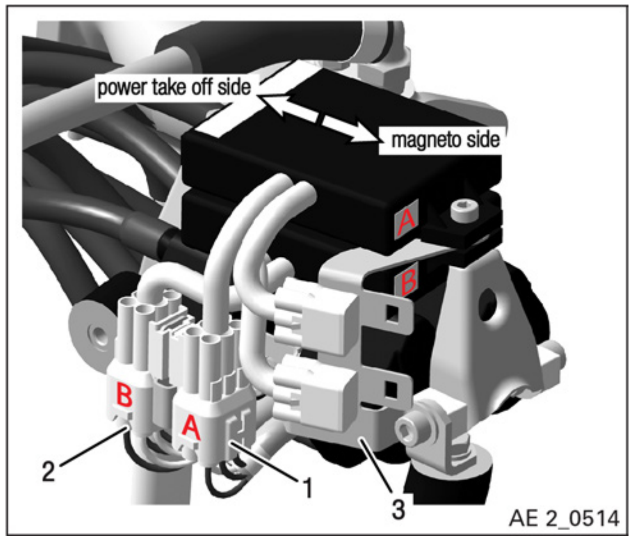

Figure 16.25

1 *Plug connection A*
2 *Plug connection B*
3 *Connector bracket*

INSTALLATION

SMD–ELECTRONIC MODULE — INSTALLATION

NOTICE

The cable shielding must be fully inserted into the cable clamp to assure optimum grounding.

Step	Procedure
1	Install Allen screw M5x25 with lock washer A5 and washer A 5.5. Install Allen screw M5x25 with cable clamp 11.3/M5 and grounding cable for SMD-electronic module. Tightening torque 2.5 Nm (22 in. lb) and LOCTITE 243.
2	Plug connection between SMD–electronic modules and trigger coil wires and red charging wires. Apply LITHIUM-BASE GREASE on connectors.

NOTE

Ensure that they are plugged in the correct position on the connector bracket.
Plug connection A —> “top”
Plug connection B —> “bottom”

Step	Procedure
3	Insert connectors (SMD-electronic module) into the connector bracket.
4	Plug connection between SMD-electronic modules and double ignition coils. Apply LITHIUM-BASE GREASE on connectors.

NOTE

Pay attention to the correct attachment position. A/B and the position on the connector bracket!
Plug connection A —> magneto side position
Plug connection B —> power take off side position

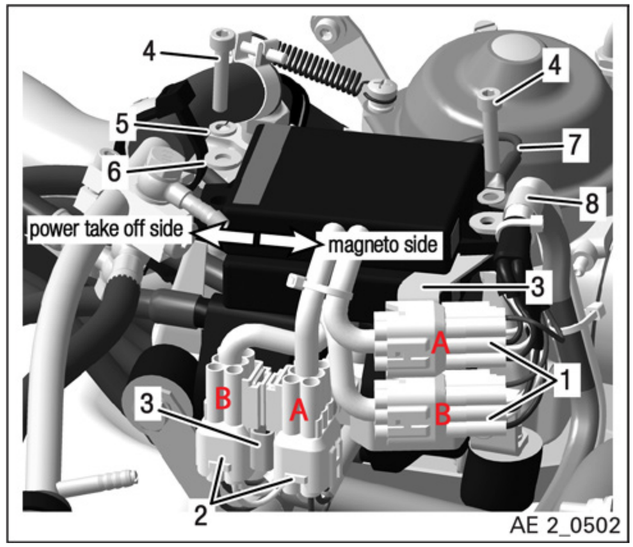

Figure 16.26

1	*Connection between SMD-electronic modules and trigger coil wires and red charging (stator) wires*	2	*Connection between SMD-electronic modules and double ignition coils*
3	*Connector bracket*	4	*Allen screw M5x25*
5	*Lock washer A5*	6	*Washer A 5.5*
7	*Grounding cable*	8	*Cable clamp 11.3/M5*

SPARK PLUG — INSTALLATION

NOTICE

Risk of damage to spark plugs!
The spark plugs must only be removed with a spark plug wrench!

Step	Procedure
1	Apply a small amount of SILICONE heat compound WACKER P12 from the 3rd to 6th thread of each spark plug and install them (when the engine is cold) in the corresponding cylinder head. Tightening torque 16 Nm (142 in. lb).

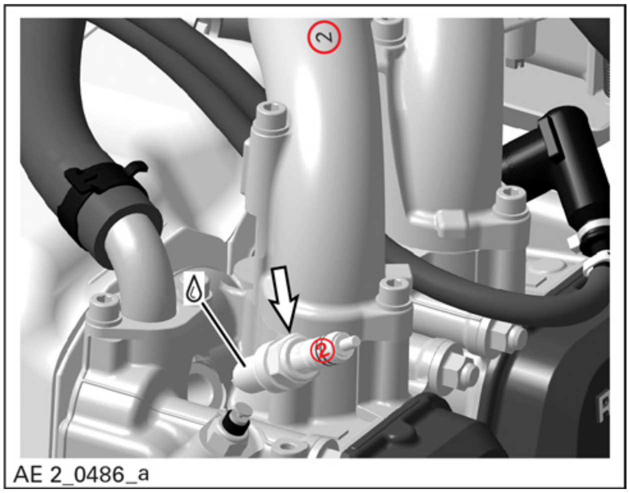

Figure 16.27

IGNITION ASSY. — INSTALLATION

Step	Procedure
1	Remove plugs (part no. 860397) from the intake openings and insert O-rings 34x2 lubricated with LITHIUM-BASE GREASE in the groove of the cylinder heads.
2	Fit both intake manifolds with pre-assembled ignition assy. and tighten crosswise with 4 Allen screws M6x25/70 and lock washers. Tightening torque 10 Nm (89 in. lb).

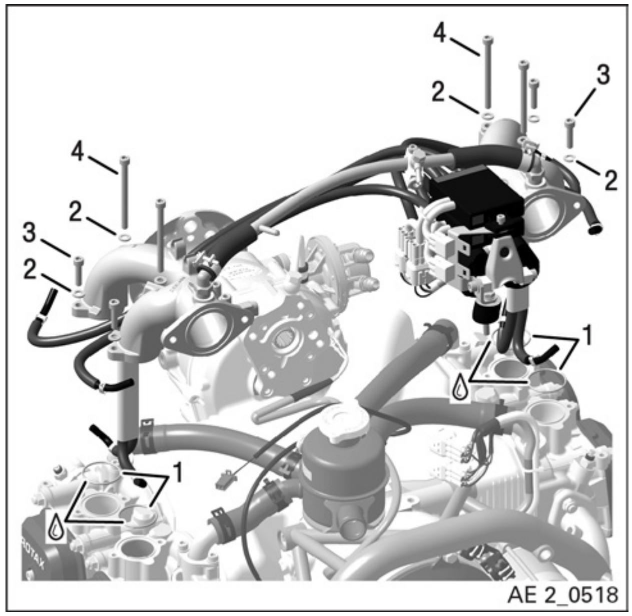

Figure 16.28

1	*O-ring 34x2*	2	*Lock washer A6*
3	*Allen screw M6x25*	4	*Allen screw M6x70*

Step	Procedure
3	Install spacer 6.5/10/11 on rubber buffer and insert. rubber buffer into bracket of ignition housing and tighten with hex. nut M6.
4	If necessary install bracket with hex screw M6x10 and lock washer A6 on to rubber buffer slightly tightening
5	Place bracket in position and fit ignition assy. on crankcase with Allen screw M8x10 and lock washer A8. Tightening torque 24 Nm (18 ft. lb).
6	Now tighten Hex. screw M6x10 with lock washer A6. Tightening torque 10 Nm (89 in. lb).
7	Engage both 6–pin connector for the pickup cables and charging cables into the connector bracket and insert the connector for the SMD-electronic modules. Apply LITHIUM-BASE GREASE on connector.

NOTE

The trigger coil wire of the ignition circuit A (top module) is marked at the end of the isolating hose with the colors blue and red. Those of the ignition circuit B (bottom module) are marked green and colorless (neutral) respectively.

NOTE

Ensure that they are plugged in in the correct position on the connector holder.

Plug connection A —> “top”
Plug connection B —> “bottom”

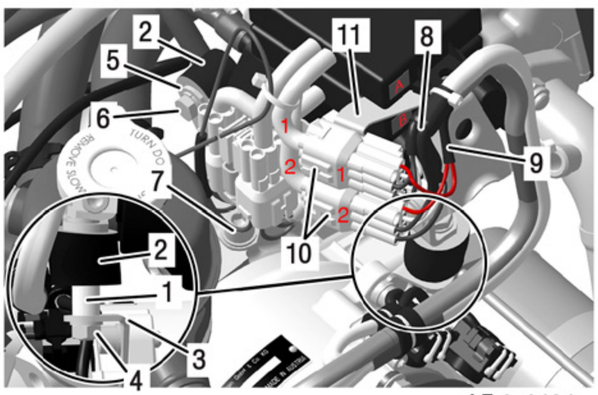

Figure 16.29

1	*Spacer 6.5/10/11*	2	*Rubber buffer*
3	*Bracket*	4	*Hex. nut M6*
5	*Bracket*	6	*Hex. screw M6x10 with lock washer A6*
7	*Allen screw M8x10 with lock washer A8*	8	*Pickup cables*
9	*Red charging wires*	10	*Connectors*
11	*Connector bracket*		

Step	Procedure
8	Fit grounding cables on the threaded holes at the intake manifold with hex. screw M6x16 and lock washer A6. Tightening torque 10 Nm (89 in. lb).
9	Unscrew Allen screws on SMD-electronic module.
10	Install Allen screw M5x25 with lock washer A5 and washer A5.5. Install Allen screw M5x25 with cable clamp 11.3/M5 and grounding cable for SMD-electronic module. Tightening torque 2.5 Nm (22 in. lb) and LOCTITE 243.

NOTICE

The cable shielding must be fully inserted into the cable clamp to assure optimum grounding.

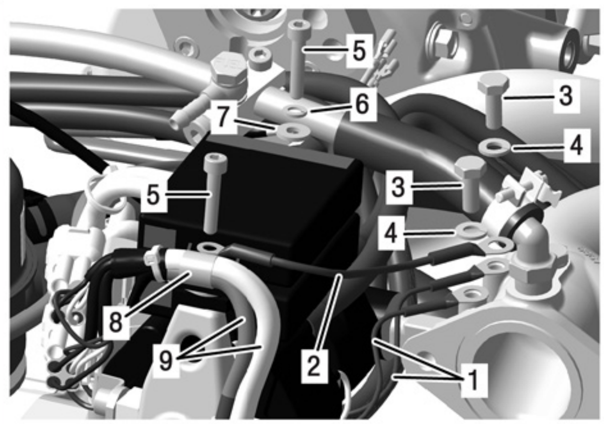

Figure 16.30

1	*Grounding cables (double ignition coil)*	2	*Grounding cable*
3	*Hex. screw M6x16*	4	*Lock washer A6*
5	*Allen screw M5x25*	6	*Lock washer A5*
7	*Washer A5.5*	8	*Cable clamp*
9	*Trigger coil wires and red charging wires*		

Step	Procedure
11	Fit two ignition cables for each of the lower spark plugs into the glass fiber/silicone protection hose and route them between cylinder heads.
12	Slide identification rings onto the ignition cables and screw spark plug connectors onto the ignition cables, secure with tie wraps and fit onto the spark plugs as shown in the wiring diagram. See Chapter Chapter 74–00–00 Wiring harness.
13	Attach 4 ignition cables each for cylinder 1–3 and 2–4 to the coolant hose with a tie wrap.
14	Attach 4 ignition cables for cylinder 1–3 with a new tie wrap, near the intake manifold.

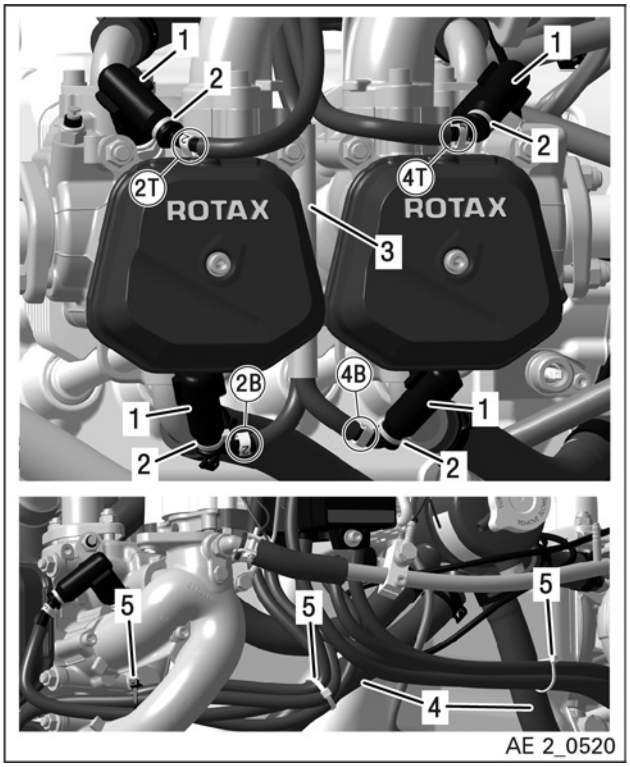

Figure 16.31

1 *Spark plug socket*
2 *Marking sleeve*
3 *Fiber/silicone protection hose*
4 *Protection hose*
5 *Tie wrap*

FINISHING WORK

- Installation of rubber flange, carburetors, airbox and fuel line, see Chapter Chapter 73–10–00.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

Chapter: 75–00–00
COOLING SYSTEM

TOPICS IN THIS CHAPTER

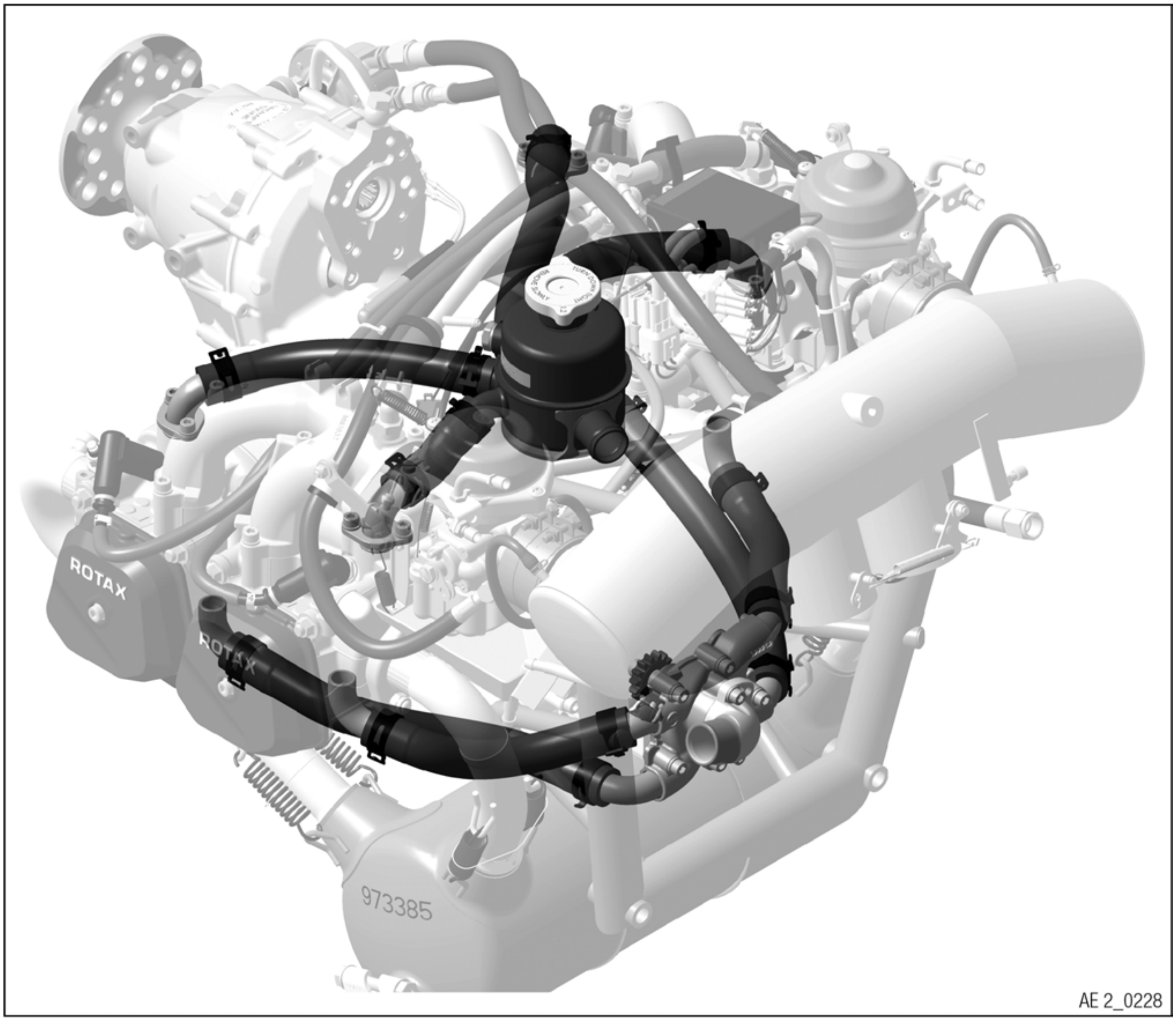

Figure 17.1: Position on the engine

SPECIAL TOOLS

Description	Part number
Spring clamp pliers	877840
Impeller wrench assy.	877295
Insertion jig	876510
Insertion jig	877258
Tapping drill M18x1	877570

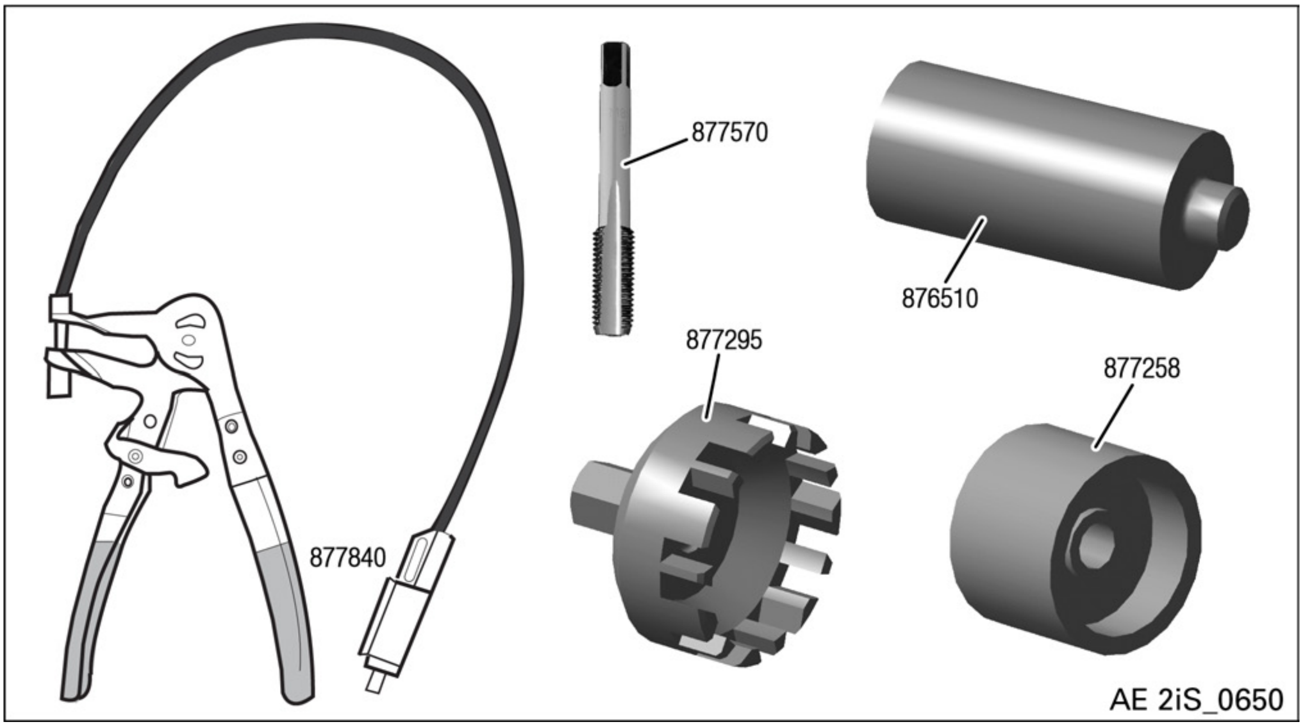

Figure 17.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
Engine oil	n.a.
LITHIUM-BASE GREASE	897330
LOCTITE 577	899796

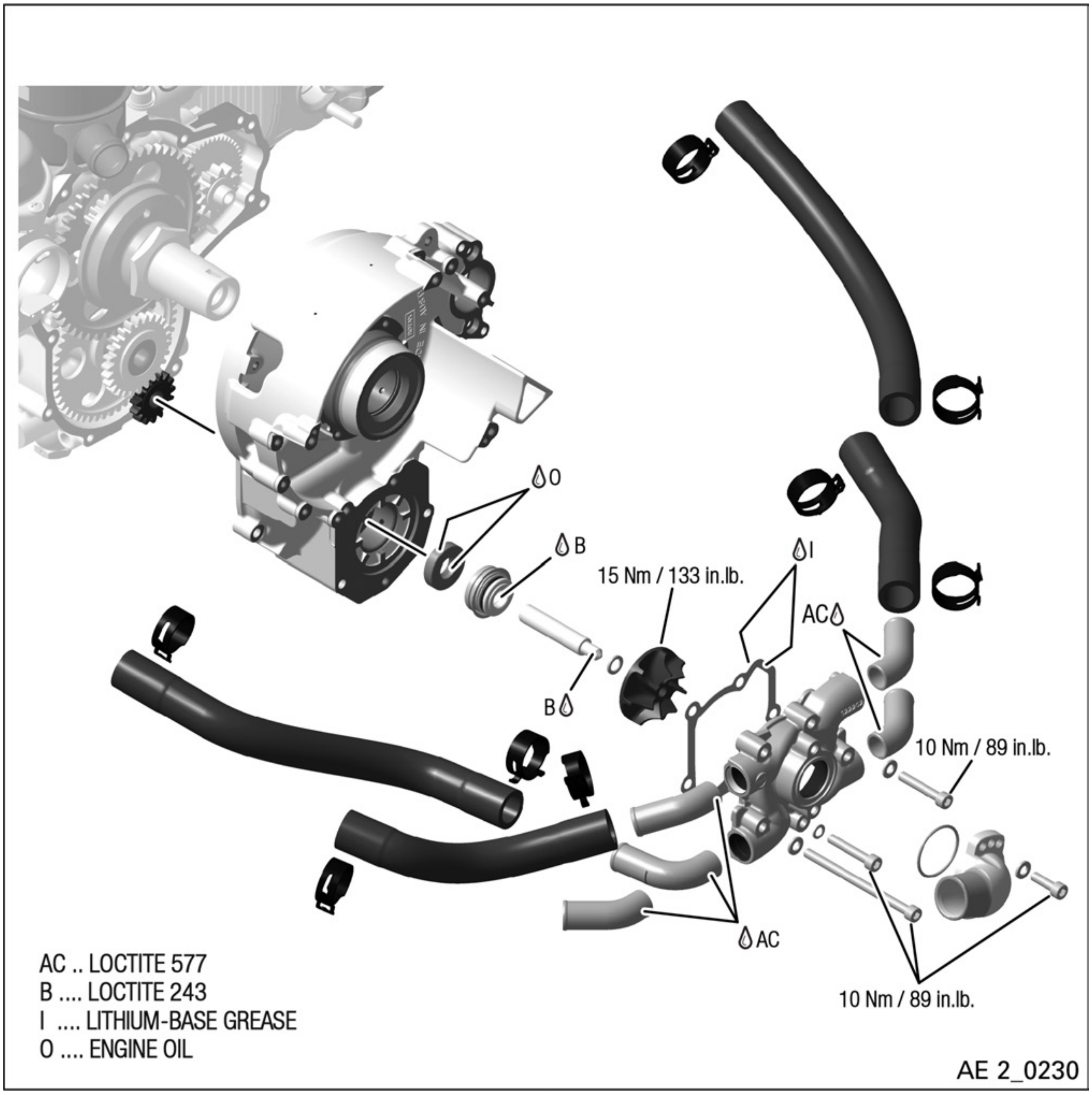
O
B
15 Nm / 133 in.lb.
I
AC
B
10 Nm / 89 in.lb.
AC
10 Nm / 89 in.lb.
AC .. LOCTITE 577
B .... LOCTITE 243
I .... LITHIUM-BASE GREASE
O .... ENGINE OIL
AE 2_0230

Figure 17.3

AE 2_0231

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 current Installation Manual (IM) for the respective engine type. 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 Installation Manual (IM) of the respective engine type. For more detailed information on operation, maintenance, safety or flight, consult the documentation provided by the aircraft manufacturer and dealer.

CONNECTIONS FOR DISPLAY SYSTEMS

Follow the instructions in the Installation Manual (IM) for the respective engine type regarding connections for instrumentation.

TEMPERATURE SENSOR

There are temperature sensors screwed in to the cylinder heads of cylinders 2 and 3. In the course of further development and standardization, new cylinder heads with modifications in its mold have been introduced. Due to these changes the coolant temperature instead of the cylinder head temperature in the aluminum will be displayed.

NOTE

Identifying of new cylinder heads: The electrical connection of the temperature sensor is pointing upwards.

See latest Installation Manual (IM) and/or SI-912-020/SI-914-022 “Running modifications”.

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!

NOTICE

High pressure in the cooling system might cause damage.
The hose between the expansion tank and the overflow bottle must be free of blockage and venting bore must not be clogged.

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 fuel) 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.

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

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.

NOTICE

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 current Maintenance Manual Line (MML) for the respective engine type.

Engine cleaning.
See current Maintenance Manual Line (MML) for the respective engine type.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

REMOVAL

NOTICE

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

Preparation

- Switch the ignition switch OFF

NOTE

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

Drain coolant.
See Maintenance Manual Line (MML) for the respective engine type.

Drain the fuel.
See Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

Disconnect coolant hose in accordance with the aircraft manufacturer's specifications.

EXPANSION TANK AND COOLANT HOSE - REMOVAL

NOTICE

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.

NOTICE

When removing the form hoses, ensure that the coolant elbows are not damaged!

NOTE

On old engine designs the spring type of hose clamps are not installed.
On engines with the old expansion tank, the old hose locations and the old coolant hoses don´t have to be upgraded and can be continued to be used.

Step	Procedure
1	Cut cable tie.
2	Take off the hose clamps using spring clamp pliers part no. 877840.
3	Remove the coolant hose from the coolant elbow with a suitable tool.

Cylinder 2/4

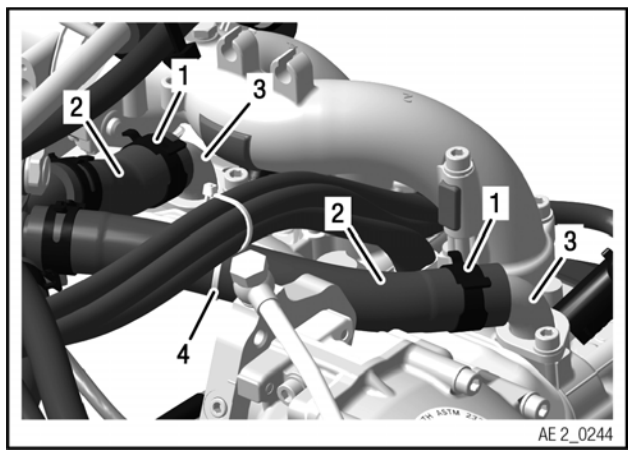

Figure 17.4

1	*Hose clamp*	2	*Coolant hose*
3	*Coolant elbow*	4	*Cable tie*

Cylinder 1/3

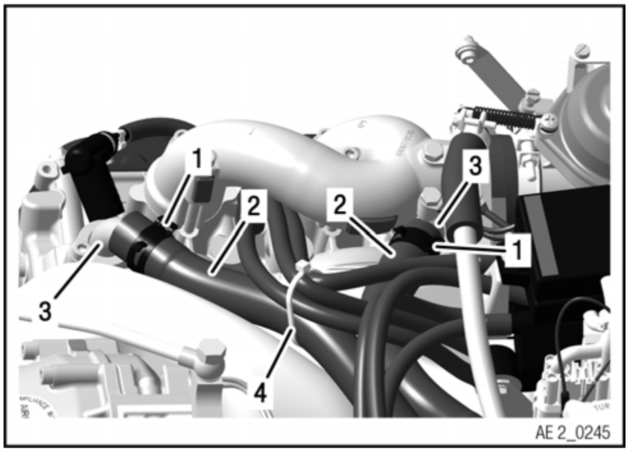

Figure 17.5

1	*Hose clamp*	2	*Coolant hose*
3	*Coolant elbow*	4	*Cable tie*

Step	Procedure
5	Remove the expansion tank assy. with all its coolant hoses.

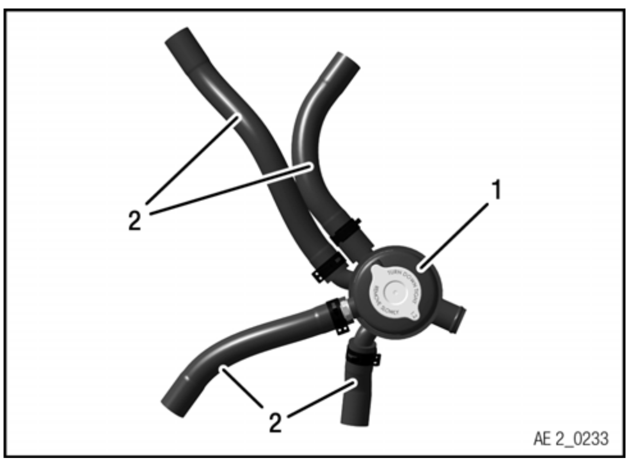

Figure 17.6

1	*Expansion tank assy.*	2	*Coolant hoses*

COOLING AIR-DUCT (OPTIONAL) — REMOVAL

Step	Procedure
1	Remove fuel hoses from fuel pump.(912 Series only). See Chapter 73–10–00.
2	Remove the expansion tank assy. with all its coolant hoses. See Chapter 75-00-00 section Expansion tank and coolant hose - removal.
3	Disconnect spark plug socket. See Chapter 74–00–00.
4	Loosen intake manifold on both sides. See Chapter 73–00–00.
5	Lift up and remove cooling air-duct.

WATER PUMP HOUSING — REMOVAL

Preparation

Remove the coolant hoses from water pump according to the aircraft manufacturer's specifications.

Step	Procedure
1	Remove all 4 hose clamps using spring clamp pliers part no. 877840 and detach the coolant hoses from the water inlet elbows of the cylinder heads with a suitable tool.

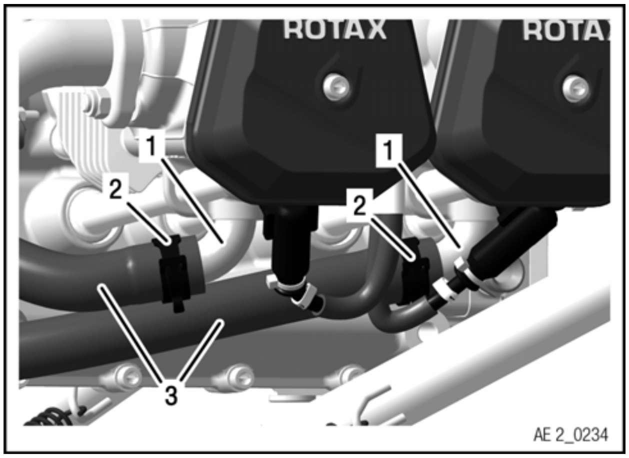

Figure 17.7

1 *Inlet elbows*
2 *Hose clamps*
3 *Coolant hoses*

Step	Procedure
2	Remove all 4 hose clamps using spring clamp pliers part no. 877840 and detach the coolant hoses from the water pump housing.
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.

NOTE

Mark the position of the coolant elbow with a suitable pen (touch-up pen).

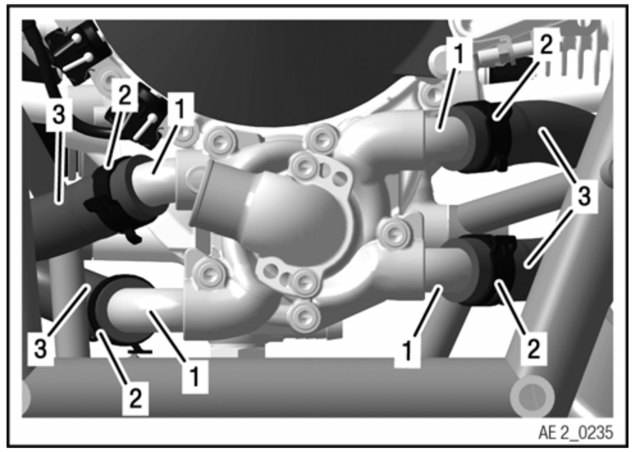

Figure 17.8

1 *Inlet elbows*
2 *Hose clamps*
3 *Coolant hoses*

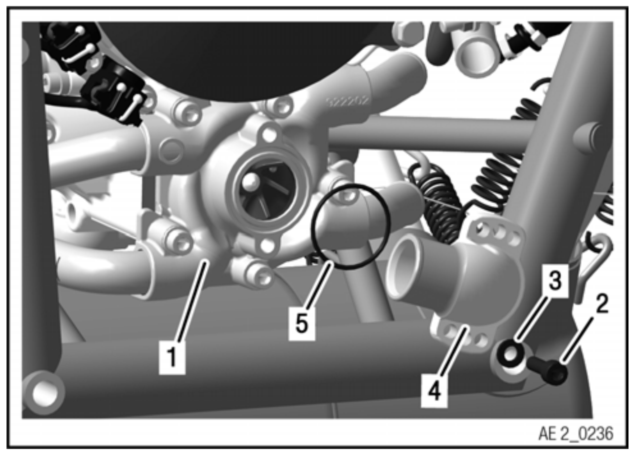

Figure 17.9

1 *Water pump housing*
2 *Allen screws M6x20*
3 *Washer 6.4*
4 *Water inlet elbow*
5 *O-ring 32x2*

Step	Procedure
3	Loosen 5 Allen screws M6 and remove water pump housing and gasket.

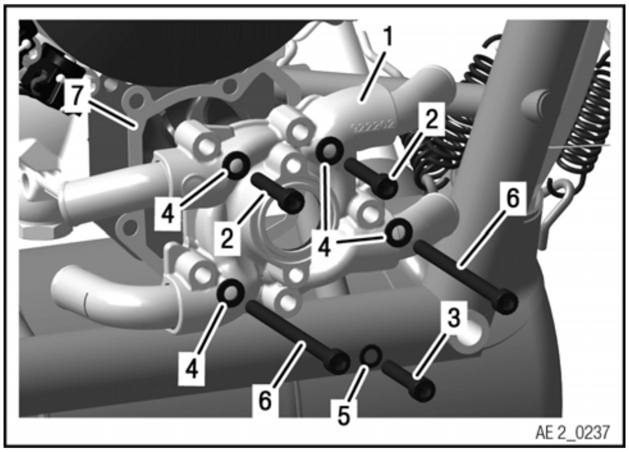

Figure 17.10

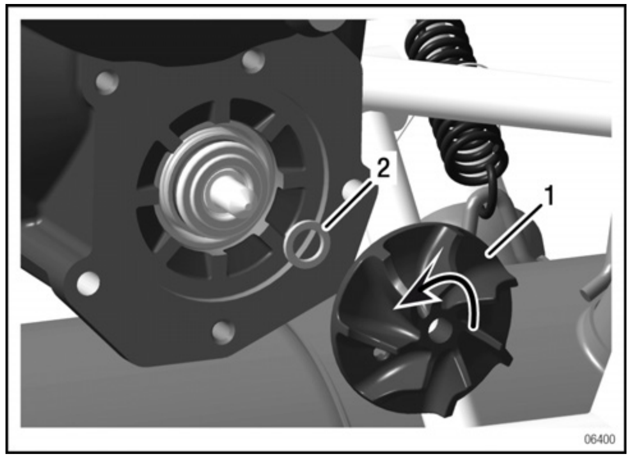

Figure 17.11: Typical

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*
7	*Gasket*		

1	*Impeller*	2	*Washer 8.2/12.5/1.5*

Lock crankshaft.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00.

Step	Procedure
4	Remove the impeller anti-clockwise with the special tool part no. 877295.

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.

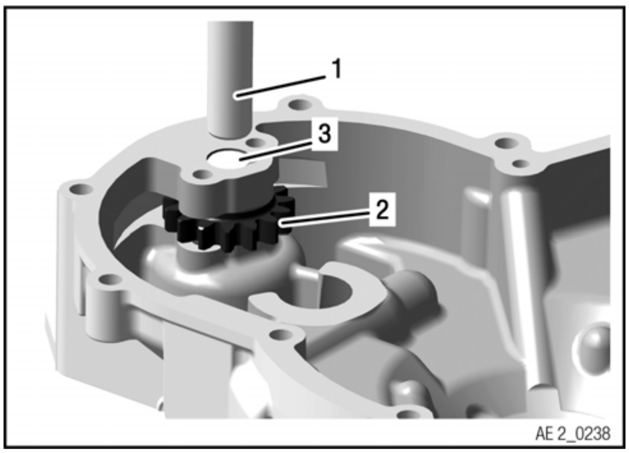

Figure 17.12

1 Press-out tool
2 Water pump gear 15T
3 Water pump shaft

OIL SEAL AND ROTARY SEAL — REMOVAL

NOTICE

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.).

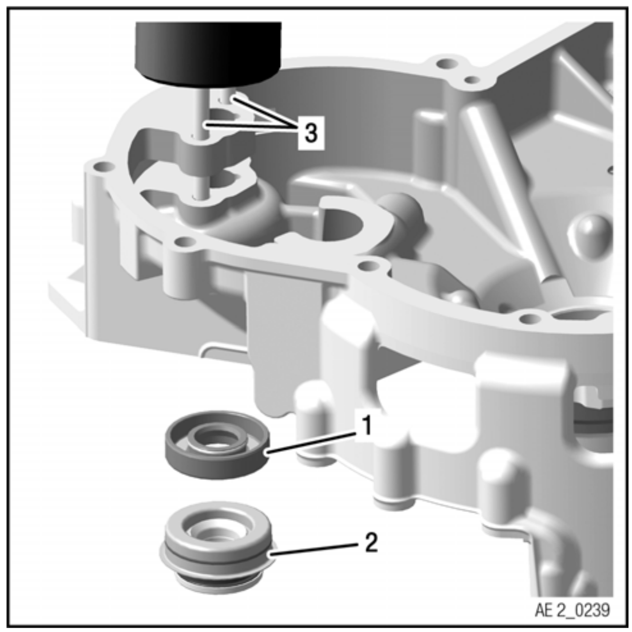

Figure 17.13

1 Oil seal
2 Rotary seal
3 Press-out tool

COOLANT HOSES — REMOVAL

Step	Procedure
1	Take off hose clamps using spring clamp pliers part no. 877840.
2	Remove the coolant hoses from the coolant elbows on the expansion tank with a suitable tool.
3	Remove the rubber plate.

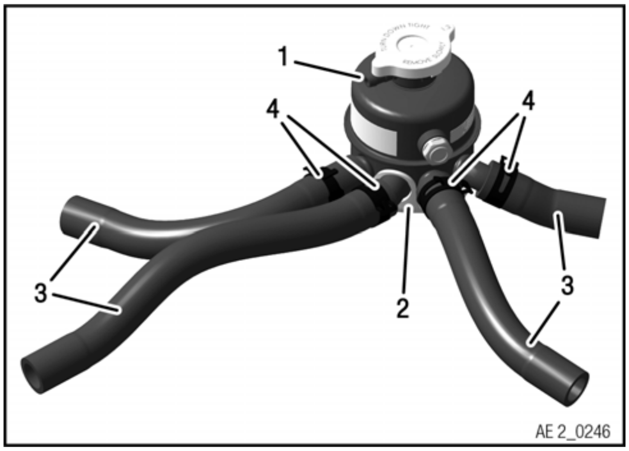

Figure 17.14

1 *Expansion tank* 2 *Rubber plate*
3 *Coolant hoses* 4 *Hose clamps*

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 also with tapping drill M18x1 part no. 877570.

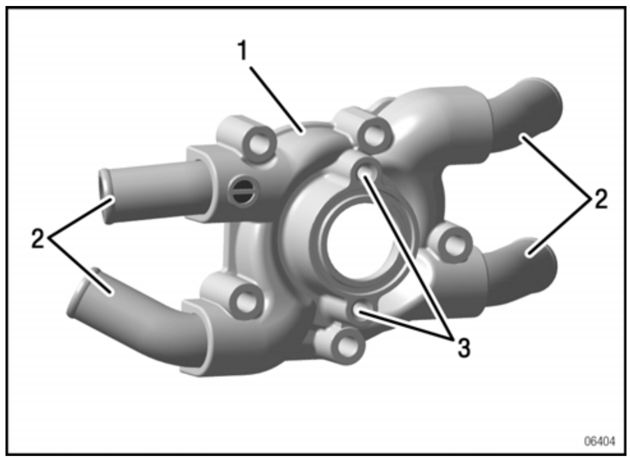

Figure 17.15

1 *Water pump housing* 2 *Bent socket*
3 *Thread*

INSPECTION

COOLING SYSTEM SINGLE PARTS — INSPECTION

NOTICE

Cracks in cooling system components are not permissible!
If in doubt, check the affected parts for cracks using the dye penetrant or similar method.

NOTICE

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 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.

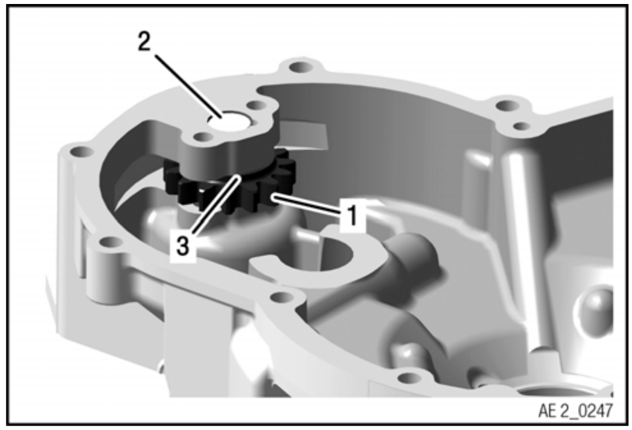

Figure 17.16

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.

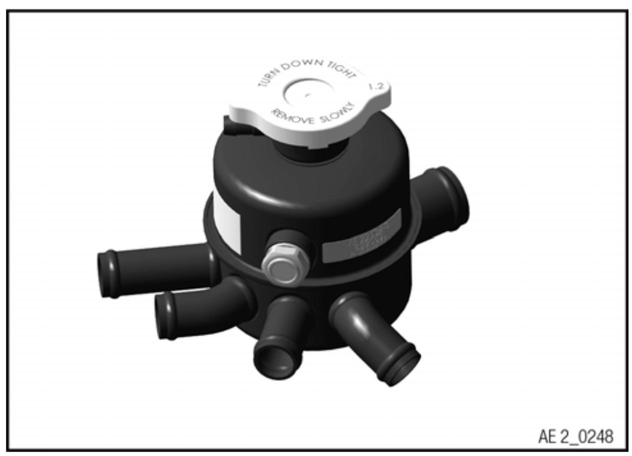

Figure 17.17

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.

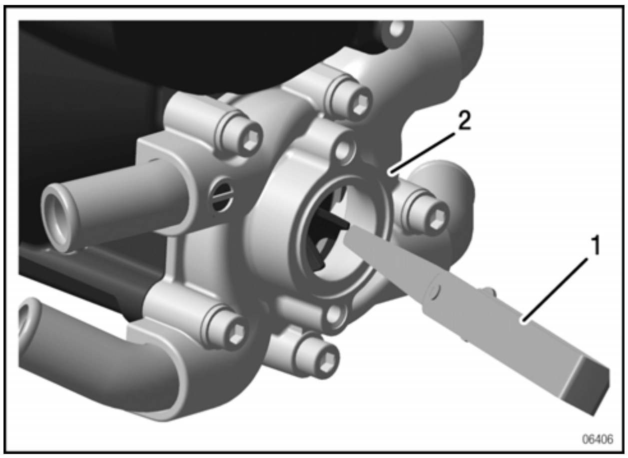

Figure 17.18: Typical

1 Feeler gauge *2 Water pump housing*

WEAR LIMITS

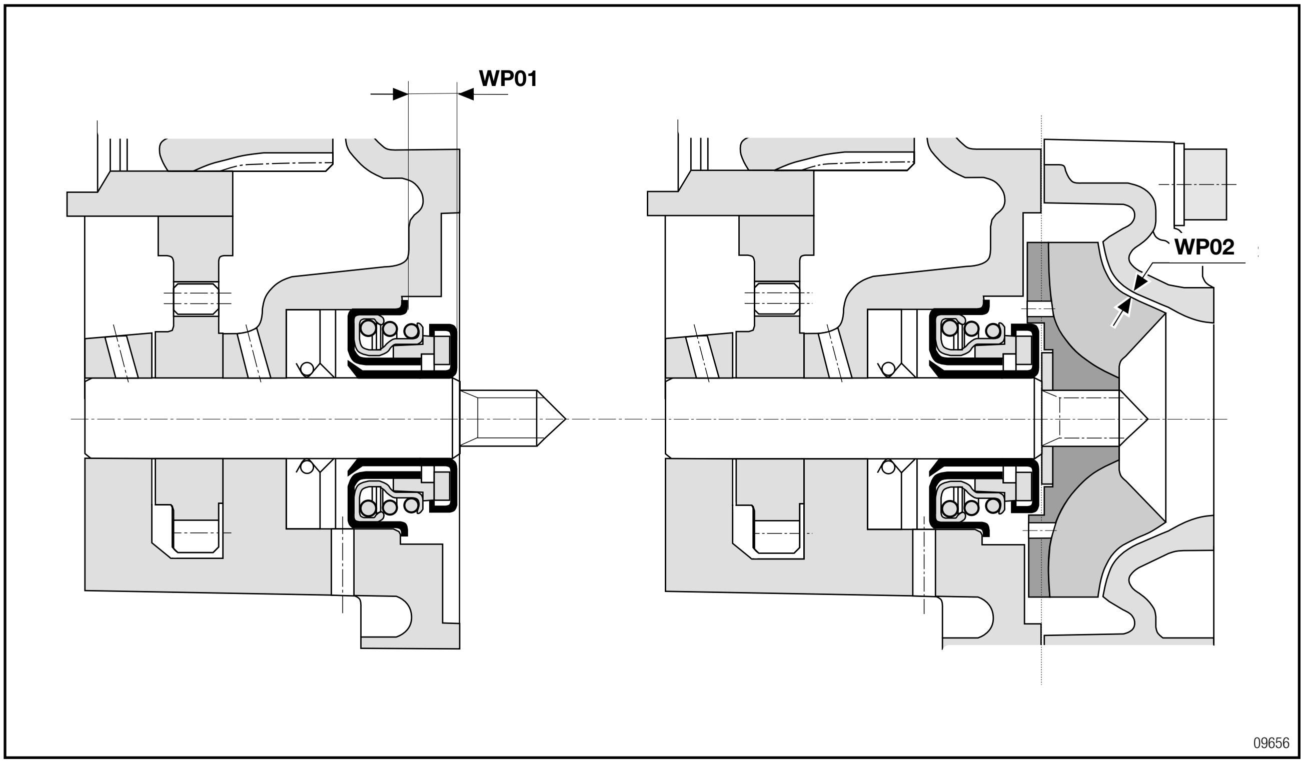

Figure 17.19

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 (with open side showing to crankcase) using a suitable jig part no. 876510 into the ignition housing till end stop.

NOTE

Oil seal must not be visible through the leakage bore.

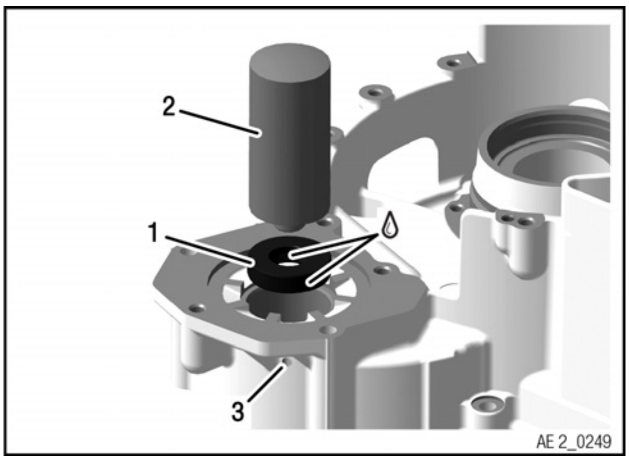

Figure 17.20

1	*Oil seal*	*2*	*Insertion jig part no. 876510*
3	*Leakage bore*		

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.

NOTE

Ensure that no LOCTITE 243 is in contact with the sealing ring.

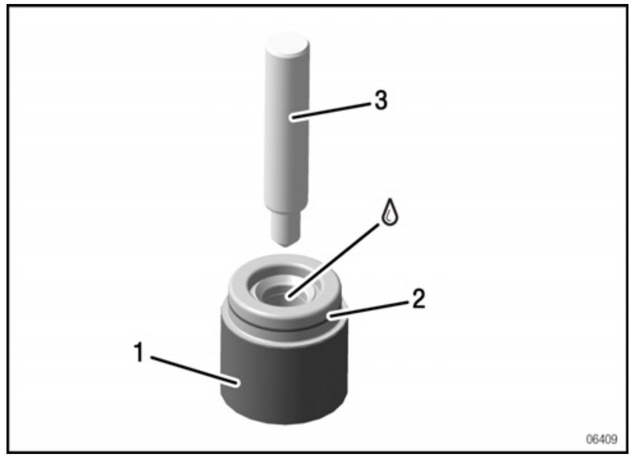

Figure 17.21

1	*Insertion jig part no. 877258*	*2*	*Rotary seal*
3	*Water pump shaft*		

Step	Procedure
2	Insert the pump gear in the ignition housing.
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.

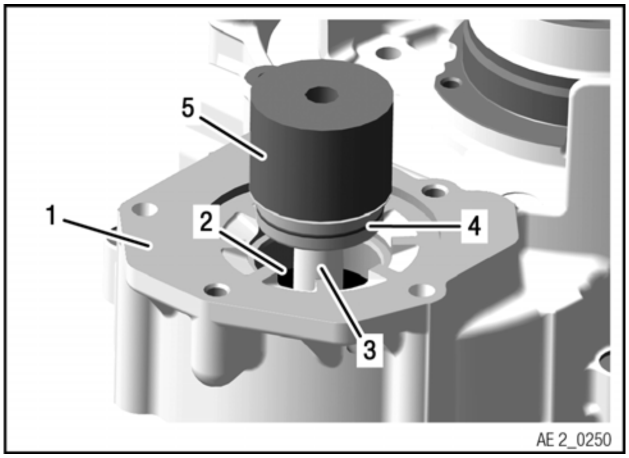

Figure 17.22

1	*Ignition housing*	2	*Oil seal*
3	*Pump shaft*	4	*Rotary seal*
5	*Insertion jig part no. 877258*		

Step	Procedure
4	Install the ignition housing. See Chapter 24-20-00 section Internal generator.

Lock crankshaft.
See current Maintenance Manual Line (MML) of the respective engine type, Chapter 12-20-00.

Step	Procedure
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. 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.

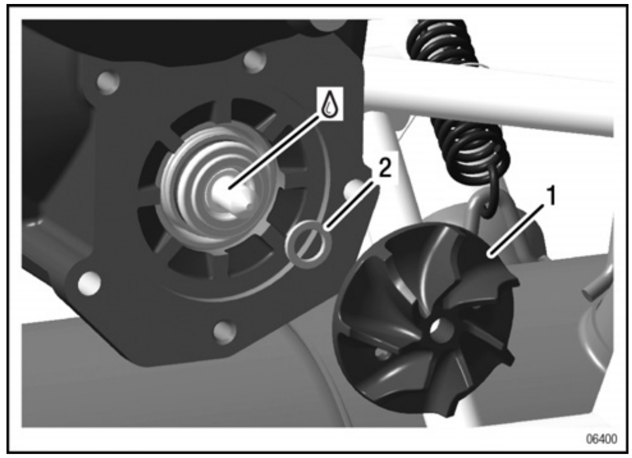

Figure 17.23: TYPICAL

1	*Impeller*	2	*Washer 8.2/12.5/1.5*

WATER PUMP HOUSING — ASSEMBLY

Step	Procedure
1	Lubricate the new bent socket with LOCTITE 577.
2	Screw the bent sockets at least 5 revolutions into the water pump housing and position it.

NOTE

Normally, fittings with a bend angle of 45° are fitted. On the engine type 912 / 914 Series and engines with ROTAX® engine suspension frame, there is a fitting with a bend angle of 80° fitted at cylinder 2.

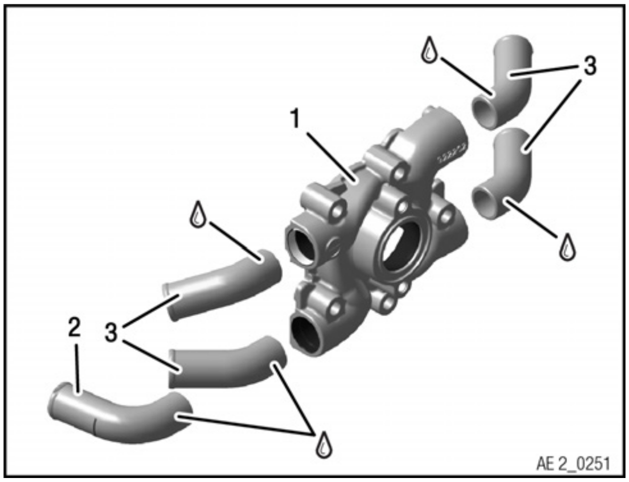

Figure 17.24

1	*Water pump housing*	2	*80° bent socket*
3	*45° bent socket*		

COOLANT HOSE — INSTALLATION

NOTICE
The push-on length of the expansion tank is 25 mm (0.9843 in.)!

NOTICE
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 coolant hose connection 1 and 2.

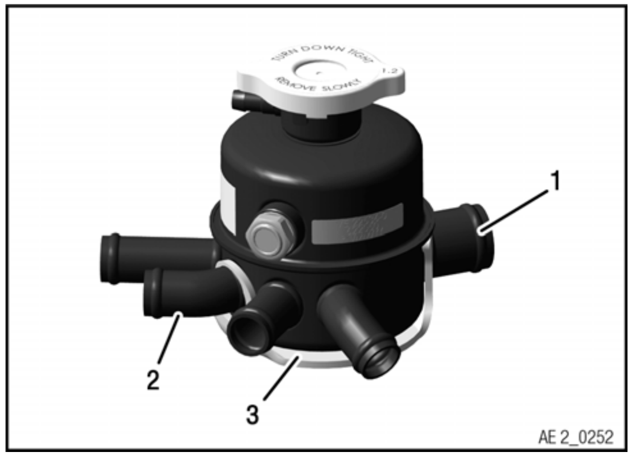

Figure 17.25

1	*Coolant hose connection 1*	2	*Coolant hose connection 2*
3	*Rubber plate*		

Step	Procedure
2	Install the hose clamps on the coolant hoses.
3	Push on the coolant hoses and align them. **NOTE** *Use form hose 90 degree between expansion tank assy. and cylinder 3.*

NOTE

Align the hose clamps so that they cannot damage the neighboring coolant hoses.
Use tool part no. 877840 (hose clamp pliers) or equivalent to mount the hose clamps.

Old engine versions

NOTE

On old engine designs the hose clamps are not installed, but can be updated to self-compensating clamps.

INSTALLATION

IGNITION HOUSING — INSTALLATION

See Chapter 24–20–00

WATER PUMP HOUSING — INSTALLATION

NOTICE

The bottom M6x35 Allen screw extends into the water chamber and is therefore stainless steel and sealed with a gasket ring.

NOTICE

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 lock washers. Tightening torque 10 Nm (89 in. lb.).

NOTE

Apply lithium-base grease on both sides of the new gasket.

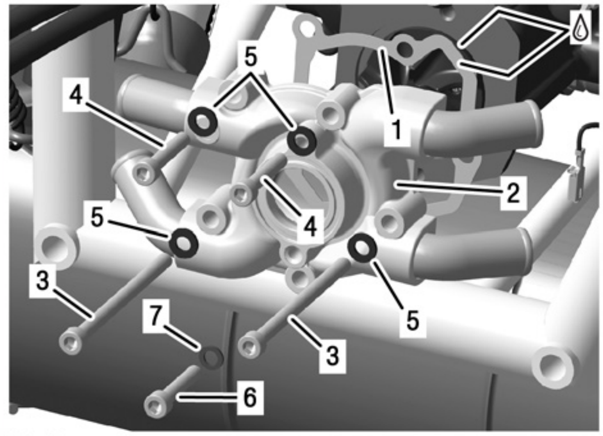

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Figure 17.26

1	*Gasket*	2	*Water pump housing*
3	*Allen screw M6x90*	4	*Allen screw M6x35*
5	*Washers 6.4Lock washers*	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 lock washers. Tightening torque 10 Nm (89 in. lb.).

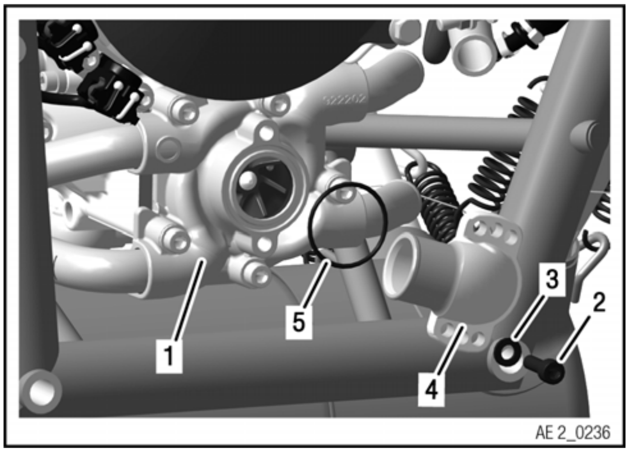

Figure 17.27

1	*Water pump housing*	2	*Allen screw M6x20*
3	*Lock washer*	4	*Water inlet elbow*
5	*O-ring*		

NOTE

The water inlet elbow is symmetrical and can, if required, be fitted in other positions.

NOTE

914 Series only:
On cylinder 1 and 2 use protection tube (heat resistant) for protection of the coolant hoses.

Step	Procedure
3	Mount hose clamps onto the coolant hoses and install it on the inlet elbows of the water pump.
4	Fasten coolant hoses with hose clamps using hose clamp pliers part no. 877840.

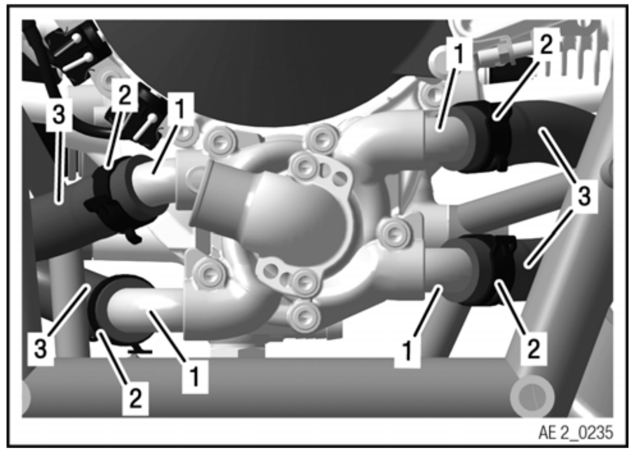

Figure 17.28

1	*Inlet elbows*	2	*Hose clamps*
3	*Coolant hoses*		

Step	Procedure
5	Mount hose clamps onto the coolant hoses and install it on the water inlet elbows of the cylinder heads.
6	Fasten coolant hoses with hose clamps using hose clamp pliers part no. 877840.

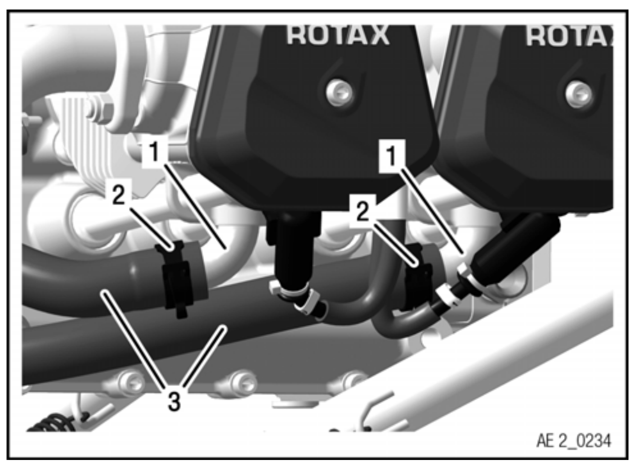

Figure 17.29

1	*Inlet elbows*	2	*Hose clamps*
3	*Coolant hoses*		

Install the coolant hoses from water pump according to the aircraft manufacturer's specifications.

COOLING AIR-DUCT (OPTIONAL) — INSTALLATION

Step	Procedure
1	Attach cooling air duct (is not mechanically held in place).
2	Install intake manifold. See Chapter 73-10-00 section
3	Connect spark plug socket. See Chapter 74–00–00.
4	Install the expansion tank assy. with all its coolant hoses. See Chapter 75-00-00 section
5	Install fuel hoses from fuel pump (912 Series only). See Chapter 73–10–00.

EXPANSION TANK AND COOLANT HOSE — INSTALLATION

NOTICE

Ensure that the expansion tank is fixed without tension.

NOTE

Check the push-on lengths, readjust the coolant hoses if necessary.

Step	Procedure
1	Install coolant elbows. See Chapter 72-30-00 section Cylinder head.
2	Mount hose clamps onto the coolant hoses.
3	Position the expansion tank assy. with the 4 coolant hoses on the engine.

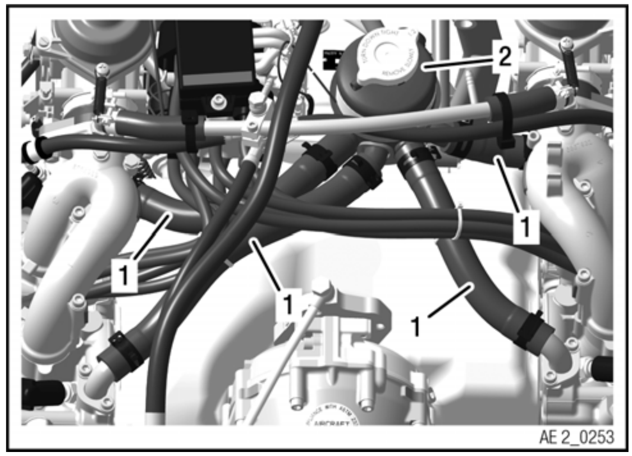

Figure 17.30

1 *Coolant hoses* 2 *Expansion tank*

NOTICE

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.).

NOTE

Start with the shortest hose.

Step	Procedure
4	Fasten coolant hoses with hose clamps using hose clamp pliers part no. 877840.
5	Install cable tie.

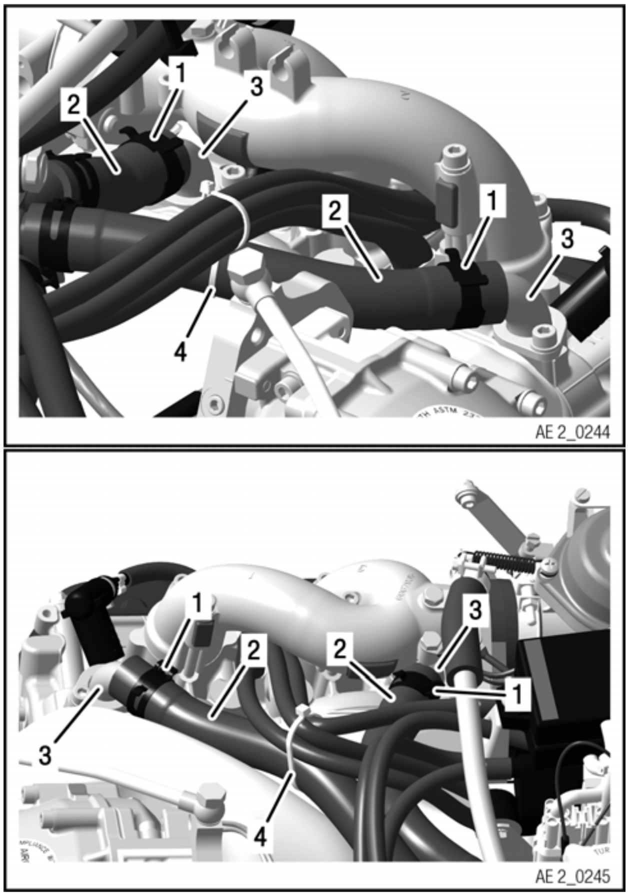

Figure 17.31

1	*Hose clamps*	2	*Coolant hoses*
3	*Coolant elbows*	4	*Cable tie*

Old expansion tank
In the case of repair/overhaul it has to be considered that the old expansion tank part no. 922398 may not offer the space to install the spring type hose clamps this is due to limited space between the tube (cylinder 1 and cylinder 3).
Due to different positions for the supply/drain hoses leading to and from the expansion tank, it is necessary to have different hose lengths. Take care of the proper length of the hose and of its overlapping length with the connectors.

FINISHING WORK

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Service the engine cooling system.
See current Maintenance Manual Line (MML) for the respective engine type.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

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Chapter: 75–20–00
MECHANICAL REV. COUNTER

TOPICS IN THIS CHAPTER

SPECIAL TOOLS

Description	Part number
PRESS-IN TOOL	877190
INSERTION JIG WITH SLEEVE	877680
HANDLE FOR INSERTION JIG	877650

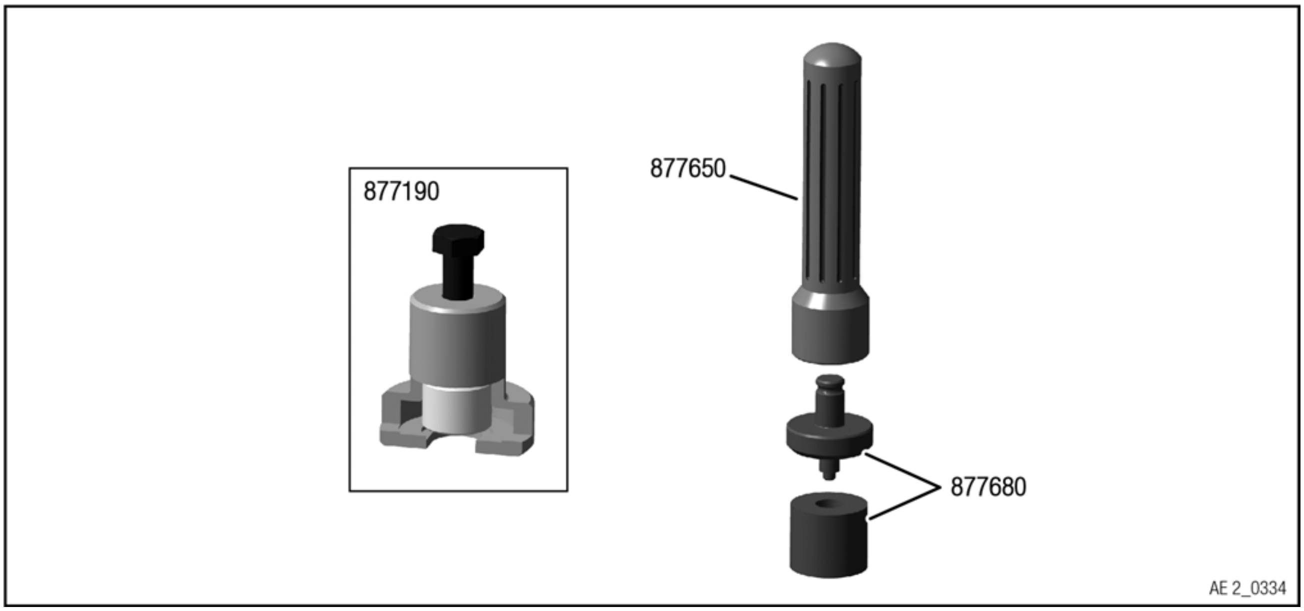


Figure 18.1

SERVICE PRODUCTS

Description	Part number
ENGINE OIL	n.a.
LOCTITE ANTI SEIZE	297434
LOCTITE 5910	899791

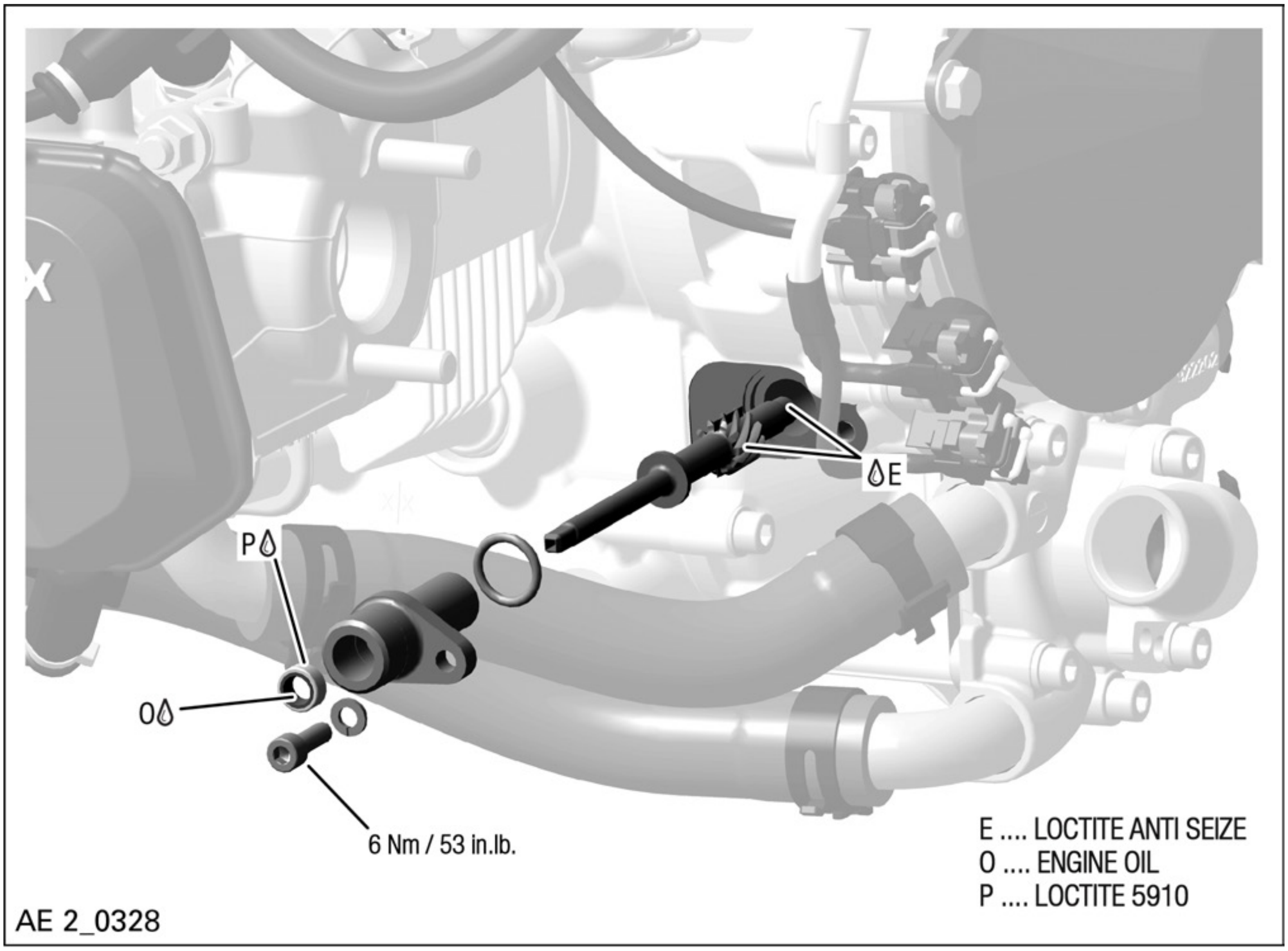


Figure 18.2

SYSTEM DESCRIPTION

The optional mechanical rev. counter and hourmeter are driven from the camshaft via a bevel gear to the rev counter shaft. A flexible shaft allows connection of a combined instrument, rev counter or hourmeter. Subsequent installation of a flex. rev counter shaft is possible after removal of the rev counter cover on the ignition housing. On engines produced from the year 2007 onwards, it is also necessary to replace the ignition cover and press the worm gear into the camshaft.

NOTE

The total transmission ratio from crankshaft to rev. counter shaft i = 4.

NOTE

As the mechanical hourmeter is directly coupled to the engine speed, the readings may deviate considerably from those given by electronic hourmeters (e.g. TCU, FlyDat).

CONNECTIONS FOR DISPLAY SYSTEMS

Follow the instructions in the Installation Manual (IM) for the respective engine type regarding connections for instrumentation.

REMOVAL

Preparation

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

- Turn the ignition switch OFF

NOTE

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

Drain oil.
See current Maintenance Manual Line (MML) for the respective engine type.

Drain coolant, if necessary.
See Maintenance Manual Line for the respective engine type.

MECHANICAL REV COUNTER DRIVE – REMOVAL

NOTE

On old engine versions without a mechanical rev counter, a cover plate is fitted in place of the rev counter housing. The engine can be retrofitted with a rev. counter drive by installation of the drive shaft.

NOTE

Check in any case that the worm drive is installed in the camshaft.

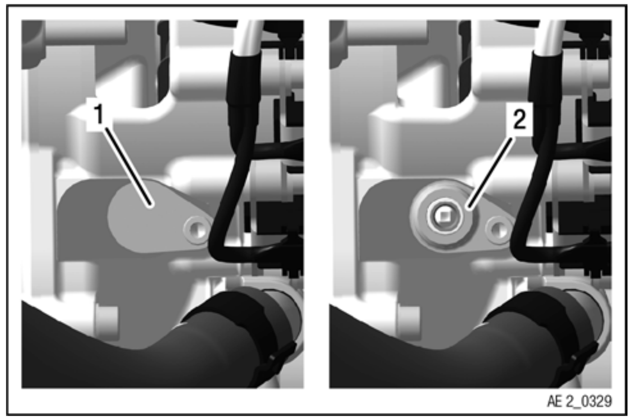


Figure 18.3

1 *Cover plate*	2 *Mechanical rev counter*

Step	Procedure
1	Remove Allen screw M5x16 with lock washer and pull the rev. counter housing along with the O-ring and the rev counter shaft out of the ignition housing.

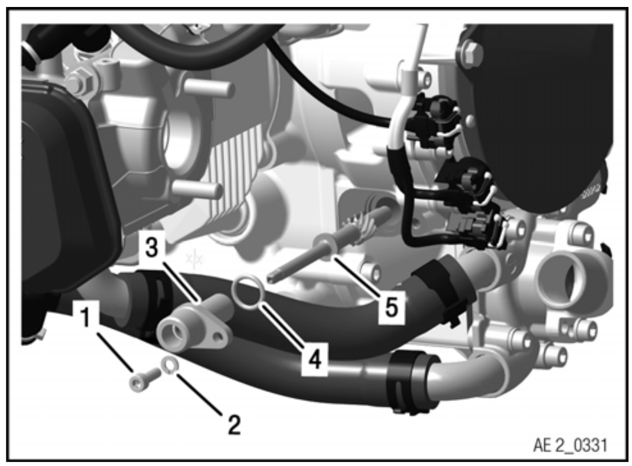


Figure 18.4

1 *Allen screw M5x16*	2 *Lock washer A5*
3 *Rev counter housing*	4 *O-ring*
5 *Rev counter shaft*	

INSPECTION

MECHANICAL REV COUNTER DRIVE – INSPECTION

Step	Procedure
1	Inspect gear-tooth system and square end of the rev counter shaft for damage. If there is an oil leakage, replace the shaft seal 6x11x3 and O-ring from rev counter housing. **NOTE** *Check also the worm gear 5T.*

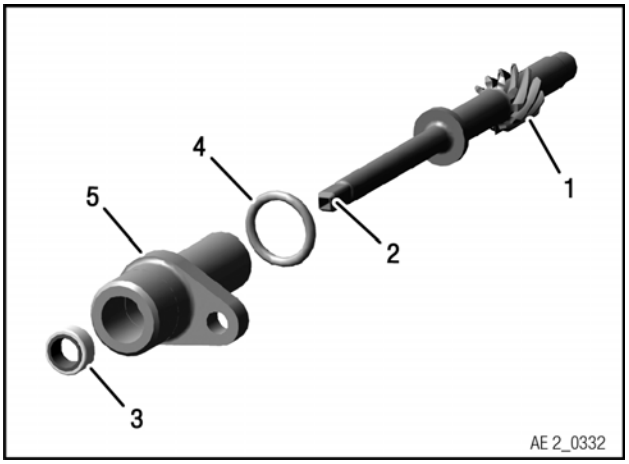


Figure 18.5

1 Gear tooth system
2 Square end
3 Shaft seal
4 O-ring
5 Rev counter housing

INSTALLATION

NOTE

On old engine versions without a mechanical rev. counter, a cover plate is fitted in place of the rev. counter housing.

NOTE

Check if worm gear 5T is installed.

Step	Procedure
1	Loosen Allen screw M5x16 with lock washer A5 and remove the cover plate together with the O-ring.

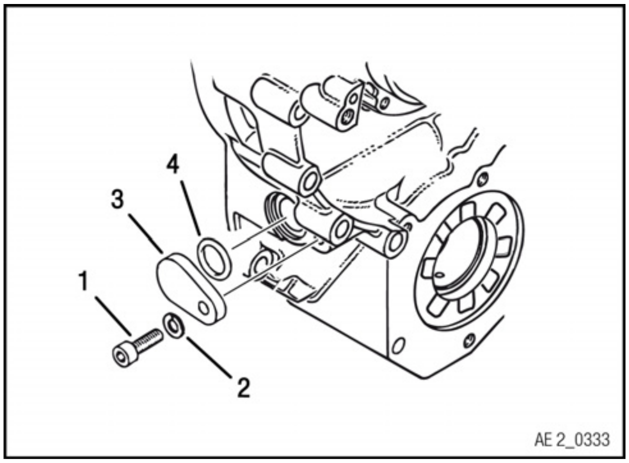


Figure 18.6

1 *Allen screw M5x16* 2 *Lock washer A5*
3 *Cover plate* 4 *O-ring*

NOTE

On new engine versions, the ignition cover must also be replaced.

Step	Procedure
2	Remove the ignition housing, see Chapter 24-20-00 Internal generator.
3	Press worm gear into the camshaft using press-in tool part no. 877190. **NOTE** *Lubricate worm gear 5T with LOCTITE ANTI SEIZE for easier press in.*

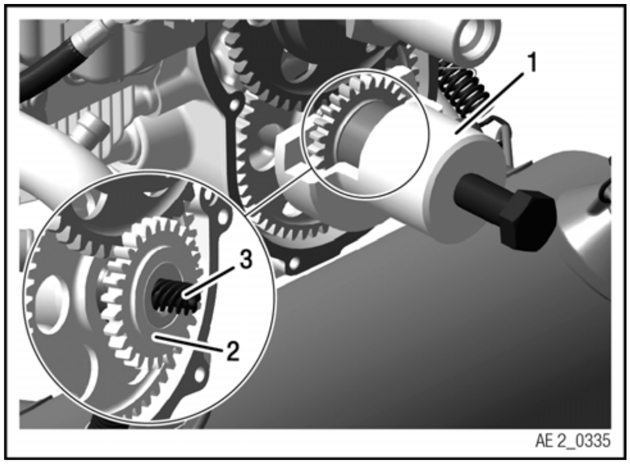


Figure 18.7

1 *Press-in tool, 877190* 2 *Camshaft*
3 *Worm gear 5T*

Step	Procedure
4	Install the ignition housing, see Chapter 24-20-00 Internal generator.

MECHANICAL REV COUNTER DRIVE – INSTALLATION

Step	Procedure
1	If necessary, apply LOCTITE 5910 on the outer diameter of the new shaft seal and press it into the rev counter housing with insertion jig part no. 877680 (closed side outwards).

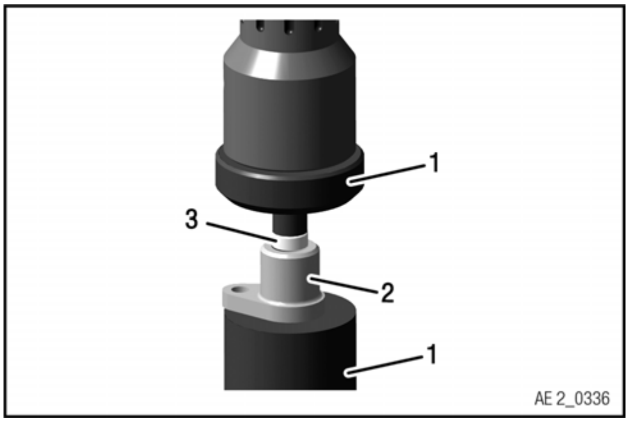


Figure 18.8

1	*Insertion jig with sleeve, 877680*	2	*Rev counter housing*
3	*Shaft seal*		

Step	Procedure
2	Lubricate drive shaft on bearing point and gear with engine oil and install it to the ignition housing.
3	Lubricate shaft seal with engine oil and install rev. counter housing with O-ring carefully into the ignition housing.
4	Tighten rev counter housing with Allen screw M5x16 and lock washer A5. Tightening torque 6 Nm (53 in.lb)

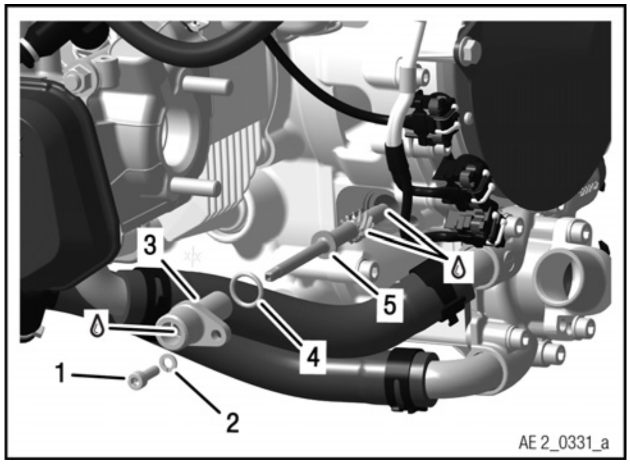


Figure 18.9

1	*Allen screw M5x16*	2	*Lock washer A5*
3	*Rev counter housing*	4	*O-ring*
5	*Rev counter shaft*		

FINISHING WORK

- Install the surrounding assemblies.

Fill with operating fluids or check the filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

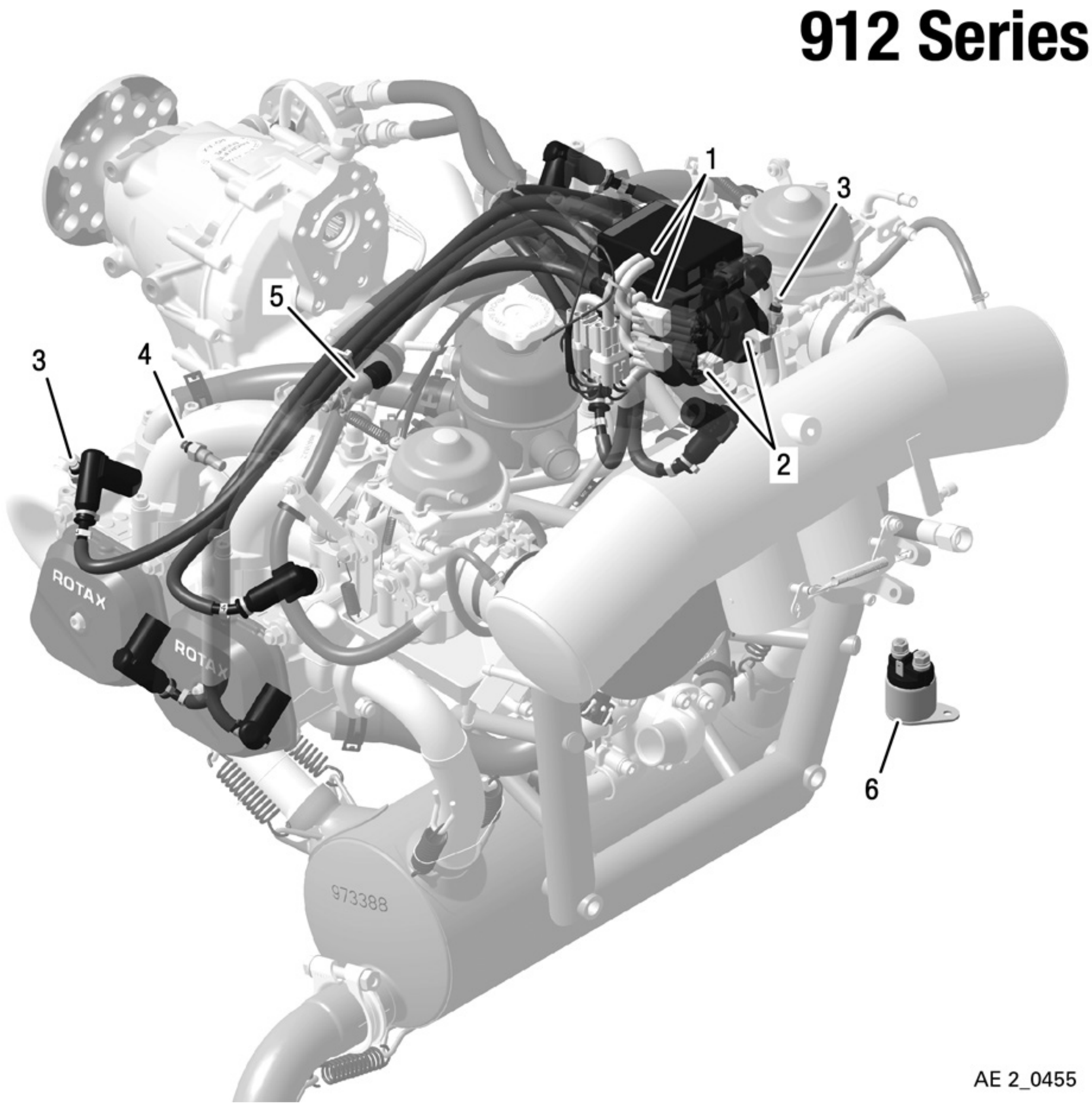
Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

Chapter: 76–00–00
ENGINE CONTROL

TOPICS IN THIS CHAPTER

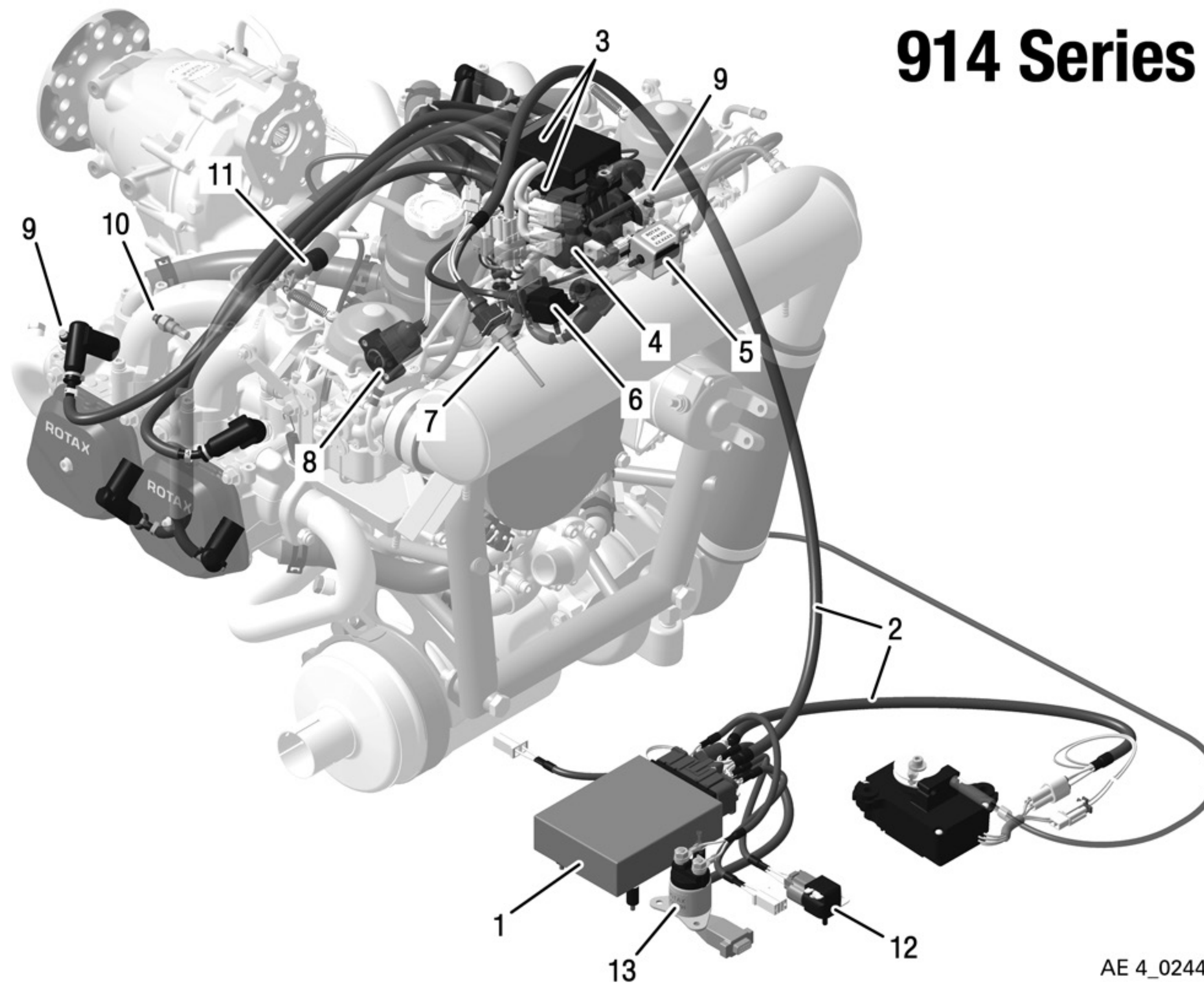
This section describes the maintenance of the ROTAX® 912/914 Series engine. The description is divided into subsections and explanations of system functions.

Subject	Section
Engine control	Chapter 76-00-00
Turbo Control Unit (TCU) (914 Series only)	Chapter 76-10-00
Wiring harness (914 Series only)	Chapter 76-50-00
Sensors and Actuators	Chapter 76-70-00



1	*SMD - Surface Mounted Devices*	2	*Double ignition coil*
3	*Coolant temperature sensor*	4	*Oil temperature sensor*
5	*Oil pressure sensor*	6	*Starter relay*

Figure 4.1



1	*TCU*	2	*Wiring harness*
3	*SMD - Surface Mounted Devices*	4	*Double ignition coil*
5	*Three-way solenoid valve*	6	*Airbox pressure sensor*
7	*Resistance thermometer*	8	*Throttle valve position sensor*
9	*Coolant temperature sensor*	10	*Oil temperature sensor*
11	*Oil pressure sensor*	12	*Ambient pressure sensor*
13	*Starter relay*		

Figure 4.2

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Chapter: 76–10–00
TURBOCHARGER CONTROL UNIT (TCU) (914 SERIES ONLY)

TOPICS IN THIS CHAPTER

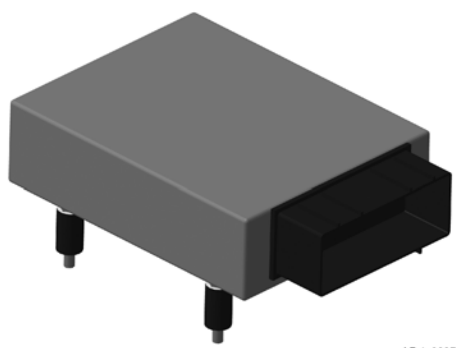

Figure 19.1: TCU

SPECIAL TOOLS

Description	Part number
USB to RS 232 plug connection (the 9-pin port of the wiring harness)	n.a.
B.U.D.S Aircraft software	864361
Computer/ Notebook/ Netbook	n.a.

SYSTEM DESCRIPTION

The electronic regulator TCU (Turbo control unit) is the “central processing unit” as the junction of all engine parameter inputs.
The TCU controls the boost pressure in the airbox. The position of the carburetor throttle valves is signalled by a potentiometer to the TCU, where it is transformed in a chosen pattern into target pressure in the airbox.

NOTE

The position of the throttle valve are divided into linear progression from 0 to 115%

After comparison of the actual airbox pressure with the target pressure, the position of the waste gate will be varied by a servo motor until the pressures are equal.

NOTE

With carb throttle valve closed, a high boost pressure is specified although hardly any exhaust gas energy is available. The waste gate will then be completely closed and the length of the Bowden cable between the servo motor and the waste gate can be verified or adjusted.

The following diagram shows the pressure regulating sequence for the newer TCU version.

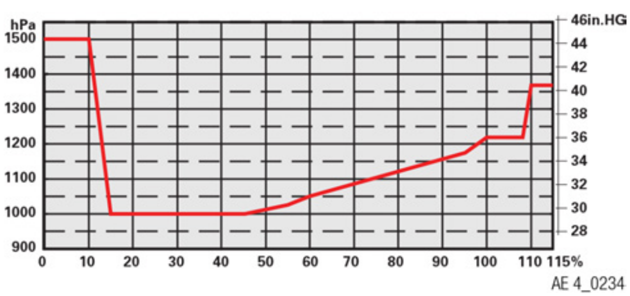

Figure 19.2

The airbox target pressures for engine operation with newer TCU versions.

Engine performance	Throttle potentiometer	Airbox – nominal pressure
Idle	~ 0%	1500 hPa (44.3 in. HG)
Continuous output	100 – 108 %	1229 hPa (36.0 in. HG)
Take-Off performance	110 – 115 %	1370 hPa (40.5 in. HG)

LAMP OUTPUT CONNECTIONS ON THE TCU

The TCU is furnished with output connections for an external “red” boost lamp and an “orange” caution lamp.
When the TCU is switched on, the two lamps are automatically subjected to a function test. Both lamps light up for 1 to 2 seconds and then go out.

Orange caution lamp
All sensor inputs are monitored by the TCU via this caution lamp.
When the lamp goes out, this indicates that the TCU is ready for operation. A lamp which flashes continuously indicates a malfunction of the TCU or its periphery.
In the event of a malfunction, for instance if a circuit is interrupted, the TCU switches over to pre-programmed default values to ensure engine operation.

NOTICE

While the default values are effective, monitoring of the respective channel e.g. overspeeding, is not possible. The monitoring function is inactive.

Red boost lamp

- Exceeding the admissible boost pressure will activate the red boost lamp, and it will light up continuously until boost pressure falls below the threshold Threshold = 1550 hPa (actual boost pressure)
- The TCU registers the time of full engine operation with boost pressure. Full throttle operation for longer than 5 minutes will cause the red warning lamp flash.

NOTICE

The red boost lamp helps the pilot to avoid full power operation with too high boost pressure for longer than 5 minutes as otherwise the engine would be thermally overstressed.

NOTE

The time observation starts at actual boost pressure of 1250 hPa. After 5 minutes the warning is issued via the boost lamp.
The warning is deactivated again as soon as the boost pressure falls below 1250 hPa. If the pressure limit is exceeded again, for example after 30 seconds, the boost lamp lights up again.

THREE-WAY SOLENOID VALVE

The TCU also controls the tree-way solenoid valve, which causes various pressures to become active on the float chamber of the carburetors. For further information, see Chapter 76–70–00 section sensors and actuators .

NOTE

The solenoid valve is inactive below the threshold.

PC INTERFACE

The TCU incorporates a serial interface. By using a specially developed program, all input and exit signals of the TCU can by monitored, checked and if necessary recorded.
This program allows quick and efficient error diagnostics without having to dismantle the complete control unit.
This program can monitor and record the operation of many elements, including the two pressure sensors, temperature sensors, rev pickup, throttle valve and waste gate position.

NOTE

This system works “real time” i.e. if necessary also during engine operation.

It allows the engineering staff to check and record TCU data during flight.
These recordings can then be evaluated on a graph and facilitate troubleshooting.
In addition, these recordings can be used as documentation for engine repair and overhaul.

NOTE

This communication program is not included in the delivery range of the engine, but is on the official Homepage www.FLYROTAX.com.

COMMUNICATION PROGRAM

Checking the Turbocharger Control Unit (TCU) by means of B.U.D.S. Aircraft software. Before connecting to the TCU, make sure you have installed the latest version of B.U.D.S. Aircraft in accordance with SI-914-037. Download newest B.U.D.S Version available at official Homepage www.FLYROTAX.com

Functions of B.U.D.S. Aircraft software
Current version of the software can communicate with the TCU (4.6 966741) providing the following functions:

- Function test of all sensors
- Checking the throttle potentiometer (throttle position, throttle valve position)
- Recalibration of the throttle position
- Extracting and clearing log files

Required items

- PC or laptop with one unused USB–Port
- B.U.D.S. Aircraft software installed, current version
- USB to Serial port adapter

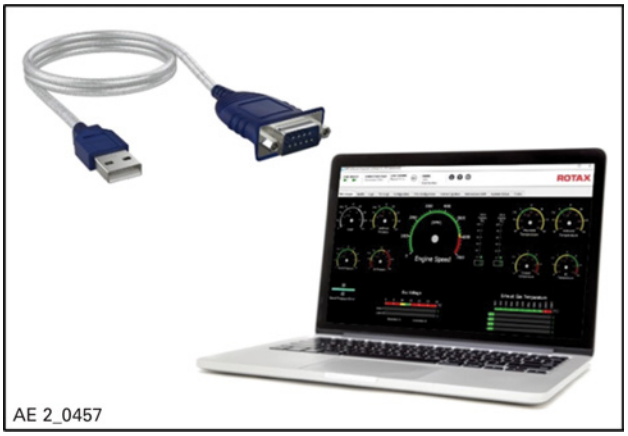

Figure 19.3

Connection

Step	Procedure
1	Connect USB-to-Serial converter to a USB-Port of the PC or Laptop and to the 9-pin RS 232 connector on the engine wiring harness.

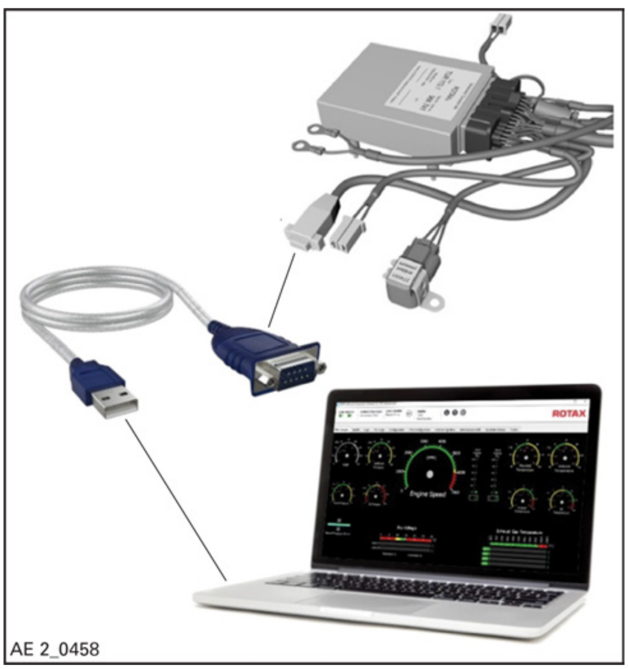

Figure 19.4

Step	Procedure
2	Provide power to the TCU.
3	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).
4	After B.U.D.S Aircraft has been started, consult “Help” for a detailed explanation of the multiple functionalists.

NOTE

If when launching B.U.D.S. Aircraft, the failure message “Serial connection error in 914 Series mode” appears, a connection between TCU and computer has been interrupted. Ensure that the USB-to-Serial converter is correctly configured and is seen by Windows as COM1, COM2, COM3 etc. and that TCU is powered ON.

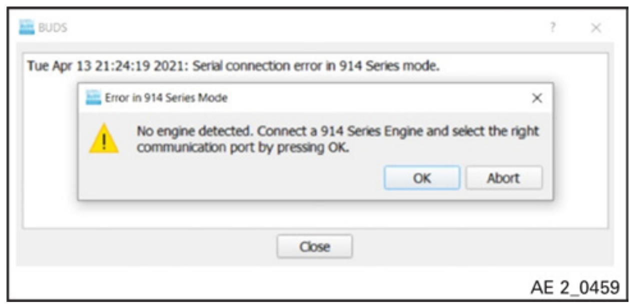

Figure 19.5

Step	Procedure
5	Choose OK. Select the appropriate COM-Port from those available in the pull-down menu.

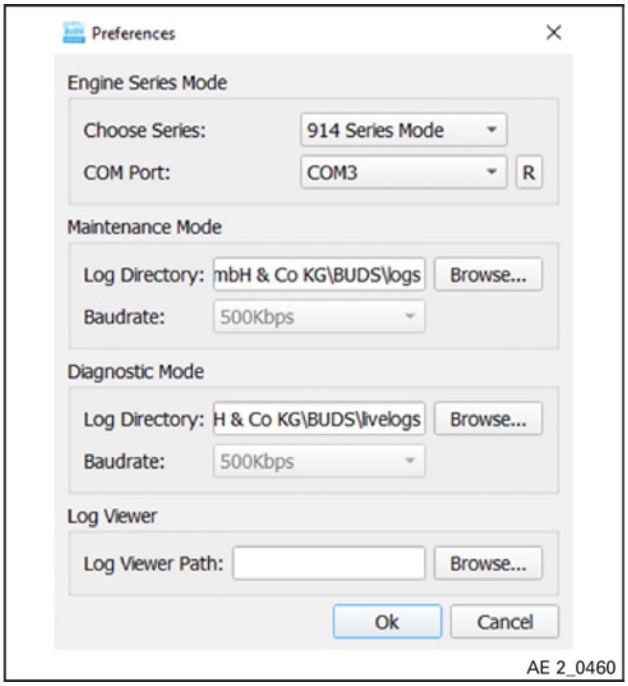

Figure 19.6

Step	Procedure
6	Choose OK to re-try connection.

NOTE

Ensure engine ignition “OFF” and secured against unintentional “ON”.

Checking the components of the turbo control

B.U.D.S. Aircraft software allows quick detection of shortcomings of the components by selecting the “Main Gauges” tab.

Figure 19.7

1	*RPM*	2	*Ambient pressure*
3	*Airbox pressure*	4	*Airbox temperature*
5	*Throttle position*	6	*Servo position*

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.

NOTICE

Danger of damage to the fuel distribution system and ignition unit!

MAINTENANCE

Beside maintenance and special checks, see current Maintenance Manual Line for the respective engine type.

TECHNICAL DATA

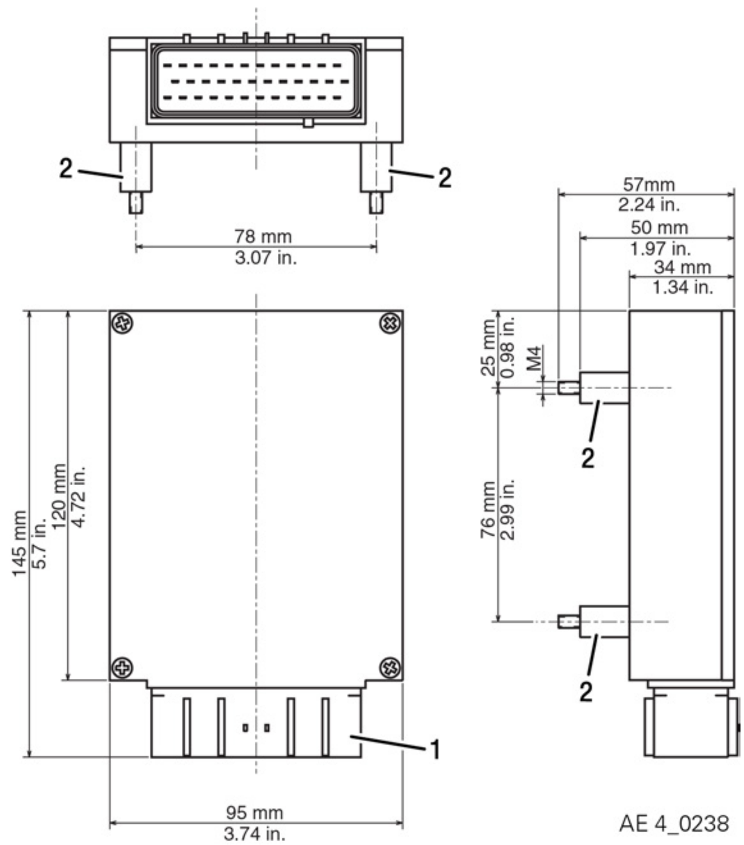

Figure 19.8

1 *Connector socket*

2 *Attachment points (rubber buffers)*

REMOVAL

TURBO CONTROL UNIT (TCU) — REMOVAL

NOTE

Location of installation may vary depending on aircraft model and is limited by the length of the wiring harness.

Step	Procedure
1	Release the 36-pin plug receptacle.

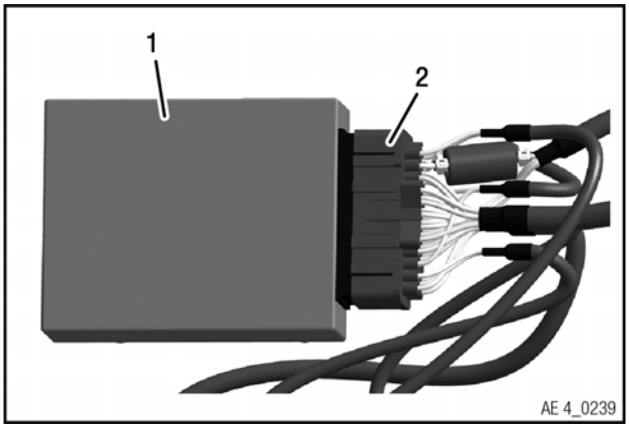

Figure 19.9

1 TCU *2 39-pin plug*

⚠ WARNING
The TCU must never be opened.

INSPECTION

NOTE

A corresponding trouble shooting chart is available on request from authorized distributors and service centers.

See latest Operators Manual (OM) for the respective engine type or the official Homepage www.FLYROTAX.com.

TURBO CONTROL UNIT — INSPECTION

Visual inspection

Step	Procedure
1	Check the component surfaces of the TCU for physical damage.
2	Check the 4 rubber buffers for damage.
3	Check the 36-pin plug receptacle.

NOTICE

Replace TCU without delay in the event of physical damage or incorrect operation.

Check by communication program

NOTICE

If this aid is not at your disposal, a trial run of the engine is required. Engine operation is only allowed for transfer to the nearest maintenance facility, where this check has to be conducted afterwards.

⚠ WARNING

If an inspection reveals irregularities, then the engine must not be taken in operation until the cause is found and rectified.

Step	Procedure
1	Inspection of the throttle valve position.
2	Test run engine.

See the corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 914 Series.

Step	Procedure
3	When switching on the TCU, observe self test of the servo motor and the caution lamps.

TCU DATA LOGS — INSPECTION

Data logs
8 control parameters are monitored and recorded by the TCU. The recording takes place at 6–minute intervals, whereby the highest value of each period will be stored.

Extract log files

Step	Procedure
1	Select “TCU Logs” tab.
2	Choose “Extract Logs”.

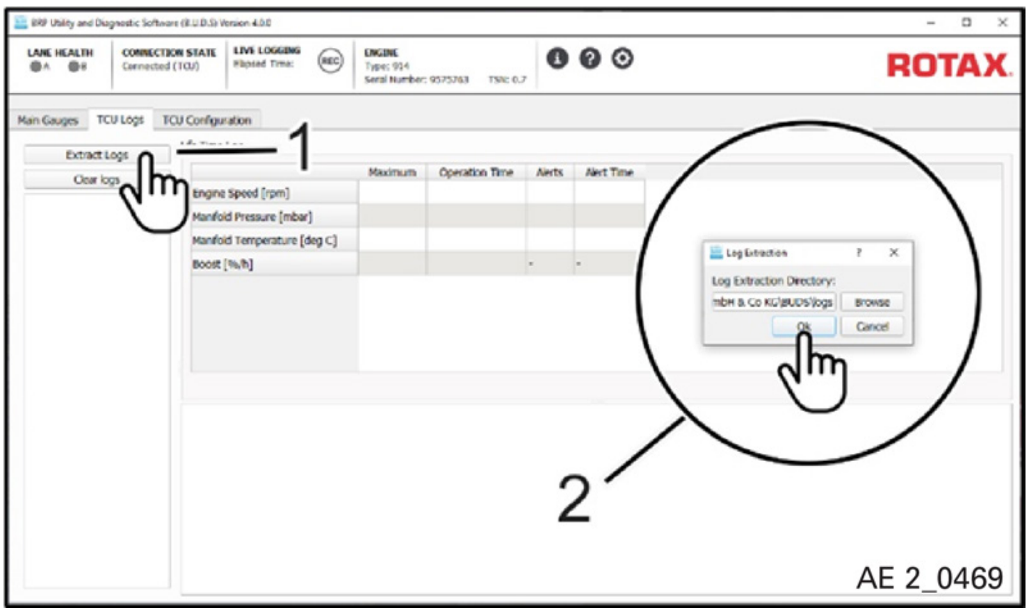

Figure 19.10

1 *Extract Logs*

2 *Extraction Directory*

NOTE

A pop-up window will appear asking for a location to save the extracted Log file. The extracted file will be saved as a .txt file and can be opened, analyzed and graphed with an application such as Micro-soft Excel.

Step	Procedure
3	Choose OK to continue.

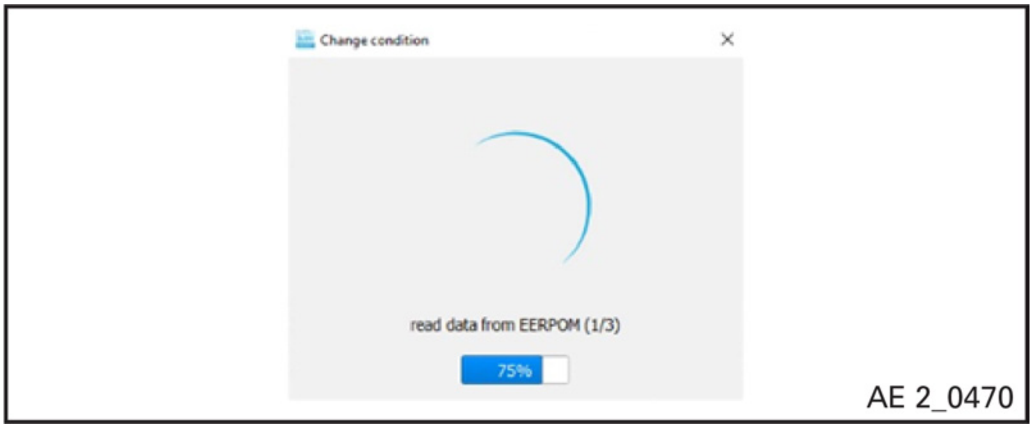

Figure 19.11

When data is fully extracted from the TCU, the Data logs can be viewed within the “TCU Logs” tab. Life Time Log section displays the Maximum values for critical information over the entire running hours of the engine. Individual log extraction files are listed on the left, selecting a log file will display the Data logs as a table sorted by time stamp in engine hours.

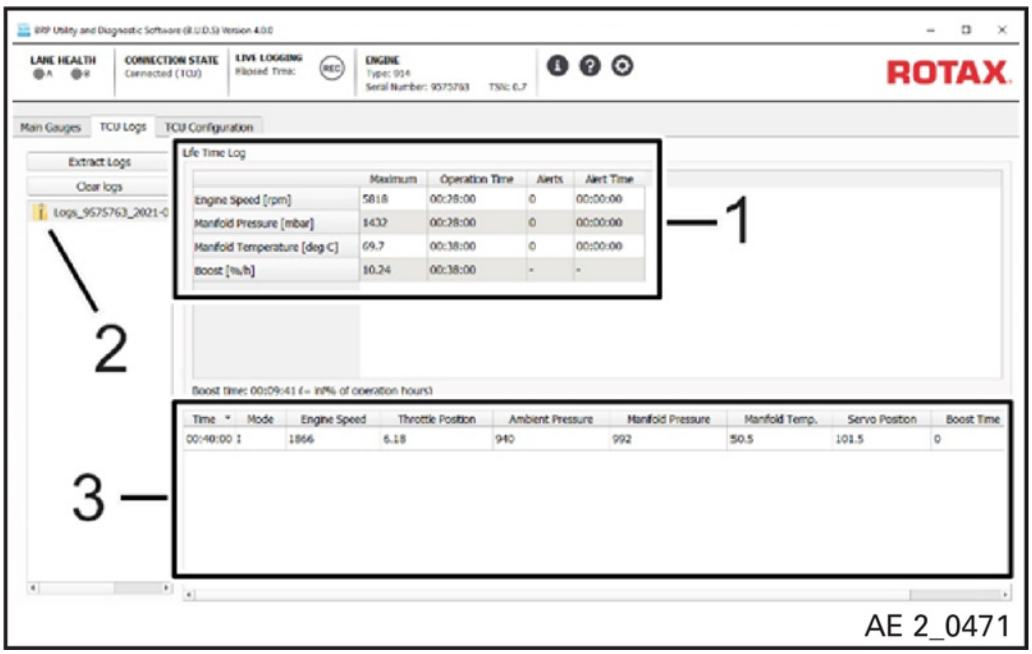

Figure 19.12

1	*Life Time Log*	2	*Extracted Logs*
3	*View Data Logs*		

Clear Log files

Step	Procedure
1	Select “TCU Logs” tab.
2	Choose “Clear Logs”.
3	When prompted, power the TCU “OFF” then “ON”.

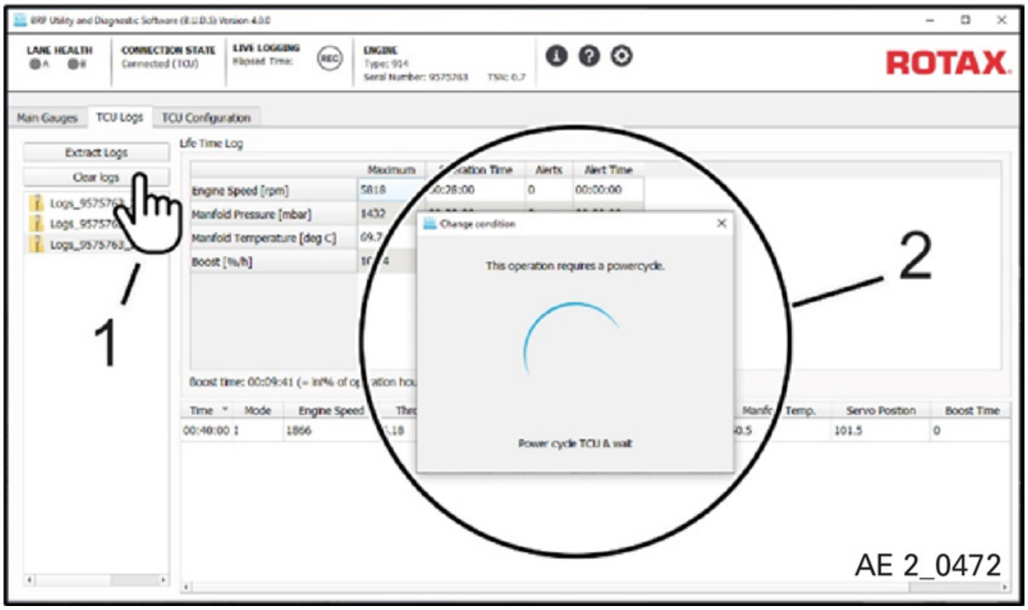

Figure 19.13

1 Clear Logs *2 Power TCU “OFF” then “ON”*

NOTE

Cleared Data Log can not be retrieved. Before clearing it is imperative to extract and save the Logs and attach them to the engine’s logbook.

NOTE

Life-time Data log for critical information such as Engine speed. airbox pressure and airbox temperature are permanently stored within the TCU.

Accessing saved log files
Extracted log files are saved locally to the laptop or PC. The default folder is C:\Program Files (x86)\BRP-Rotax GmbH & Co KG\BUDS. Log data is saved in compressed .zip file format and the file names contain date and time stamps. Within the .zip file are .CSV files (comma separated values) which can be opened and manipulated within Microsoft Excel or equivalent spreadsheet software.

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column10
Mode [I/O]	Time [sec]	Engine Speed [rpm]	Throttle-Pos. [%]	Ambient Pressure [mbar]	Manifold Pressure [mbar]	Manifold Temperature [deg. C]	Servo Position(%)	Boost Time [s]
I	2460	3228	29.27	941	1017	47.6	100.1	0
I	2520	3277	32.38	941	1016	45.4	102.4	0
I	2580	1768	6.33	941	988	45.2	100.1	0
O	2600	1741	6.33	941	989	44.8	100.1	0
I	2660	1765	6.38	941	986	46.5	104.3	0
O	2713	1740	6.38	941	984	46.6	100.1	0
I	1620	5524	102.6	941	1227	56.7	52.8	0
I	1680	5818	114.8	941	1432	69.2	103	44.08
I	1740	5817	114.74	941	1376	69.3	80.1	3.02
I	1800	4022	102.85	941	1227	55.9	102.2	0
I	1860	5523	108.21	941	1279	54.6	90.4	7
I	1920	5007	74.29	941	1105	52.3	39.3	0
I	1980	5818	114.81	941	1421	56.8	104.3	16.52
I	2040	5814	114.83	941	1381	67.1	68	60
I	2100	5812	114.79	941	1376	68.4	66.8	60
I	2160	5810	114.76	941	1376	68.9	66.7	60
I	2220	5810	114.74	941	1375	69.6	67.1	60
I	2280	5810	114.72	941	1376	69.7	67.1	58.36
I	2340	4614	65.3	941	1183	68.7	104.2	0

AE 2_0473

Figure 19.14: Sample Log file

THROTTLE VALVE POSITION SENSOR — INSPECTION

Checking the throttle valve position

Step	Procedure
1	Select the “Main Gauges” tab. To the right of Engine speed is the display position for the throttle valve (carburetor 2/4). **0% Throttle valve completely closed** **100% Throttle valve completely open**
2	Visually check whether the both throttle valves can be fully opened and closed. If necessary, correct the installation setting.
3	Check the display with throttle valve completely closed: **Nominal: 0°** (max. deviation +3%)
4	Check the display with throttle valve completely open: **Nominal: 115%** (max. deviation -2%)

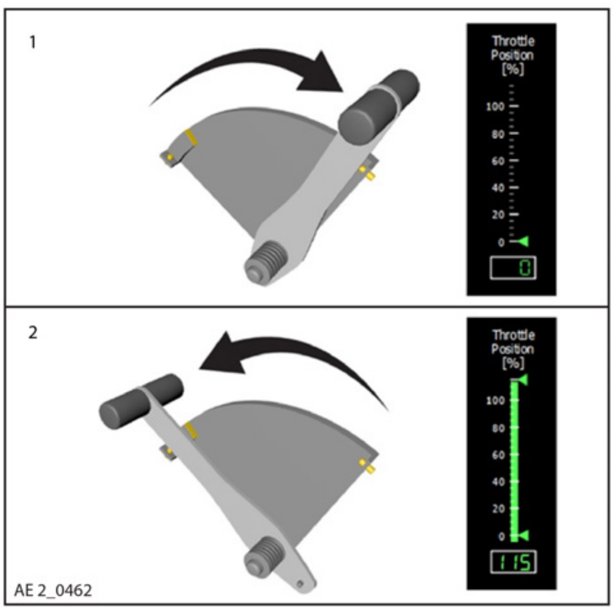

Figure 19.15

1 Idle *2 Full throttle*

NOTICE

Check whether indication is linear over the complete range from 0% to 115% i.e. the 115% position is not indicated before throttle valve is fully open.

Step	Procedure
5	Check the display at max. continuous performance (cruise). **nominal: 100% max. deviation +3%**

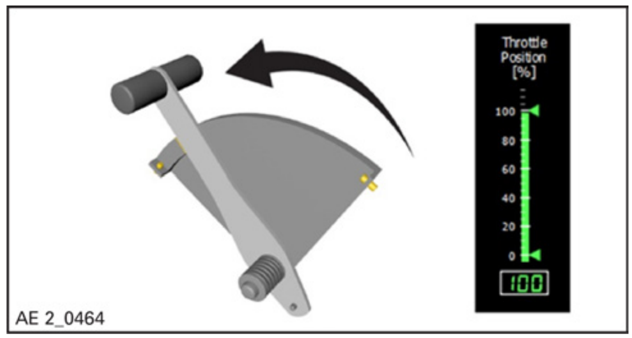

Figure 19.16

NOTICE

The throttle lever must be in positive stop position at 100%.

⚠ WARNING

This check of position is only meaningful and permissible if idle- and full throttle-position are within the permissible tolerances.

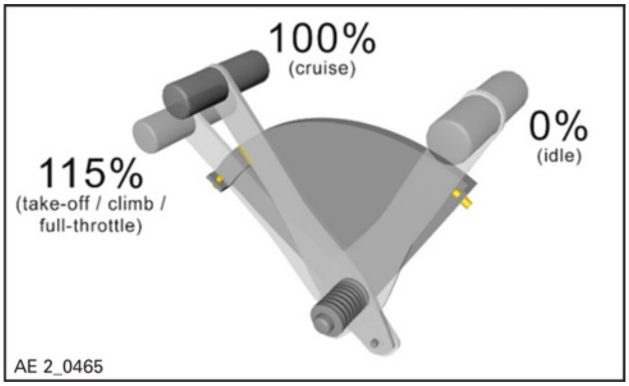

Figure 19.17

NOTE

If the throttle position for idle and full throttle are not within the permissible tolerances or if not proceeding linearly, then a new calibration of the throttle position is absolutely necessary.

INSPECTION PROTOCOL FOR TURBO CHARGER

Inspection protocol for turbo charger control unit

Engine type:		TSN:	
Engine serial no.:		TSO:	
TCU serial no.:		TSN: / TSO:	
TCU part no.:			
B.U.D.S. Program-Version:	☐ B.U.D.S. 4.0	☐	☐
Visual check:			
carburetor 2/4, serial no.:			
Check with:	ROTAX testcase ☐	on engine ☐	

lamp control

lamps flash during switch on:	orange lamp ☐	red lamp ☐

solenoid control

solenoid operates at : ☐	1260 mbar(966473 / 966741)	Airbox pressure

Remarks : ______________________________

____

____

____

____

OVER-BOOST-WARNING

red lamp steady at :	O.K. ☐ airbox pressure >1550mbar

plausibility-control (MONITOR-menu)

LOAD [1] (idle) :	0È % (target value)	%
LOAD [1] (full) :	115 % (target value)	%
ambient pressure[2]:		mbar
airbox pressure[2]:		mbar
airbox temperature[3]:		°C
servoposition (idle)[4]:	100 %±3 (target value)	%

[1] Linear values of load

[2] With new ambient pressure sensor +60 mbar (+/- 10 mbar) difference between the two values (compare actual pressure of the day)

[3] temperature should be equal to ambient temperature

[4] Servoposition at IDLE = 100% servoposition = Waste-Gate closed

calibration-control

	B.U.D.S. 4.0	
	966741 ☐	☐
Servo OFFSET	.... 60 ☐	.... ☐
Servo RANGE	.... 900 ☐	.... ☐
Throttle OFFSET	.... 60 ☐	.... ☐
Throttle RANGE	.... 710 ☐	.... ☐
Airbox pressure sensor calibration parameter A	.......12219 ☐	.... ☐
Airbox pressure sensor calibration parameter B	.... 250 ☐	.... ☐
Ambient pressure sensor calibration parameter A	.... 6720 ☐	.... ☐
Ambient pressure sensor calibration parameter B	.... -37 ☐	.... ☐

Signature Tester : ______________ Date: ______________

AE 4_0268

Figure 19.18

INSTALLATION

TURBO CONTROL UNIT (TCU) — INSTALLATION

NOTE

Location of installation may vary depending on aircraft model and is limited by the length of the wiring harness.

Step	Procedure
1	Connect the 36-pin plug receptacle. Observe the instructions of the aircraft manufacturer.

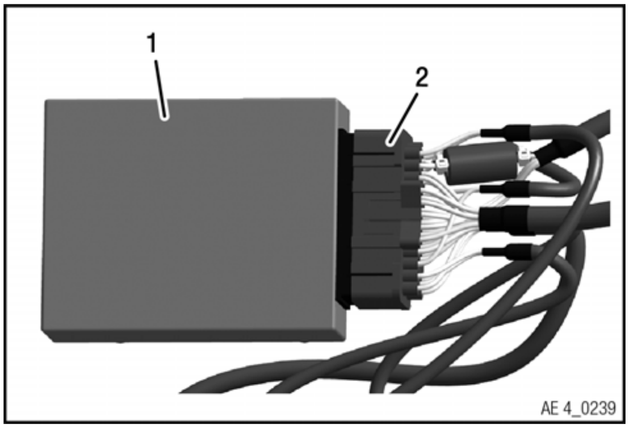

Figure 19.19

1 TCU *2 39-pin plug*

FINISHING WORK

- Transfer the actual data documented when removing the old TCU to the newly installed TCU.
- Delete the error memory of the new TCU.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

- Read out the TCU.

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Chapter: 76–50–00
WIRING HARNESS (914 SERIES ONLY)

TOPICS IN THIS CHAPTER

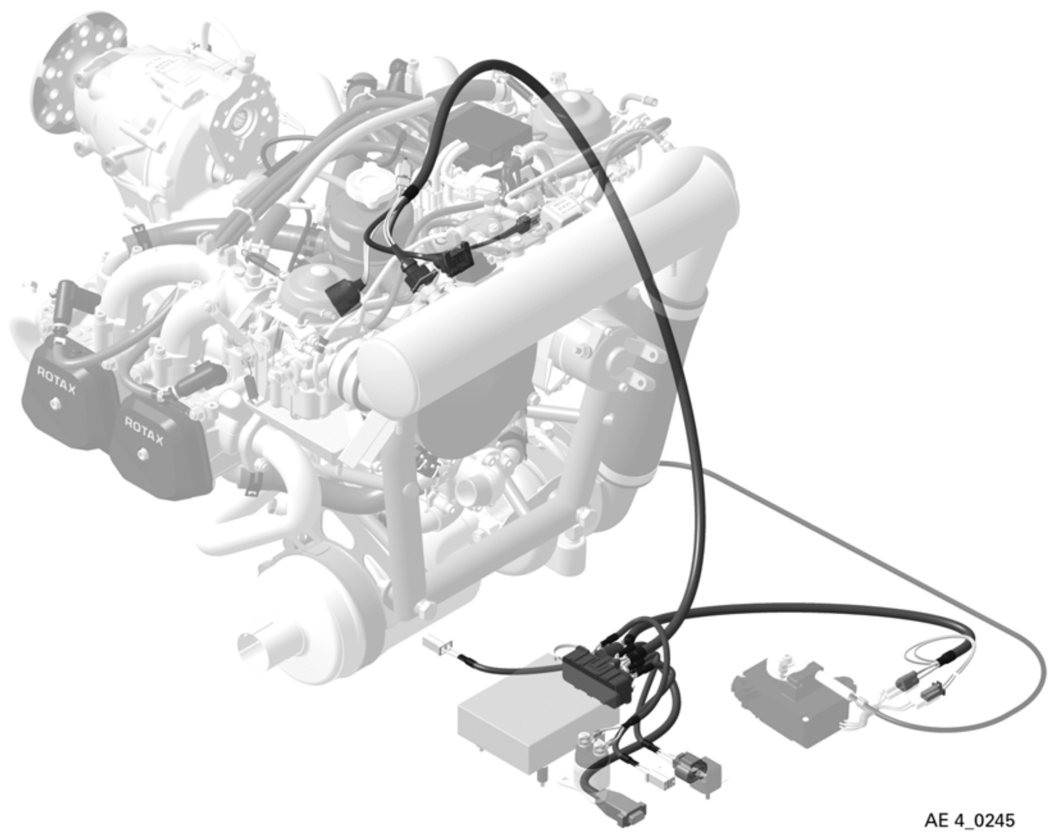


Figure 20.1: Wiring harness

SYSTEM DESCRIPTION

All sensors are connected with the TCU via a common wiring harness. In addition to the voltage supply for the TCU, the following connections are provided on the wiring harness:

- plug connections, each for one warning and one boost lamp
- plug connection for the three-way solenoid valve
- two wires for an additional electronic rev counter
- PC interface for reading the TCU data via computer

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.

NOTICE

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 current Maintenance Manual Line for the respective engine type .

WIRING HARNESS

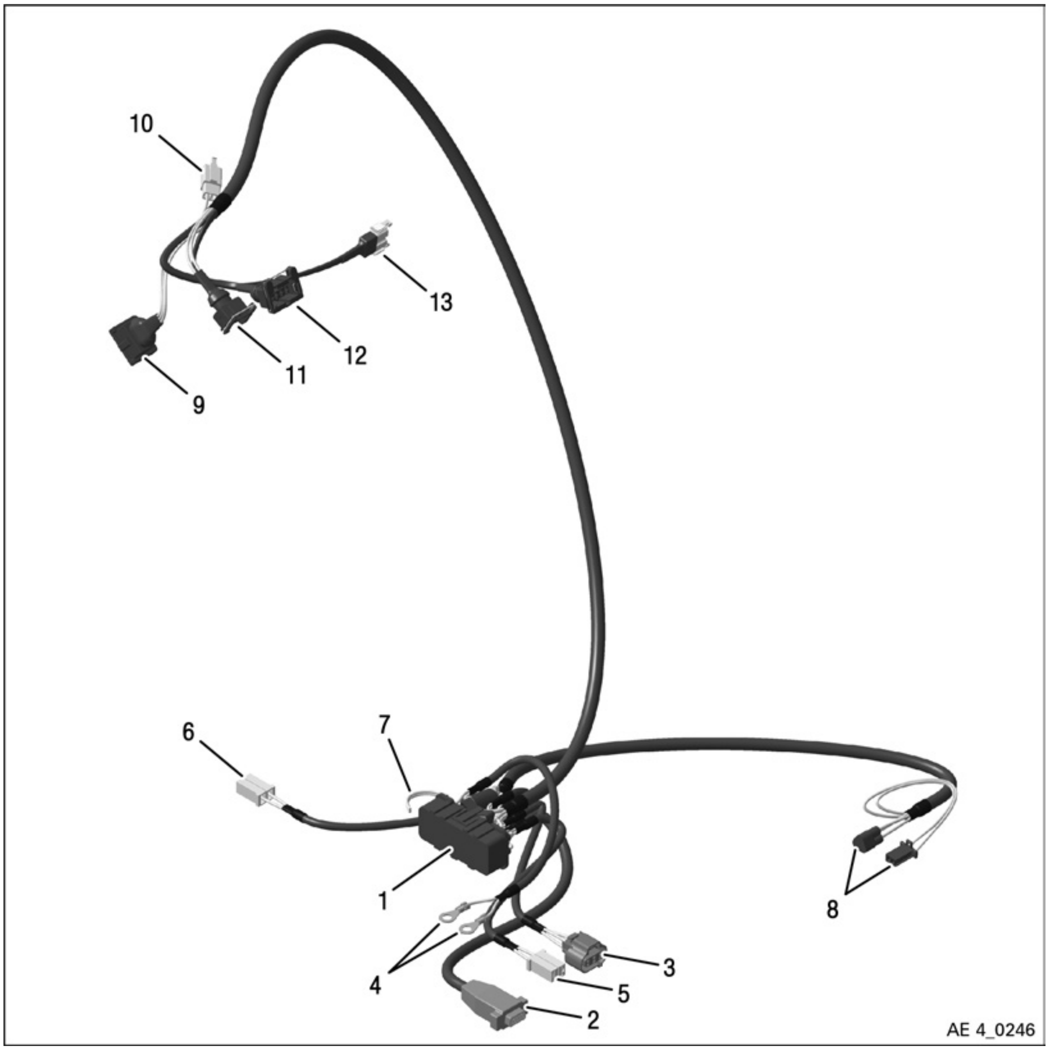


Abbildung 20.2

1	*Connector TCU*	2	*PC (RS232)*
3	*Ambient pressure sensor*	4	*Power supply*
5	*Caution lamp*	6	*Warning lamp*
7	*External rev. counter*	8	*Servo motor*
9	*Throttle valve position sensor*	10	*Trigger coil (Speed - Electronic rev counter)*
11	*Resistance thermometer*	12	*Airbox pressure sensor*
13	*three–way solenoid valve*		

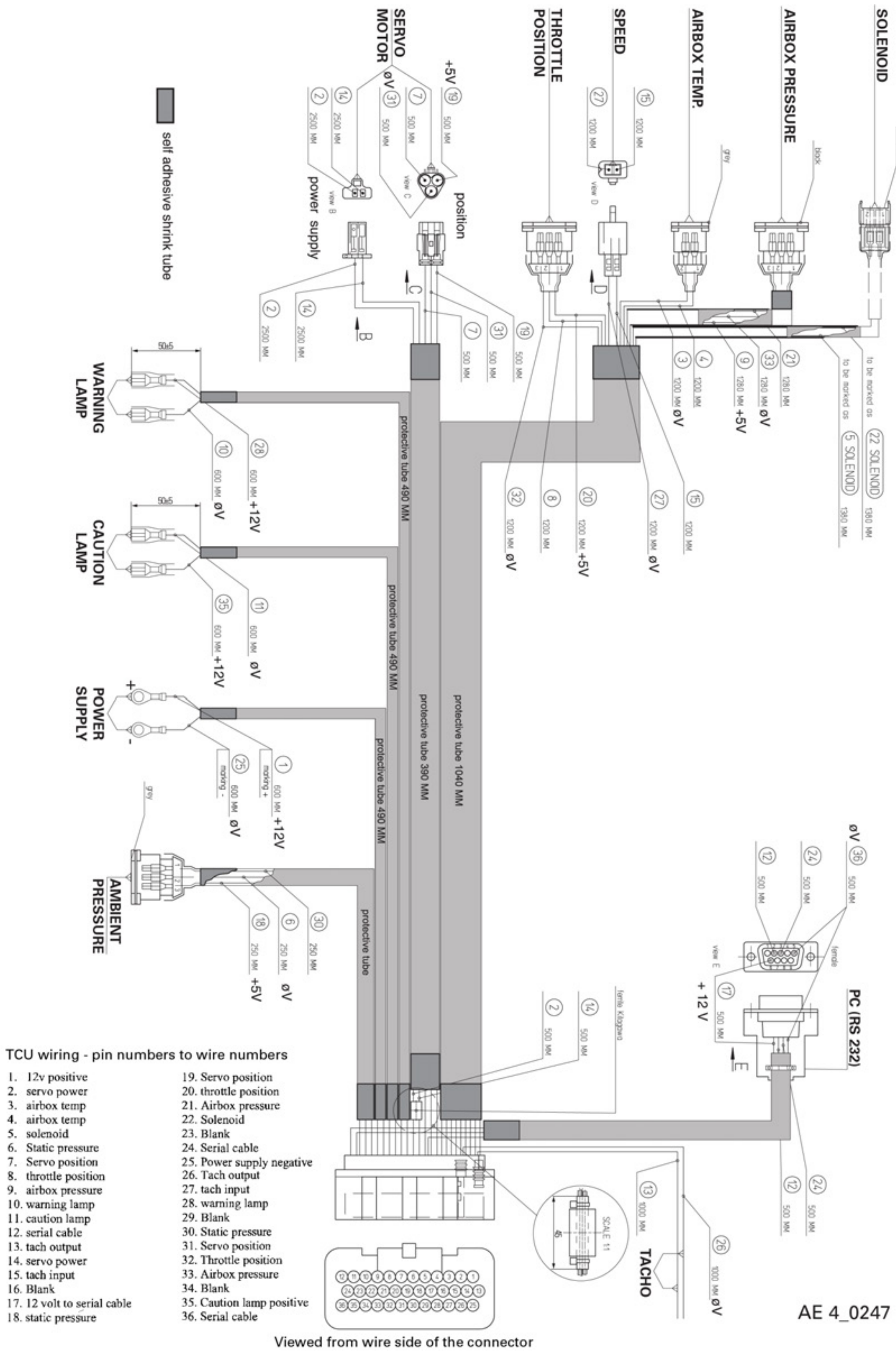


Abbildung 20.3

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 current Maintenance Manual Line (MML) for the respective engine type, Chapter 05-00-00 and 12-00-00.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12–20–00 section Planned maintenance.

Please observe the instruction of the aircraft manufacturer.

- Disconnect all detachable connections (all cable ties, cable holders, clamps etc.).
- Disconnect the wiring harness from caution lamp, warning lamp and external rev counter.
- Disconnect the wiring harness from TCU.

NOTE

All connectors must be provided with a protective covering after being removed or detached.

TURBO CONTROL UNIT (TCU) — DISCONNECTION

See Chapter 76-10-00 Turbo control unit (TCU) – removal

STARTER RELAY — DISCONNECTION

Wiring harness designation:

- grey plug connection
- power supply

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.

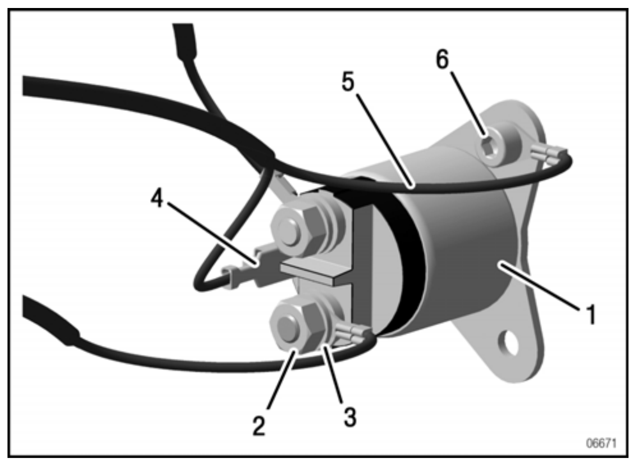


Figure 20.4

1	*Starter relay*	*2*	*Hex. nut M6*
3	*Washer 6.4*	*4*	*Faston connector (aircraft)*
5	*Ground (aircraft)*	*6*	*Bolt/ screw (aircraft)*

SERVO MOTOR — DISCONNECTION

Wiring harness designation:

- servo motor

Step	Procedure
1	Push in the tab on the top of the 2-pin plug connector (power supply) and at the same time pull the connector out of the connection socket.
2	Disconnect the 3-pin plug connector (position)

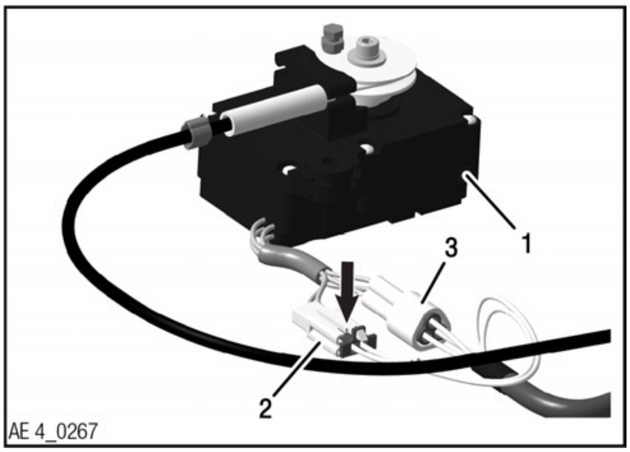


Figure 20.5

1	*Servo motor*	*2*	*Connector (power supply)*
3	*Connector (position)*		

AMBIENT PRESSURE SENSOR — DISCONNECTION

Wiring harness designation:

- grey plug connection
- ambient pressure

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.

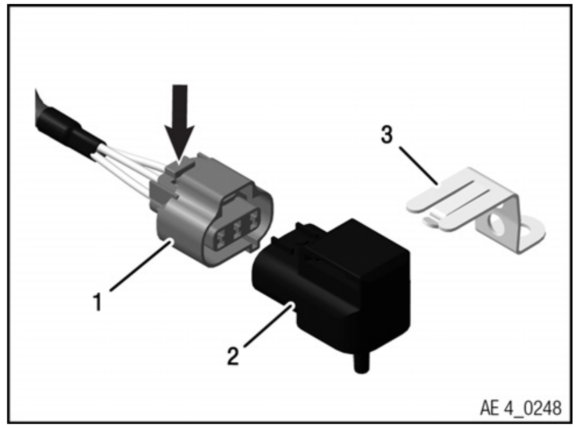


Figure 20.6: Allocation of connections

1	*Connector*	*2*	*Ambient pressure sensor*
3	*Holding bracket*		

RESISTANCE THERMOMETER — DISCONNECTION

Wiring harness designation:

- grey plug connection
- airbox temp.

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.

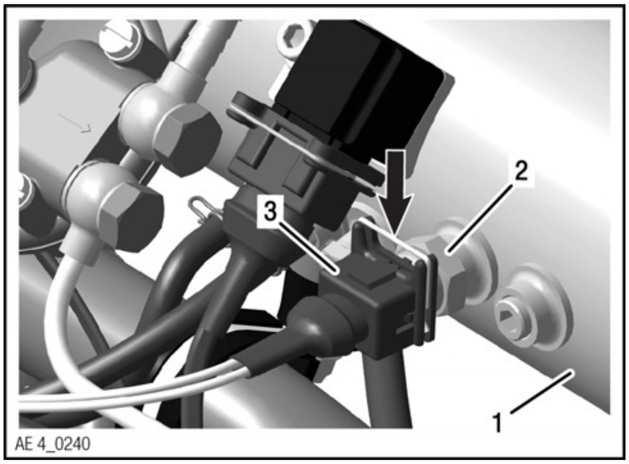


Figure 20.7: Location

1	*Airbox*	2	*Resistance thermometer*
3	*Connector*		

AIRBOX PRESSURE SENSOR — DISCONNECTION

Wiring harness designation:

- black plug connection
- airbox pressure

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.

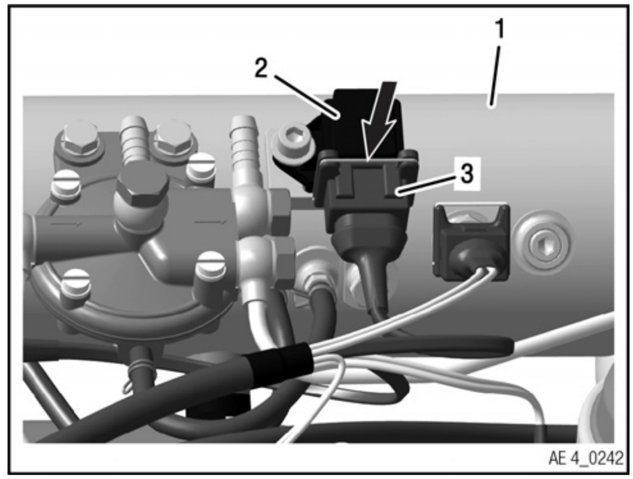


Figure 20.8

1	*Airbox*	2	*Airbox pressure sensor*
3	*Connector*		

THROTTLE VALVE POSITION SENSOR — DISCONNECTION

Wiring harness designation:

- throttle position

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.

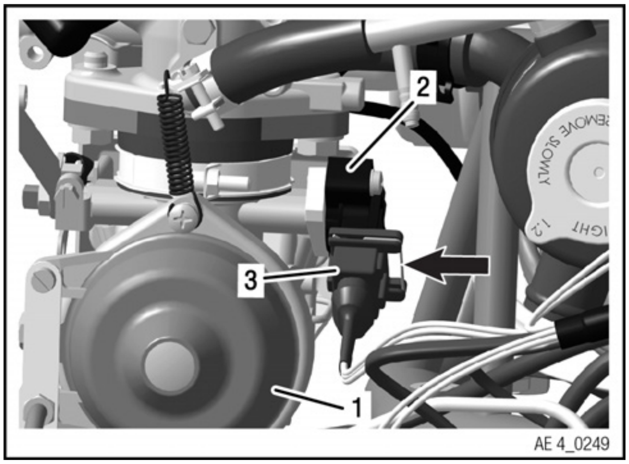


Figure 20.9

1	*Carburetor 2/4*	2	*Throttle valve position sensor*
3	*Connector*		

THREE-WAY SOLENOID VALVE — DISCONNECTION

Wiring harness designation:

- grey plug connection
- solenoid

Step	Procedure
1	Unplug the connector of the three-way solenoid valve.

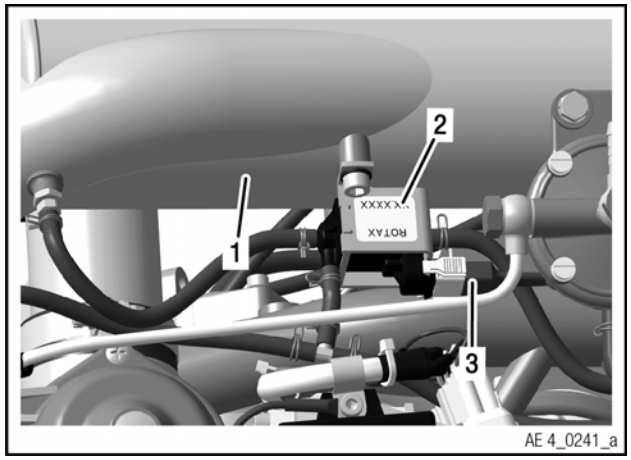


Figure 20.10

1	*Airbox*	2	*Three-way solenoid valve*
3	*Connector*		

TRIGGER COIL (SPEED) – DISCONNECTION

Wiring harness designation:

- speed

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 of the trigger coil.

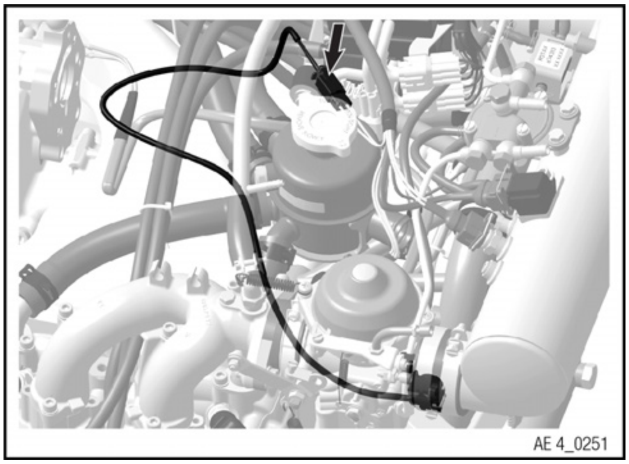


Figure 20.11

WIRING HARNESS — REMOVAL

NOTE

After all plugs are disconnected the wiring harness can be removed.

INSPECTION

NOTICE

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.

NOTICE

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.

⚠ WARNING

If an inspection reveals irregularities, then the engine must not be taken in operation until the cause is found and rectified.

NOTICE

In the event of physical damage or incorrect operation, replace part without delay. Repair on your own authority is not permitted.

NOTICE

Due to a modification a three-way solenoid valve was introduced. If the engine is equipped with an old three-way solenoid valve then, if the wiring harness needs to be replaced, the three-way solenoid valve also has to be changed.

General visual inspection. See relevant Maintenance Manual Line 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!).

- For verification and troubleshooting, check all connections for passage and physical damage
- Verify that all plug connections are fit tightly

If the wiring harness is replaced,

- the throttle valve position must be recalibrated
- and the turbocharger control checked.
- If this aid is not at your disposal, an engine test run has to be performed.

Electric test

The electric test of the wiring harness takes place in the installed state.

Step	Procedure
1	Connect the wiring harness • on the TCU direct with the PC (Connector RS 232 to USB).
2	Install the required communication program on the PC. See Chapter 76-10-00 Section “System description” “Communication program”.

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.

NOTICE

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: TCU connector with a thin layer of Deoxit contact spray.
All the other connectors with a dielectric silicone-based lubricant or an equivalent lubricant.

WIRING HARNESS — INSTALLATION

Please observe the instructions of the aircraft manufacturer.

Step	Procedure
1	Connect the wiring harness to the warning lamp and caution lamp.
2	Connect the wiring harness to the external rev. counter.
3	Connect the wiring harness to the TCU.

STARTER RELAY — CONNECTION

Please observe the instructions of the aircraft manufacturer.

Wiring harness designation:

- power supply

Step	Procedure
1	Install the grounding bolt/screw. Observe the instructions of the aircraft manufacturer.
2	Install starter cables on terminals with hex. nut M6 and Washer 6.4. Tightening torque 10 Nm (89 in. lb).
3	Install faston connector.

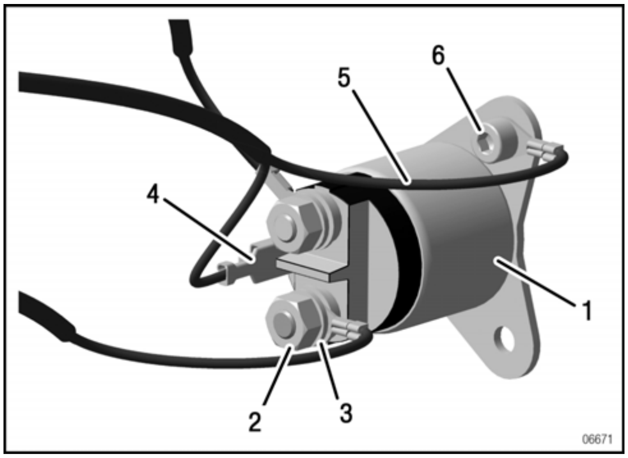


Figure 20.12

1	*Starter relay*	2	*Hex. nut M6*
3	*Washer 6.4*	4	*Faston connector (aircraft)*
5	*Ground (aircraft)*	6	*Bolt/ screw (aircraft)*

SERVO MOTOR— CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

THROTTLE VALVE POSITION SENSOR — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

AIRBOX PRESSURE SENSOR — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

RESISTANCE THERMOMETER — 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.

TRIGGER COIL (SPEED) — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

THREE-WAY SOLENOID VALVE — CONNECTION

The sensors are connected and disconnected in the same way. See Chapter 76-50-00 section Removal.

TURBO CONTROL UNIT (TCU) — CONNECTION

See Chapter 76-10-00 Turbo control unit (TCU) – installation

FINISHING WORK

Please observe the instruction of the aircraft manufacturer.

- Connect all detachable connections (all cable ties, cable holders, clamps)
- 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 current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

Chapter: 76–70–00
SENSORS AND ACTUATORS

TOPICS IN THIS CHAPTER

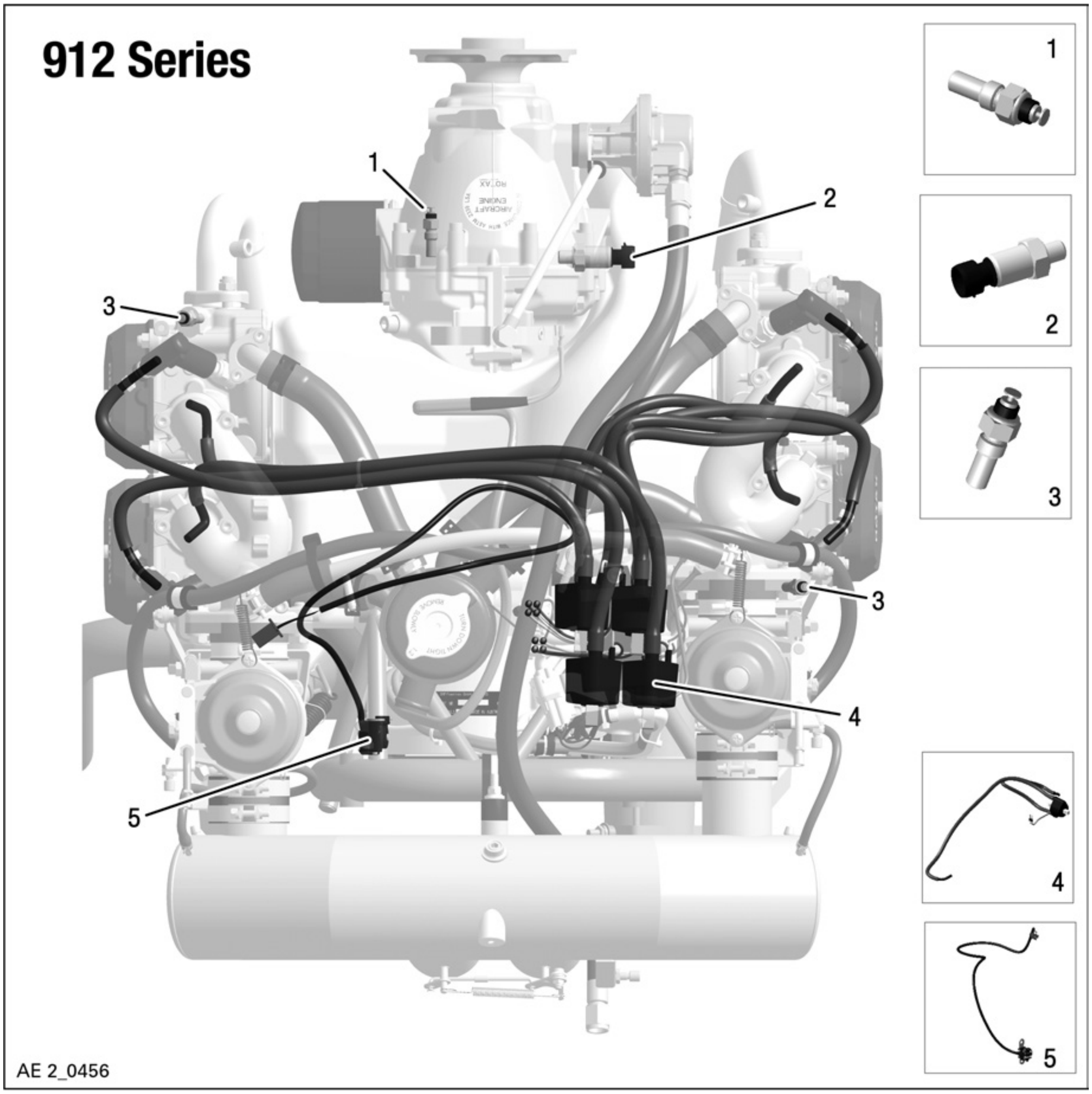


Figure 21.1

Sensors

1 *Oil temperature sensor*

2 *Oil pressure sensor*

3 *Coolant temperature sensor*

Actuators

4 *Double ignition coil*

5 *Trigger coil (Speed-Electronic rev. counter)*

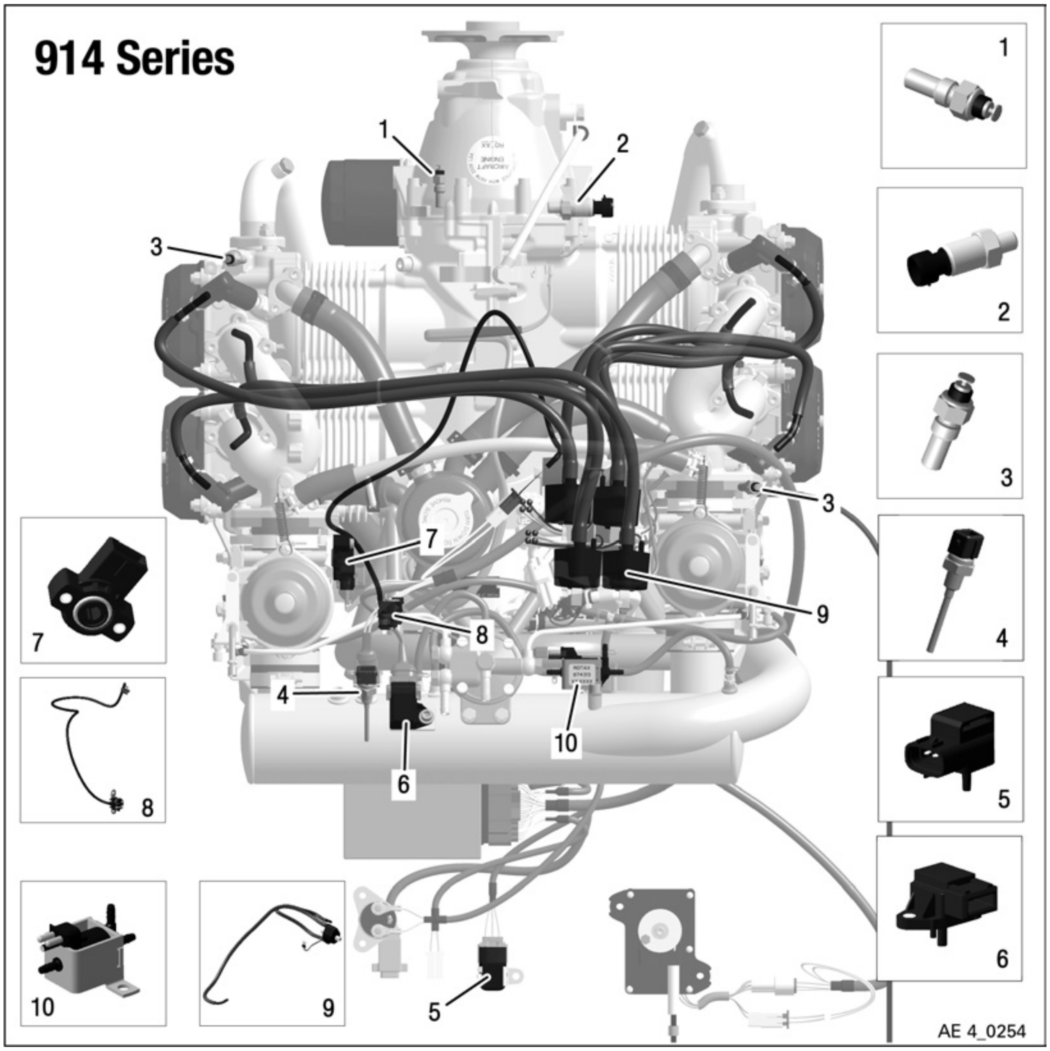


Figure 21.2

Sensors

1	*Oil temperature sensor*	2	*Oil pressure sensor*
3	*Coolant temperature sensor*	4	*Resistance thermometer*
5	*Ambient pressure sensor*	6	*Airbox pressure sensor*
7	*Throttle valve position sensor*	8	*Trigger coil (Speed-Electronic rev. counter)*

Actuators

9	*Double ignition coil*	10	*Three–way solenoid valve*

SERVICE PRODUCTS

Description	Part number
LOCTITE 5910	899791
LOCTITE 243	897651
LITHIUM-BASE GREASE	897330
Locking paint	898570

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. The information captured by the sensors is transmitted to the TCU where it is processed, and the corresponding signals are sent on to the actuators.

SENSORS

Airbox pressure sensor (914 Series)
provides the actual boost pressure in the airbox.

Ambient pressure sensor (914 Series)
conveys the prevailing ambient pressure.

Throttle valve position sensor (914 Series)
supplies actual position of carburetor throttle valve.

NOTE

The target boost pressure is determined from the inputs of the above-mentioned sensors.

Electronic rev. counter signal
transmits the actual engine speed via the 5th sensors on the ignition housing.

Resistance thermometer (914 Series)
conveys the prevailing intake air temperature in the airbox.

Coolant temperature sensor
measures the coolant temperature and is situated on the cylinder head.

Oil temperature sensor
measures the oil inlet temperature and is situated on the oil pump.

Oil pressure sensor
measures the oil pressure and is situated on the oil pump housing.

ACTUATORS AND INDICATORS

Orange caution lamp (914 Series)
All sensor inputs are monitored by the TCU via this caution lamp.

- lamps goes out
  This indicates that the TCU is ready for operation.
- lamp flashes
  This indicates a malfunction of the TCU or its periphery.

In the event of a malfunction, for instance if a circuit is interrupted, the TCU switches over to pre-programmed default values to ensure engine operation.

NOTICE
While the default values are effective, monitoring of the respective channel e.g. overspeed, is not possible. The monitoring function is inactive.

Red boost lamp (914 Series)
Exceeding the admissible boost pressure will activate the red boost lamp, and it will light up continuously until boost pressure falls below the threshold.
Threshold 1550 hPa (actual boost pressure)
The TCU registers the time of full engine operation with boost pressure. Full throttle operation for longer than 5 minutes will cause the red warning lamp to flash.

NOTICE
The red boost lamp helps the pilot to avoid full power operation with too high boost pressure for longer than 5 minutes as otherwise the engine would be thermally overstressed.

NOTE

The time observation starts at actual boost pressure of 1250 hPa. After 5 minutes the warning is issued via the boost lamp.
The warning is deactivated again as soon as the boost pressure falls below 1250 hPa. If the pressure limit is exceeded again, for example after 30 seconds, the boost lamp lights up again.

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.

Three – way solenoid valve
At an airbox pressure above 1270 hPa, the pressure in the float chambers will be raised by the ram air

pressure at airbox initiated by the TCU via the three-way solenoid valve. As a result, the effective pressure in the fuel bowl will be increased by the same amount

TEMPERATURE AND PRESSURE MEASUREMENT SYSTEM

All the sensors are connected with the TCU via a common wiring harness. In addition to the voltage supply for the TCU, the following connections are provided on the wiring harness:

- plug connections, each for one warning and one boost lamp
- plug connection for the three-way solenoid valve
- 2 wires for an additional electronic rev counter
- PC interface for reading the TCU data via computer

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!

NOTICE

Danger of damage to the fuel distribution system and ignition unit!
Do not touch or pull off 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 current Maintenance Manual Line for the respective engine type.

REMOVAL

Preparation
Before the sensors and actuators are removed, the procedures and checks described below must be carried out to identify any further faults rectify them as part of repair work.

NOTE

This work can only be carried out on the whole unit.

General visual inspection. See Maintenance Manual Line (MML) for the respective engine type.

- Use the diagnostic program for troubleshooting and read out the error memory. (only for 914 Series)

OIL TEMPERATURE SENSOR — REMOVAL

NOTE

Remove the oil temperature sensor only if required, e.g. in the event of damage or for cleaning.

Step	Procedure
1	Screw the sensor out of the oil pump housing.
2	Clean the thread of the sensor.

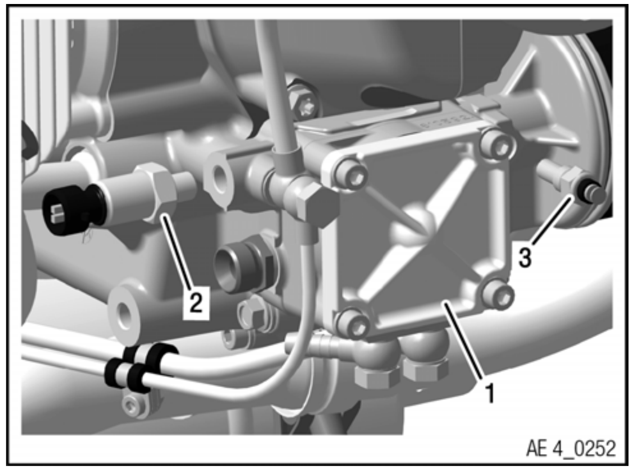


Figure 21.3

1	*Oil pump housing*	2	*Oil pressure sensor*
3	*Oil temperature sensor*		

OIL PRESSURE SENSOR — REMOVAL

NOTE

Remove the oil pressure sensor only if required, e.g. in the event of damage or for cleaning.

NOTE

Take care which oil pump housing is mounted. The part number is shown on the housing.

Step	Procedure
1	Disconnect oil pressure cable part no. 864250 from oil pressure sensor.
1	Screw the oil pressure sensor out of the oil pump.
2	Clean the thread of the oil pressure sensor.

old version
Sensor part no. 956413

NOTE

New oil pressure sensor cannot be installed on old oil pump assemblies without modification to oil pump housing.

Step	Procedure for oil pump housing part no. 911809
Option A: Replace oil pump housing	
1	Remove the oil pump housing in accordance with the relevant Maintenance Manual.
Option B: Rework of the oil pump housing	
1	Recut threads with M10x1 thread tap.
2	Clean the thread completely from swarf.

NOTE

A change for the wiring harness is needed, see Installation Manual (IM) for the respective engine type, Chapter 76-00-00.

COOLANT TEMPERATURE SENSOR — REMOVAL

Step	Procedure
1	Screw the sensor out of the cylinder head.
2	Clean the thread of the sensor.

Location
The coolant temperature sensor are installed on cylinder head 2 and 3.

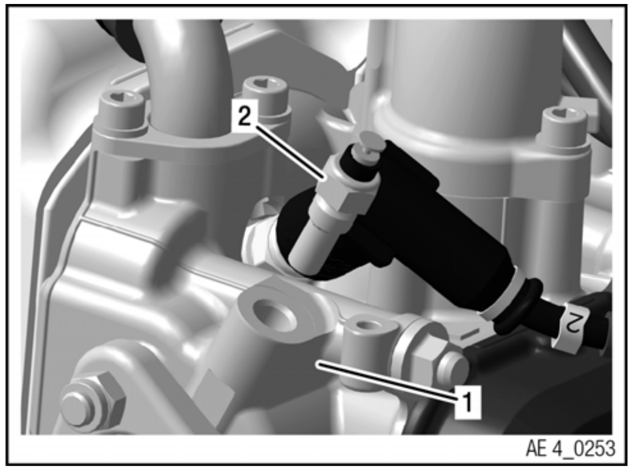


Figure 21.4

1 Cylinder head   *2 Coolant temperature sensor*

RESISTANCE THERMOMETER — REMOVAL (914 SERIES ONLY)

Location
The resistance thermometer is integrated in the airbox.

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	Unscrew the sensor.
3	Clean the thread of the sensor.

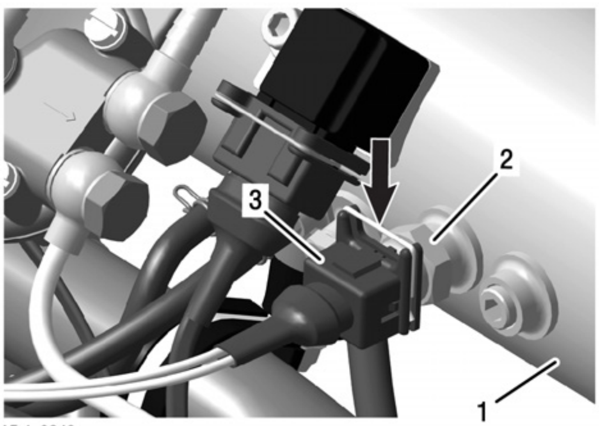


Figure 21.5: Location

1 Airbox *2 Resistance thermometer*
3 Connector

AMBIENT PRESSURE SENSOR – REMOVAL (914 SERIES ONLY)

Location
The installation location depends on the aircraft type, but is limited by the length of the wiring harness.

NOTICE

The sensor is designed for a pressure range of 100 hPa to 1200 hPa and max. pressure must not exceed 3500 hPa otherwise the sensor must be replaced.

Step	Procedure
1	Check the current values via communication program (Monitoring).
2	Disconnect the plug connection to the wiring harness.
3	Disconnect the air pressure hose.
4	Remove ambient pressure sensor from holding bracket.

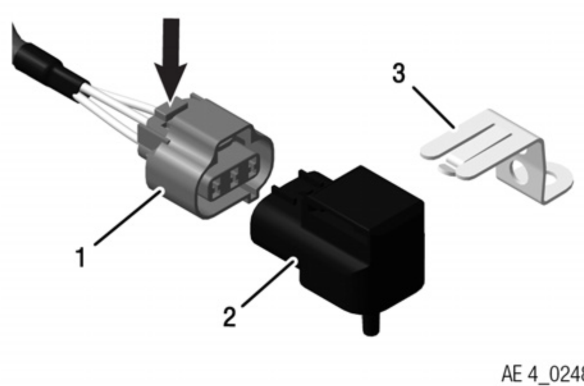


Figure 21.6

1 Connector *2 Ambient pressure sensor*
3 Holding bracket

AIRBOX PRESSURE SENSOR — REMOVAL (914 SERIES ONLY)

Location
The airbox pressure sensor is integrated in the airbox.

See SI-914-013 and SI-914-015, “Introduction of a new airbox”, latest issue.

NOTICE

The sensor is designed for a pressure range of 500 hPa to 2500 hPa and max. pressure must not exceed 3500 hPa otherwise the sensor must be replaced.

Step	Procedure
1	Check the current values via communication program (Monitoring).
2	Disconnect the plug connection to the wiring harness.
3	Loosen the Allen screw with washer and remove airbox pressure sensor and O-ring.

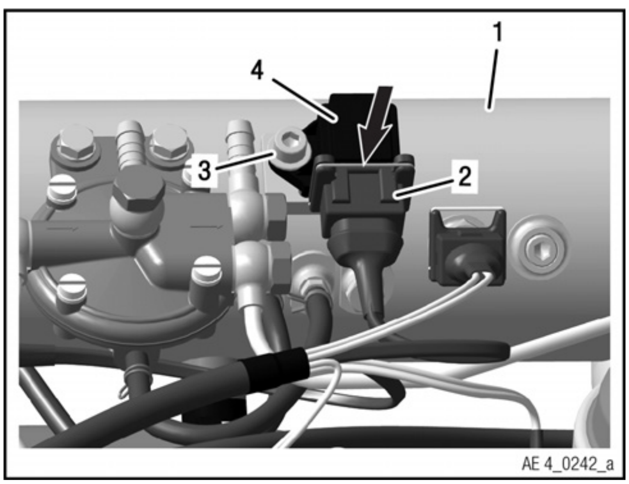


Figure 21.7

1	*Airbox*	2	*Connector*
3	*Allen screw with washer*	4	*Airbox pressure sensor and O-ring*

THROTTLE VALVE POSITION SENSOR— REMOVAL (914 SERIES ONLY)

Location
The throttle valve position sensor is installed on constant depression carburetor 2/4.

Step	Procedure
1	Disconnect the plug connection to the wiring harness.
2	Loosen the 2 combined screws with washers and remove throttle valve position sensor with O-ring.

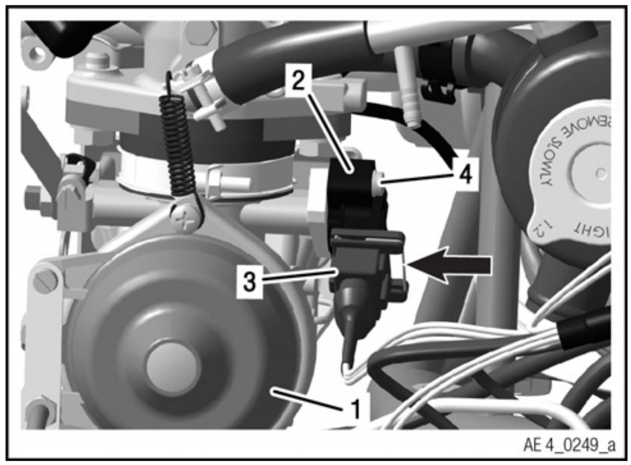


Figure 21.8

1	*Carburetor*	2	*Throttle valve position sensor*
3	*Connector*	4	*Combined screw with washer*

THREE-WAY SOLENOID VALVE — REMOVAL (914 SERIES ONLY)

Step	Procedure
1	Unplug connection wiring harness of three-way solenoid valve.
2	Loosen 3x clamps for three-way solenoid valve and remove pressure connection line.
3	Open 2 Allen screws with lock washers and remove three-way solenoid valve.

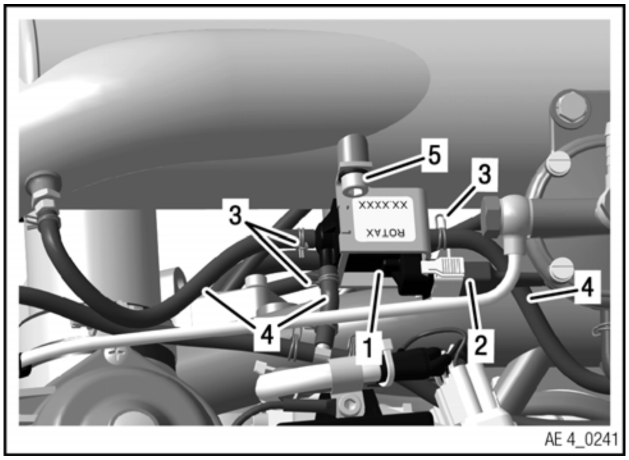


Figure 21.9

1	*Three-way solenoid valve*	2	*Plug*
3	*Clamp*	4	*Pressure connection line*
5	*Allen screw with lock washer*		

ELECTRONIC REV COUNTER– REMOVAL

See Chapter 24–20-00 Internal generator.

DOUBLE IGNITION COIL – REMOVAL

See Chapter 74-20-00 Distribution

WARNING LAMP — REMOVAL

See documentation of aircraft manufacturer.

INSPECTION

SENSORS AND ACTUATORS

Preparation

NOTE

Before inspection of the sensors and actuators, ensure that the whole aircraft system is fully functional!

See documentation of aircraft manufacturer.

- Battery
- Grounding connections
- Cable connections

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.

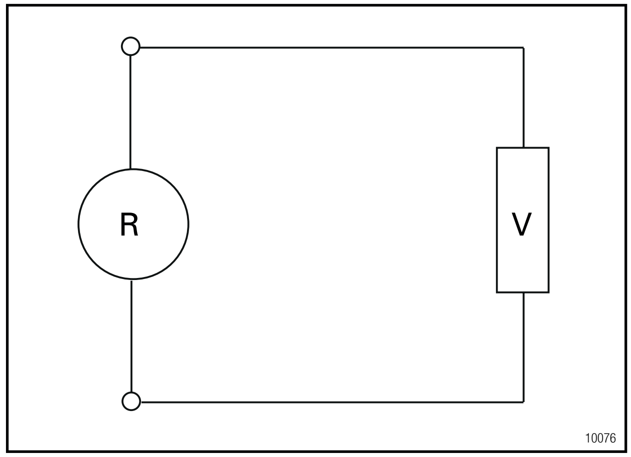


Figure 21.10

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.

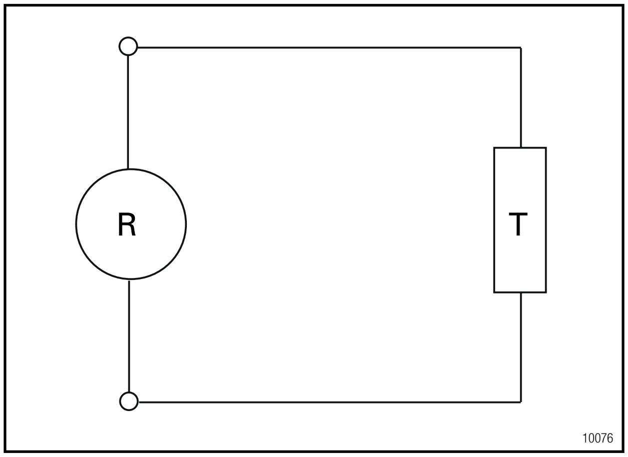


Figure 21.11

R *Ohmmeter* *T* *Temperature sensor*

VOLTAGE MEASUREMENT

General note

NOTICE

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.

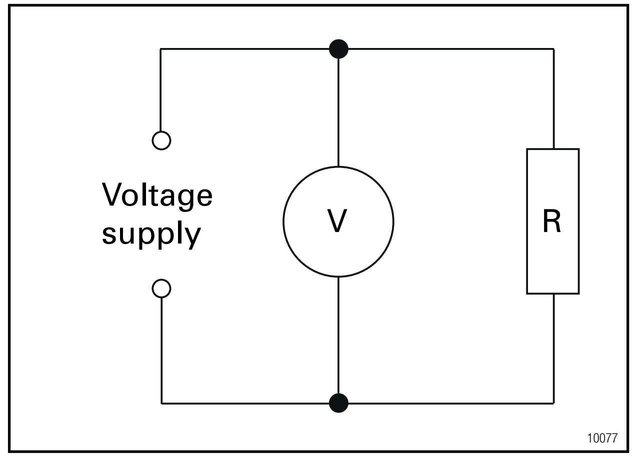


Figure 21.12

V *Parallel-connected voltmeter* *R* *Consumer*

NOTICE

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.

NOTICE
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.

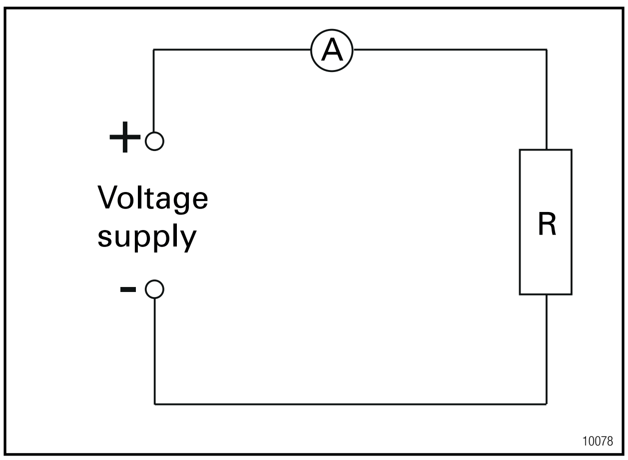


Figure 21.13

A *Series-connected ammeter*
R *Consumer*

OIL TEMPERATURE SENSOR — INSPECTION

NOTICE
Replace parts in the event of physical damage, mechanical defects or readings outside tolerance.

NOTE

The max. operating temperatures must not be exceeded. In the event of temperature rise above the limit:

Step	Procedure
1	Check the oil system. See corresponding Maintenance Manual Line (MML) for the respective engine type, 912 Series or 914 Series.
2	Check the oil temperature sensor.
3	Check the indicating instrument.
4	Check the wiring connections.
5	Check the sensor cable.

NOTE

Grounding connection of the temperature sensor need to be set to measure the resistance correctly.
The ground connection of the oil temperature sensor is established directly via the housing.

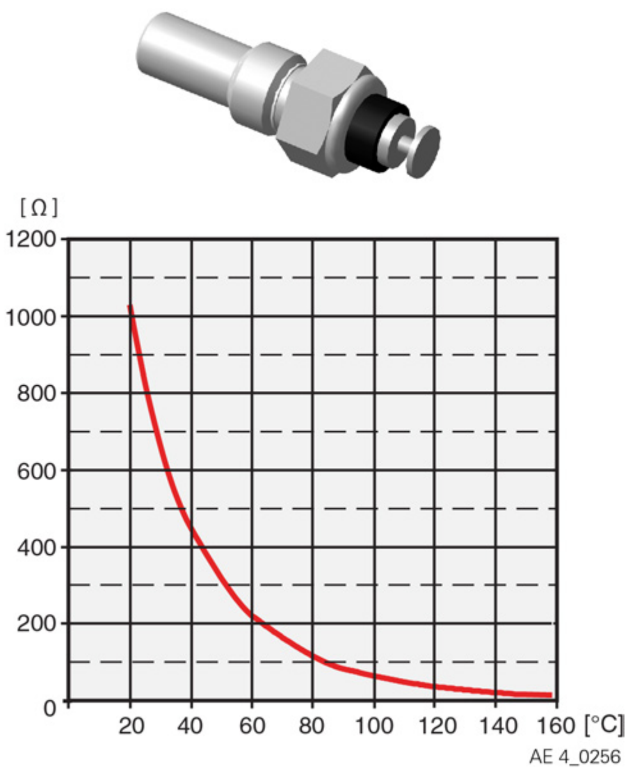


Figure 21.14

COOLANT TEMPERATURE SENSOR — INSPECTION

NOTICE
Replace parts in the event of physical damage, mechanical defects or readings outside tolerance.

NOTE

For sensor resistance, see following graph of sensor resistance over temperature deviation: max ± 10%.

NOTE

Grounding connection of the temperature sensor need to be set to measure the resistance correctly.
The ground connection of the coolant temperature sensor is established directly via the cylinder head.

NOTE

The different versions of the cylinder heads can be mixed installed, but make sure, if and at which position the cylinder head temperature and coolant temperature is measured. This also defines the naming of the indicating instrument with the appropriate temperature limit.

See latest Installation Manual and/or SI-912-020/SI-914-022 “Running modifications”.

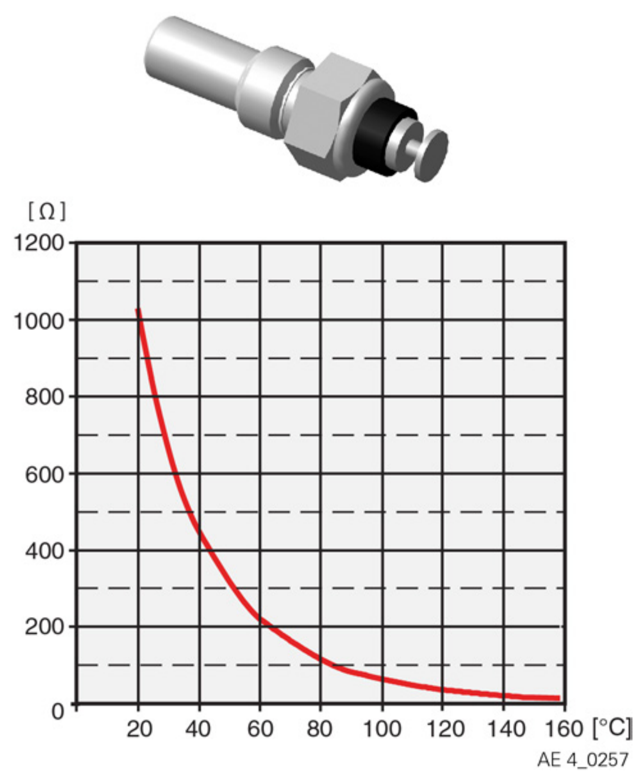


Figure 21.15

RESISTANCE THERMOMETER — INSPECTION (914 SERIES ONLY)

NOTICE

Replace parts in the event of physical damage or resistance readings out of the wear limits.

Step	Procedure
1	Inspect for physical damage.
2	Measure the resistance between the two terminals. Allowance for resistance: max ±1%

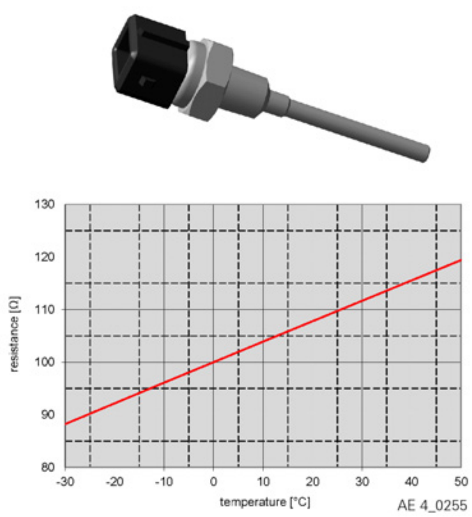


Figure 21.16

OIL PRESSURE SENSOR — INSPECTION

NOTICE

Replace parts in the event of physical damage, mechanical defects or readings outside tolerance.

NOTE

The range of the sensor is from 0 to 10 bar (0 to 145 psi). This range is indicated on the wrench flats of the sensor.

NOTICE

The pressure range of the display instrument must be adjusted to the pressure range of the sensor. If this is not done, an incorrect oil pressure will be displayed.

NOTE

Due to the further development a new oil pressure sensor has been introduced. See therefore the latest issue of Service Instruction “Oil pressure sensors” SI-912-030 and SI-914-031 respectively.

Step	Procedure
1	Inspect for physical damage.
2	Measure the amps between the terminals C and B.

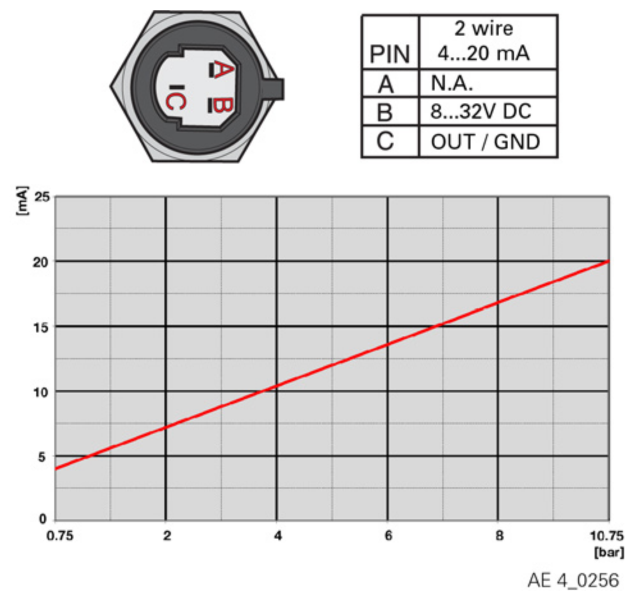


Figure 21.17

NOTE

Grounding connection of the sensor is direct via the oil pump housing.

NOTICE
The max. operating temperature must not be exceeded.

AMBIENT PRESSURE SENSOR — INSPECTION (914 SERIES ONLY)

NOTICE
If the max. pressure is exceeded during the course of measuring, the sensor must be replaced.

NOTICE
Replace parts in the event of physical damage, mechanical defects or readings outside tolerance.

NOTE

The easiest way to check the function of the ambient pressure sensor is to use the communication program. It this program is not at your disposal, the following static checks can be carried out.

Step	Procedure
1	Inspect for physical damage.
2	Connect pin (C) to ground.
3	Connect pin (A) to positive side of voltage supply **Us**.
4	Apply test pressure to sensor (D).
5	Take reading of output voltage between pin (B) and (C).
6	Divide the measured output voltage (**Ua**) by the supply voltage (**Us**).

NOTE

Calculation of this pressure ratio is required since the diagram is effective over a whole voltage range and not just for a single voltage.

Step	Procedure
7	Enter this value in the table Ua/Us. A pressure can be read off at the intersection of the straight line.

NOTE

A pressure can be read off at the intersection of the straight lines. Max. deviation ± 60 hPa.

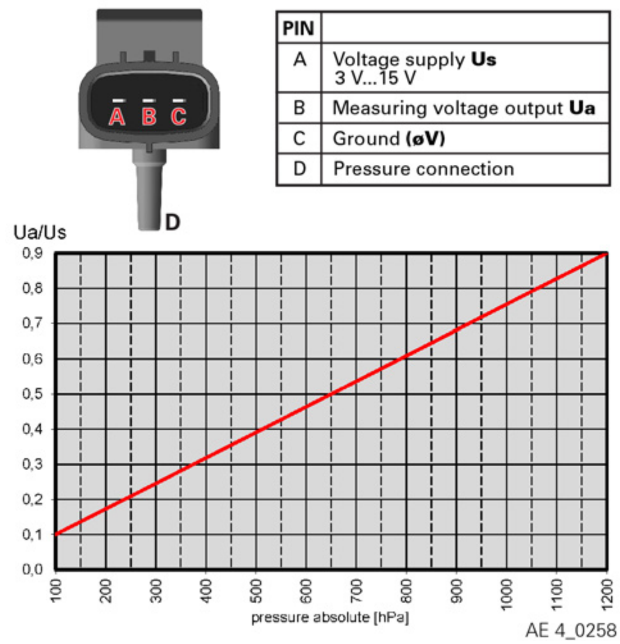


Figure 21.18: Diagram

AIRBOX PRESSURE SENSOR — INSPECTION (914 SERIES ONLY)

NOTICE

If the max. pressure is exceeded during the course of measuring, the sensor must be replaced.

NOTICE

Replace parts in the event of physical damage, mechanical defects or readings outside tolerance.

NOTE

The easiest way to check the function of the airbox pressure sensor is to use the communication program. It this program is not at your disposal, the following static checks can be carried out.
If the max. pressure is exceeded during the course of measuring, the sensor must be replaced.

Step	Procedure
1	Inspect for physical damage.
2	Connect pin (C) to ground.
3	Connect pin (A) to positive side of voltage supply **Us**.
4	Apply test pressure to sensor (D).
5	Take reading of output voltage between pin (B) and (C).
6	Divide the measured output voltage (**Ua**) by the supply voltage (**Us**).
7	Enter this value in the table Ua/Us. A pressure can be read off at the intersection of the straight line.

NOTE

Calculation of this pressure ratio is required since the diagram is effective over a whole voltage range and not just for a single voltage.

NOTE

A pressure can be read off at the intersection of the straight lines. Max. deviation ± 40 hPa.

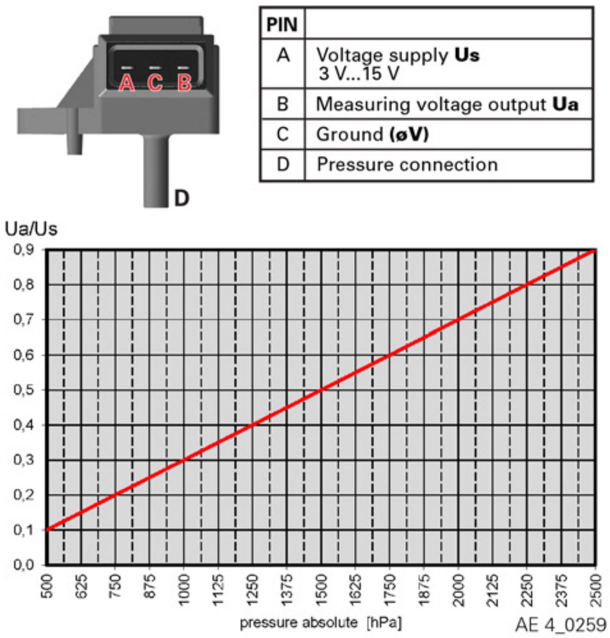
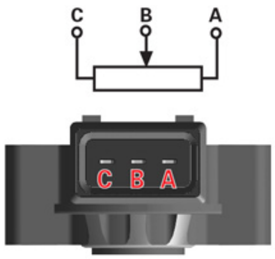


Figure 21.19

THROTTLE VALVE POSITION SENSOR — INSPECTION (914 SERIES ONLY)

NOTICE

Replace parts in the event of physical damage or resistance readings out of the wear limits.



PIN	
A	positive
B	Loop closed
C	minus

AE 4_0260

Figure 21.20

Removed

Step	Procedure
1	Check for physical damage.
2	Check O-ring for damage.

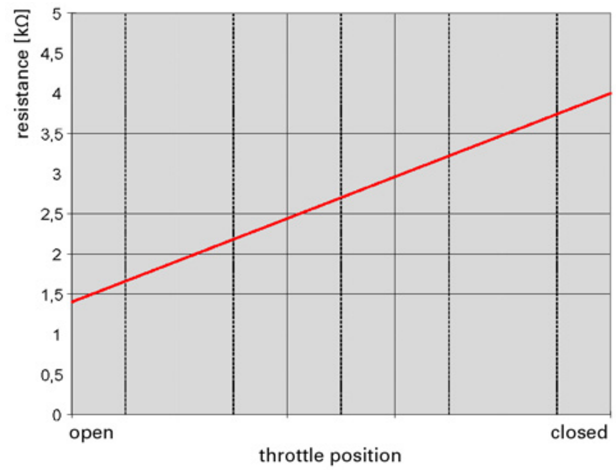
NOTE

If the O-ring is damaged the throttle valve position sensor must be replaced.

Step	Procedure
3	Measure the nominal resistance between connections (C) and (A). Nominal resistance: 3.2 to 4.8 kΩ.
4	Measure the resistance between the connections (B) and (A). Throttle valve closed (throttle lever pos. 0%): 3.4 to 4.6 kΩ. Throttle valve open (throttle lever pos. 115%): 0.8 to 2.0 kΩ.

NOTE

Check complete operating range as shown in the following diagram for linear resistance progress.



AE 4_0261

Figure 21.21

Step	Procedure
5	Measure the resistance between the connections (C) and (B). Throttle valve open (throttle lever pos. 115%): 2.4 to 3.2 kΩ Throttle valve closed (throttle lever pos. 0%): 100 to 300 Ω

NOTE

Check complete operating range as shown in the following diagram for linear resistance progress.

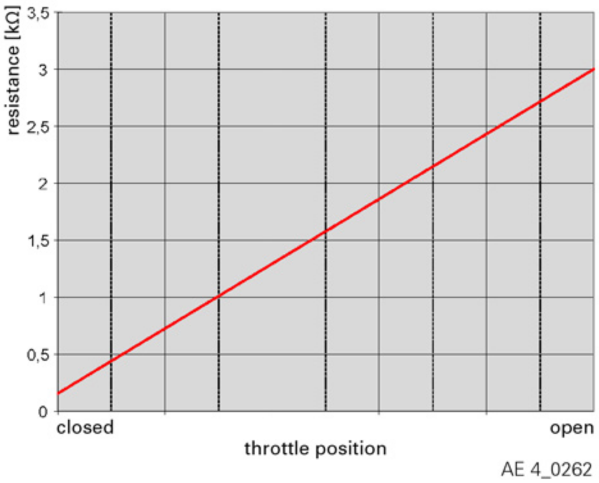


Figure 21.22

Fitted
If the throttle valve position sensor was removed from the carburetor for checking:

- Verification of the throttle valve position via the communication program will be necessary. See 76-10-00 Throttle valve position – inspection
- If this aid is not at your disposal, an engine test run has to be performed. See the corresponding Maintenance Manual (Line Maintenance) for the respective engine type 914 Series.

NOTE

Engine operation is only permissible for transfer to the nearest maintenance facility, where this check has to be performed afterwards.

- When reassembling the original throttle valve position sensor, it is not necessary to dismantle the adapter flange. This would increase the installation tolerance unnecessarily.

THREE-WAY SOLENOID VALVE — INSPECTION

NOTICE

Replace parts in the event of physical damage, mechanical defects or readings outside tolerance.

Step	Procedure
1	Inspection of physical damage.
2	Check for pneumatic passage. Disconnect the pressure connection lines. See Chapter 73–10–00
3	Check the mixture enrichment (dynamic). To do so, fit a T-fitting into line between three-way solenoid valve and float chamber to facilitate the measuring by pressure gauge of the pressure at airbox pressure exceeding 1250 hPa. The T-fitting may remain in place, but for standard operation it must be securely closed.
4	Measure the resistance between the two terminals. Disconnect plug connection with wiring harness but reestablish immediately after completion of check and verify tight fit and engagement of catch. Resistance at 20 °C (68 °F): 22 to 25 Ω

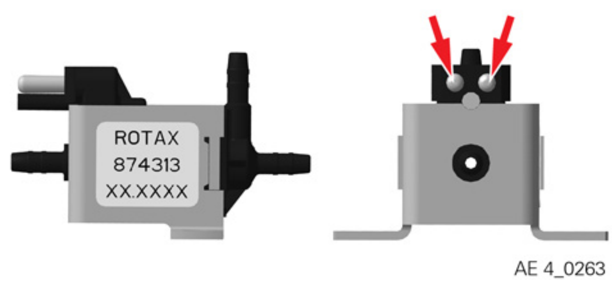


Figure 21.23

ELECTRONIC REV COUNTER – INSPECTION

See Trigger coil kit, Electronic rev Counter — inspection.

DOUBLE IGNITION COIL — INSPECTION

See Chapter 74–20–00 Double ignition inspection.

INSTALLATION

Preparation

- Clean all parts carefully
- Remove protective coverings

OIL TEMPERATURE SENSOR — INSTALLATION

NOTICE

Do not use LOCTITE 243, if oil pump housing is not dry.
Use a suitable gasket ring instead.

Step	Procedure
1	Apply LOCTITE 243 on the thread of the sensor.
2	Screw the sensor into the oil pump housing. Tightening torque 7 Nm (62 in. lb).

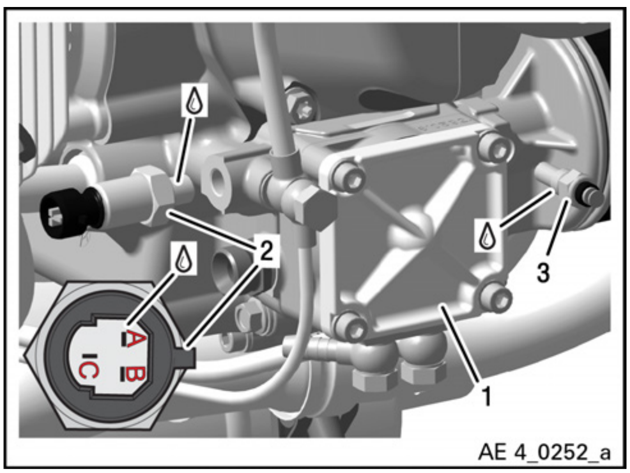


Figure 21.24

1 Oil pump housing
2 Oil pressure sensor
3 Oil temperature sensor

OIL PRESSURE SENSOR — INSTALLATION

NOTICE

Take care which oil pump housing is mounted. The part number is shown on the housing..

NOTICE

Do not use LOCTITE 243, if oil pump housing is not dry.
Use a suitable gasket ring instead.

Step	Procedure
1	Close PIN A of the oil pressure sensor with LOCTITE 5910, Silicone adhesive or similar.
2	Apply LOCTITE 243 on the thread of the sensor.
3	Screw the sensor into the oil pump housing. Tightening torque 15 Nm (133 in.lb).
4	Connect sensor with oil pressure cable part no. 864250.

Old version
Sensor part no. 956413

NOTE

New oil pressure sensor cannot be installed.

Step	Procedure for oil pump housing 911809
1	Replace or rework oil pump housing. See Chapter 76-70–00 – removal.
2	Close PIN A of the oil pressure sensor with LOCTITE 5910, Silicone adhesive or similar.
3	Apply LOCTITE 243 on the thread of the sensor.
4	Screw the sensor into the oil pump housing. Tightening torque 15 Nm (133 in.lb).
5	Connect sensor with oil pressure cable part no. 864250.

COOLANT TEMPERATURE SENSOR — INSTALLATION

Location
The coolant temperature sensor are installed on cylinder 2 and 3.

Step	Procedure
1	Apply LOCTITE 243 on the thread of the sensor.
2	Screw the sensor into the cylinder head. Tightening torque 7 Nm (62 in. lb)

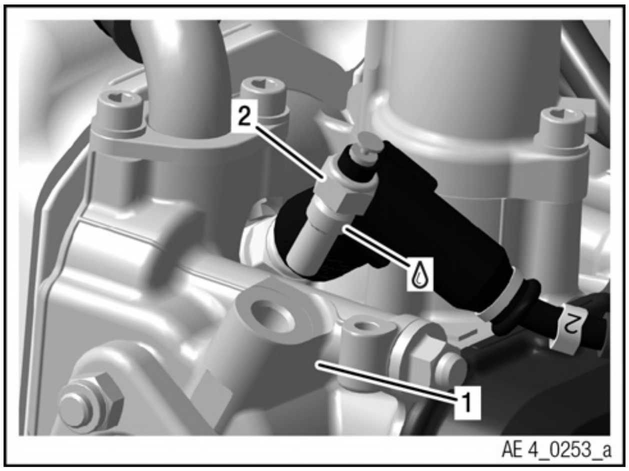


Figure 21.25

1 Cylinder head *2 Coolant temperature sensor*

NOTE

The different versions of the cylinder heads can be mixed installed, but make sure, if and at which position the cylinder head temperature and coolant temperature is measured. This also defines the naming of the indicating instrument with the appropriate temperature limit.

See latest Installation Manual and/or SI-912-020/SI-914-022 “Running modifications”.

RESISTANCE THERMOMETER — INSTALLATION (914 SERIES ONLY)

Step	Procedure
1	Apply LOCTITE 243 on the thread of the sensor.
2	Screw the sensor into the airbox till it is aligned correctly, but with a minimum of tightening torque 5 Nm (44 in. lb).
3	Connect the plug connection to the wiring harness. See Chapter 76-50-00 Wiring harness.

NOTE

On engines equipped with the older TCU versions, part no. 966470 to 966473, the airbox temperature sensor part no. 966430 must be used. See SB-914–013 “Turbocharger control unit (TCU) with software level according to RTCA DO 178 B”.

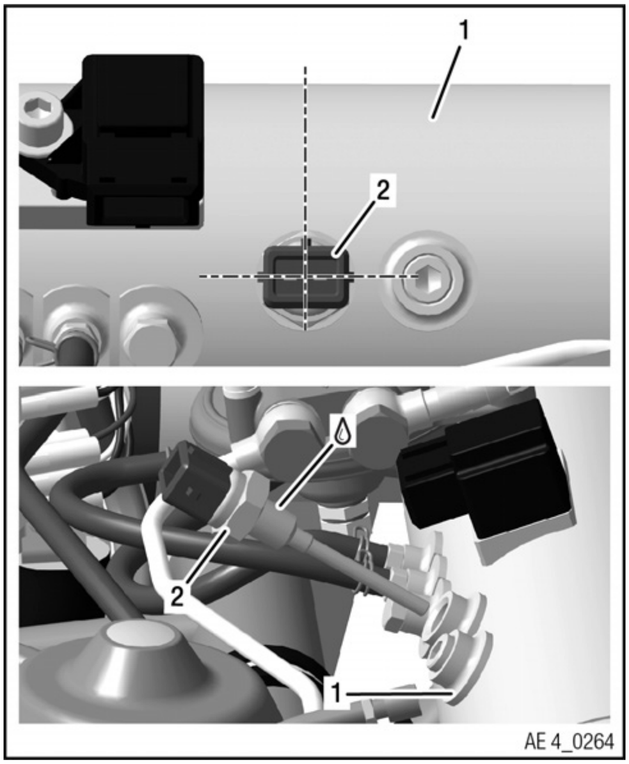


Figure 21.26

1	*Airbox*	2	*Resistance thermometer*

AMBIENT PRESSURE SENSOR (914 SERIES ONLY) — INSTALLATION

Location
The installation location depends on the aircraft type, but is limited by the length of the wiring harness.

See documentation of aircraft manufacturer.

Step	Procedure
1	Connect the air pressure hose.
2	Connect the plug connection to the wiring harness. See Chapter 76–50–00 Wiring harness.
3	Install ambient pressure sensor on holding bracket.

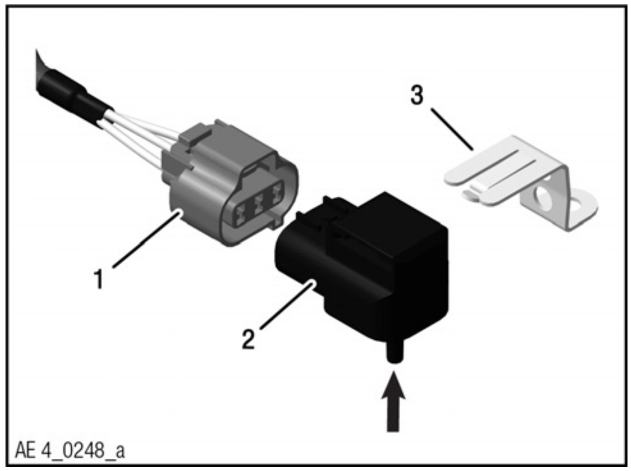


Figure 21.27

1	*Connector*	2	*Ambient pressure sensor*
3	*Holding bracket*		

AIRBOX PRESSURE SENSOR — INSTALLATION (914 SERIES ONLY)

See SI-914-013 and SI-914-015, “Introduction of a new airbox”, latest issue.

Step	Procedure
1	Install airbox pressure sensor with a new O-ring 6.4x1.8 lubricated with lithium base grease on the airbox.
2	Tighten Allen screw M6x14 and Washer 6.2/14/1 with LOCTITE 243. Tightening torque 5 Nm (133 in. lb)
3	Connect the plug connection to the wiring harness. See Chapter 76-50-00 Wiring harness.

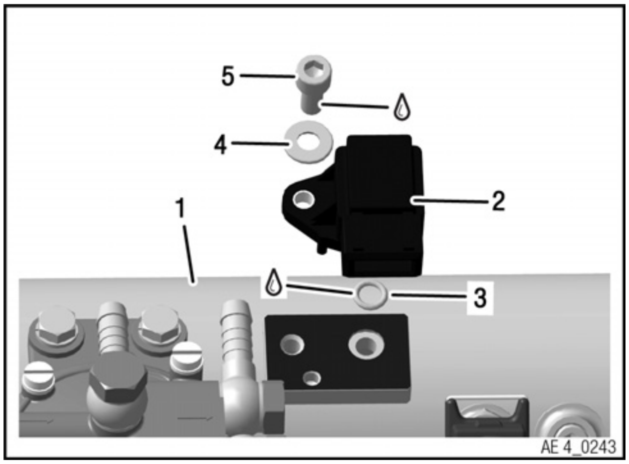


Figure 21.28

1	*Airbox*	2	*Airbox pressure sensor*
3	*O-ring 6.4x1.8*	4	*Washer 6.2/14/1*
5	*Allen screw M6x14*		

THROTTLE VALVE POSITION SENSOR—INSTALLATION (914 SERIES ONLY)

Preparation
Adapter flange installation, see Chapter 73-00-10 Carburetor.

NOTE

Small installation tolerances can be compensated by turning the throttle vale position sensor. For tolerances, see Chapter 76-10-00, otherwise, re-calibration is necessary. The turning range when installed is from 0% - 115%.

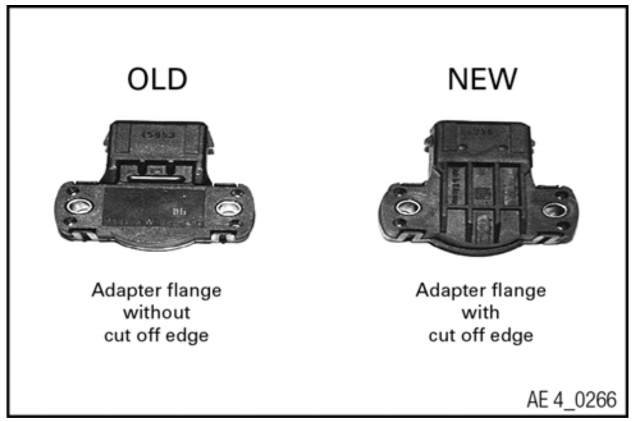


Figure 21.29

Step	Procedure
1	When installing the throttle valve position sensor, check the version.
2	Ensure that it engages with free movement in the flat surface of the throttle valve shaft.
3	Fasten combined screws M4x22 and washer 4.3 secured with LOCTITE 243.

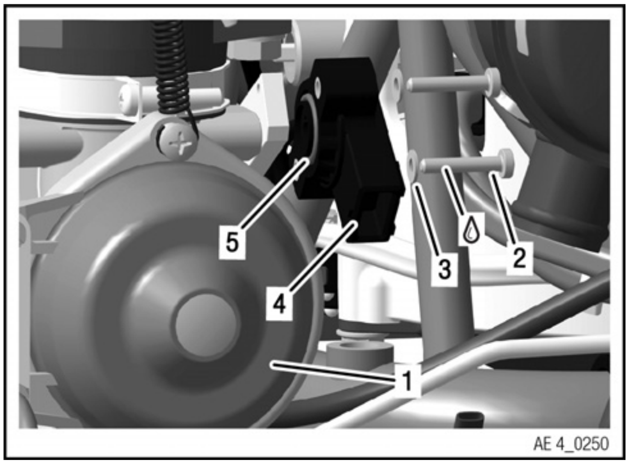


Figure 21.30: adapter flange

1	*Carburetor 2/4*	*2*	*Combined screw M4x22*
3	*Washer 4.3*	*4*	*Throttle valve position sensor*

Step	Procedure
4	In addition, witness paint marking must be applied to the screws.
5	Check the position of the throttle valve position sensor via the communication program. See Chapter 76-10-00 TCU
6	Connect the plug connection to the wiring harness.See Chapter 76-50-00 Wiring harness.

THROTTLE VALVE POSITION SENSOR — RECALIBRATION

Recalibration of the throttle valve position

Step	Procedure
1	Select “TCU Configuration” tab
2	Check whether the throttle valve (carburetor 2/4) can be fully opened and closed. Verify that Bowden cables allow the complete travel from stop to stop.
3	Choose “Throttle Calibration”.
4	Follow the instructions on the display, i.e.: Close the throttle valve completely (idle) and confirm with OK.

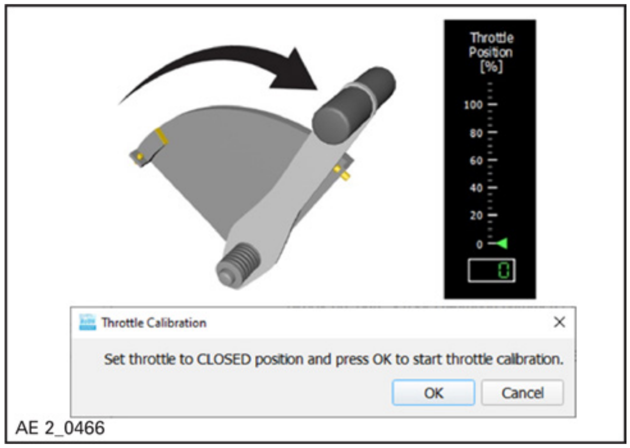


Figure 21.31

Step	Procedure
5	Fully open the throttle valve and confirm with OK.

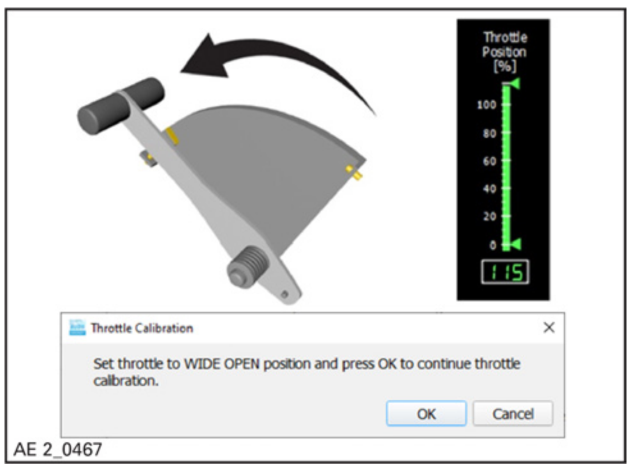


Figure 21.32

Step	Procedure
6	Choose OK Calibration data will be transferred automatically and the calibration is saved within the TCU.

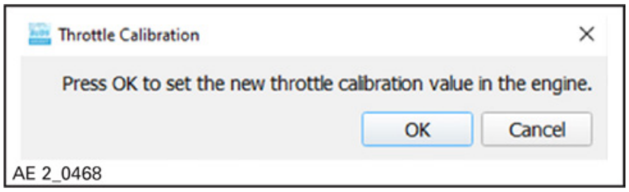


Figure 21.33

Step	Procedure
7	Verification of the throttle valve position as per Chapter 76–10–00 Throttel valve position — inspection.

THREE-WAY SOLENOID VALVE — INSTALLATION (914 SERIES ONLY)

Step	Procedure
1	Install three-way solenoid valve with 2 Allen screws M6x14 and washer A6. Tightening torque: 8 Nm (70 in.lb).
2	Install pressure connection lines. See Chapter 73-10-00 Pressure connection line.
3	Connect the plug connection to the wiring harness. See Chapter 76-50-00 Wiring harness.

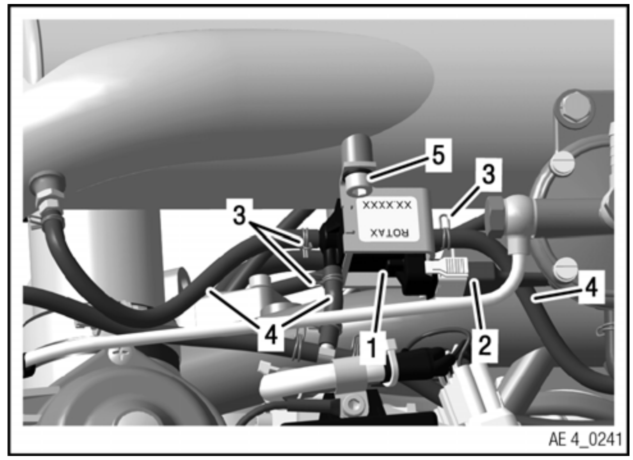


Figure 21.34

1	*Three-way solenoid valve*	*2*	*Plug*
3	*Clamp*	*4*	*Pressure connection line*
5	*Allen screw with lock washer*		

DOUBLE IGNITION COIL — INSTALLATION

To do this, see Chapter 74-20-00 Distribution.

ELECTRONIC REV COUNTER — INSTALLATION

See Chapter 24-20-00 Internal generator

FINISHING WORK

- Complete the engine

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

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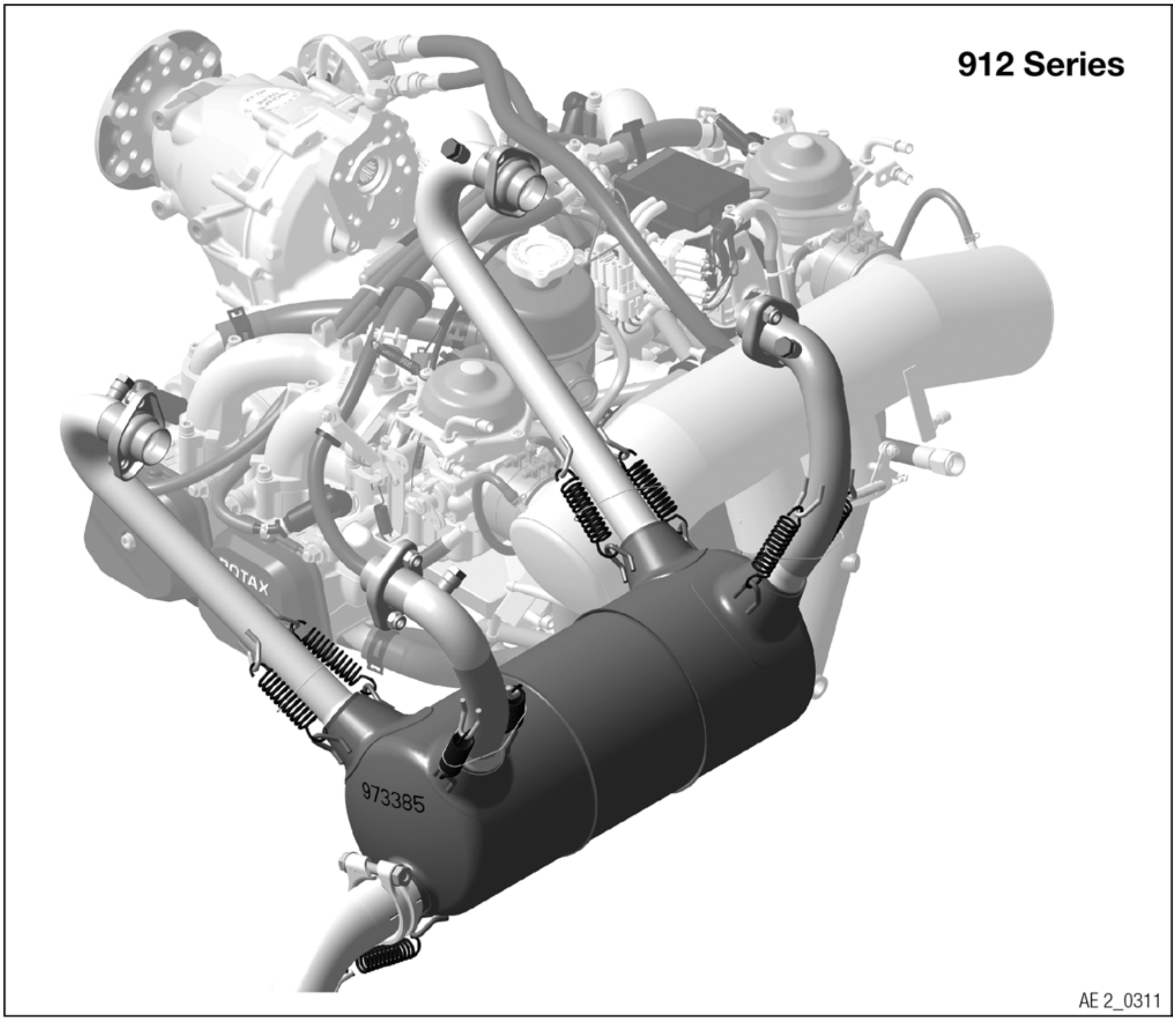
Chapter: 78–00–00
EXHAUST SYSTEM AND TURBOCHARGER

TOPICS IN THIS CHAPTER


912 Series
973385
ROTAX
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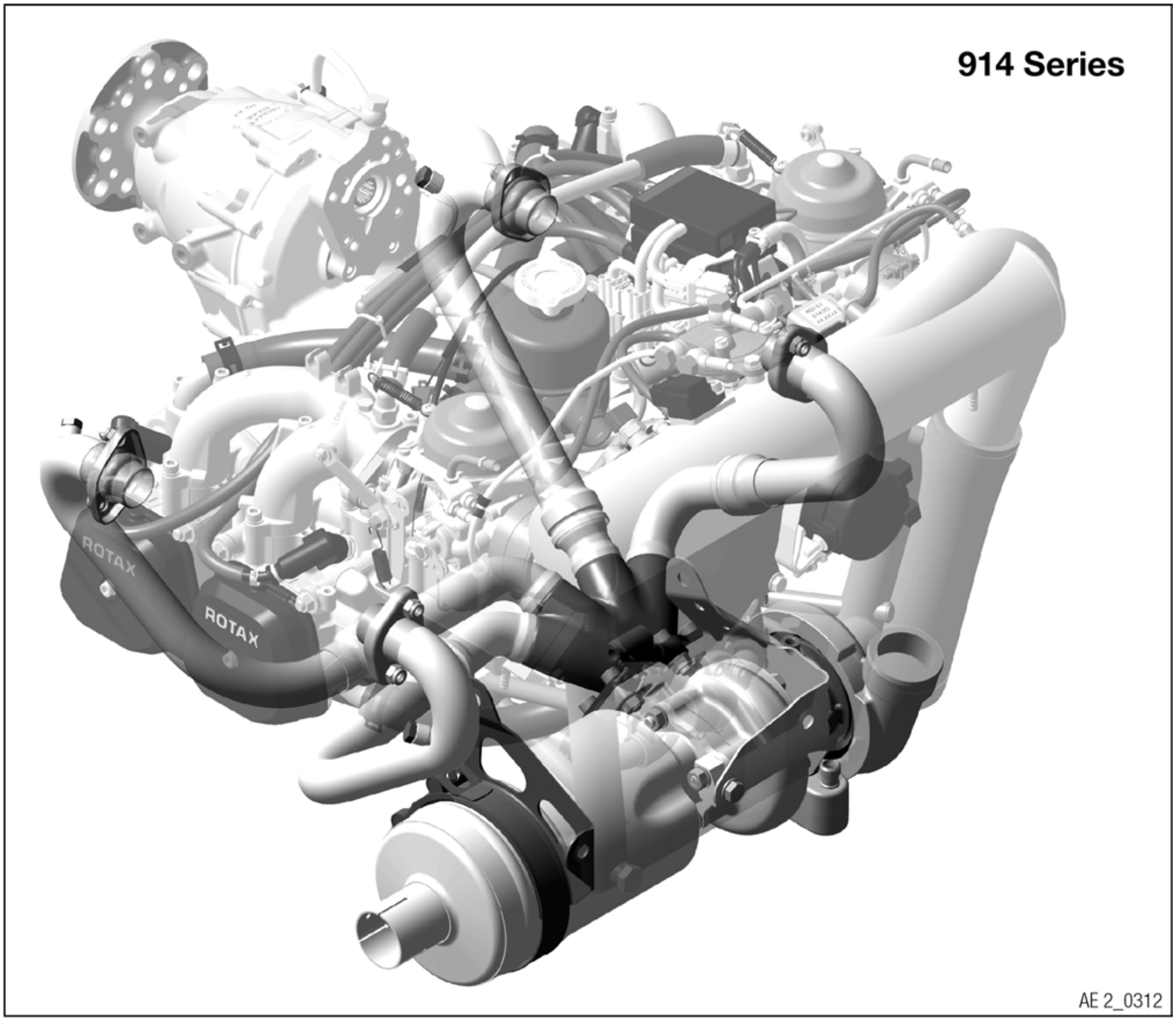

Figure 22.1

SYSTEM DESCRIPTION

912 Series

The exhaust system on ROTAX® 912 Series is optional. If it was not ordered when the engine was purchased, only the 4 exhaust sockets on the cylinder head are supplied.

The exhaust system must be designed and manufactured by the aircraft or aircraft frame manufacturer.

914 Series

The exhaust system on ROTAX® 914 Series collects all gases which accumulate in the combustion chamber of the cylinders and routes them via exhaust pipes and exhaust manifold to the exhaust turbocharger. There, the combustion gases drive the exhaust gas turbine to achieve a power increase. See Chapter 78-20-00. From the exhaust turbocharger, the combustion gases are routed to the muffler, which is fitted for noise reduction.
The exhaust system is made of stainless steel. The exhaust pipe is connected to the exhaust manifold by means of slide sleeves to ensure that expansion due to heat can be compensated for.
The exhaust pipes are sealed to the cylinder head by the ridge on the exhaust pipes. The muffler is supported via the exhaust bracket on the engine suspension frame.
Owing to continuous further development, the exhaust pipes were slightly reworked. The couplings were optimized for their position. Position of the EGT connections to the exhaust pipes for cylinders 3 and 4 were routed such that installation of the new drip trays is possible.

NOTE

If replacement of any single old part number is necessary, you must replace it with the same old part number. If the old part number is not available, the entire assembly including all 4 pipes and manifold must be replaced with new part numbers. New style pipes and manifold are not interchangeable with old style.

REMOVAL, INSPECTION, ASSEMBLY

Follow the manufacturer's instructions for removal, inspection and assembly.

Engine performance and specific fuel consumption remain unchanged or are slightly better when using this stainless steel muffler.
The muffler is 0.3 kg lighter than the muffler which is usable only for the 912 A/ F/UL Series.
By optimizing the design of the muffler the noise emission may seem subjectively higher compared with muffler for 912 A/F/UL Series. The exact measuring of the actual noise emission can be conducted only when the muffler is installed in the aircraft.

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

On 912 Series
The manufacturer of the exhaust system must attach or provide the connections M8x1 for installation of the metal-sheathed thermocouples, part no. 966370, in the exhaust pipes.

On 914 Series
The connection thread M8x1 for attachment of the metal-sheathed thermocouples, part no. 966370, are already provided in the exhaust pipes.

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Chapter: 78–10–00
EXHAUST

TOPICS IN THIS CHAPTER

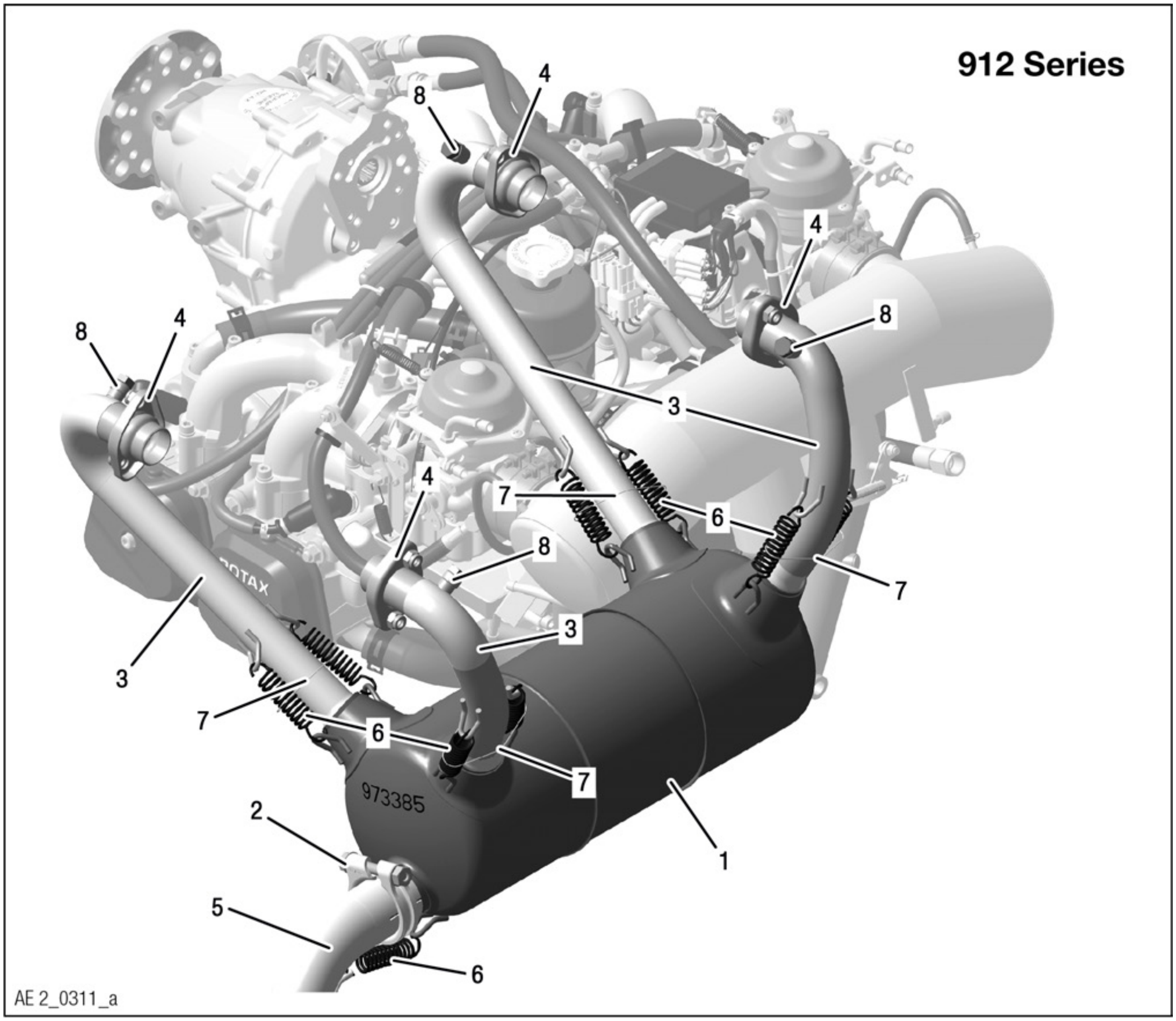


Figure 23.1

1	*Muffler assy.*	2	*Clamp*
3	*Exhaust pipe*	4	*Exhaust flange*
5	*Outflow pipe / exhaust elbow*	6	*Spring*
7	*Safety wire*	8	*Exhaust temperature sensor (EGT) socket*

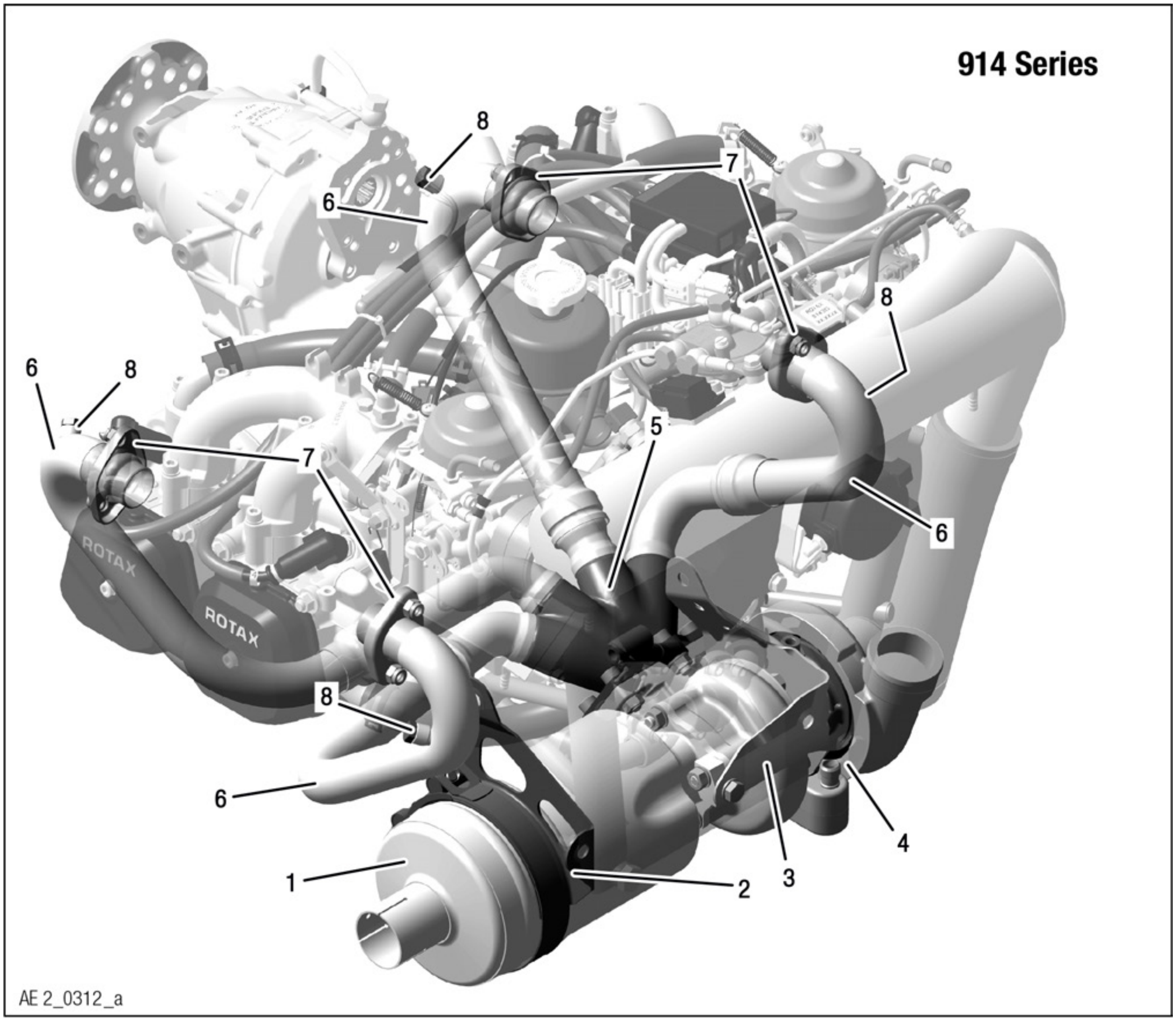
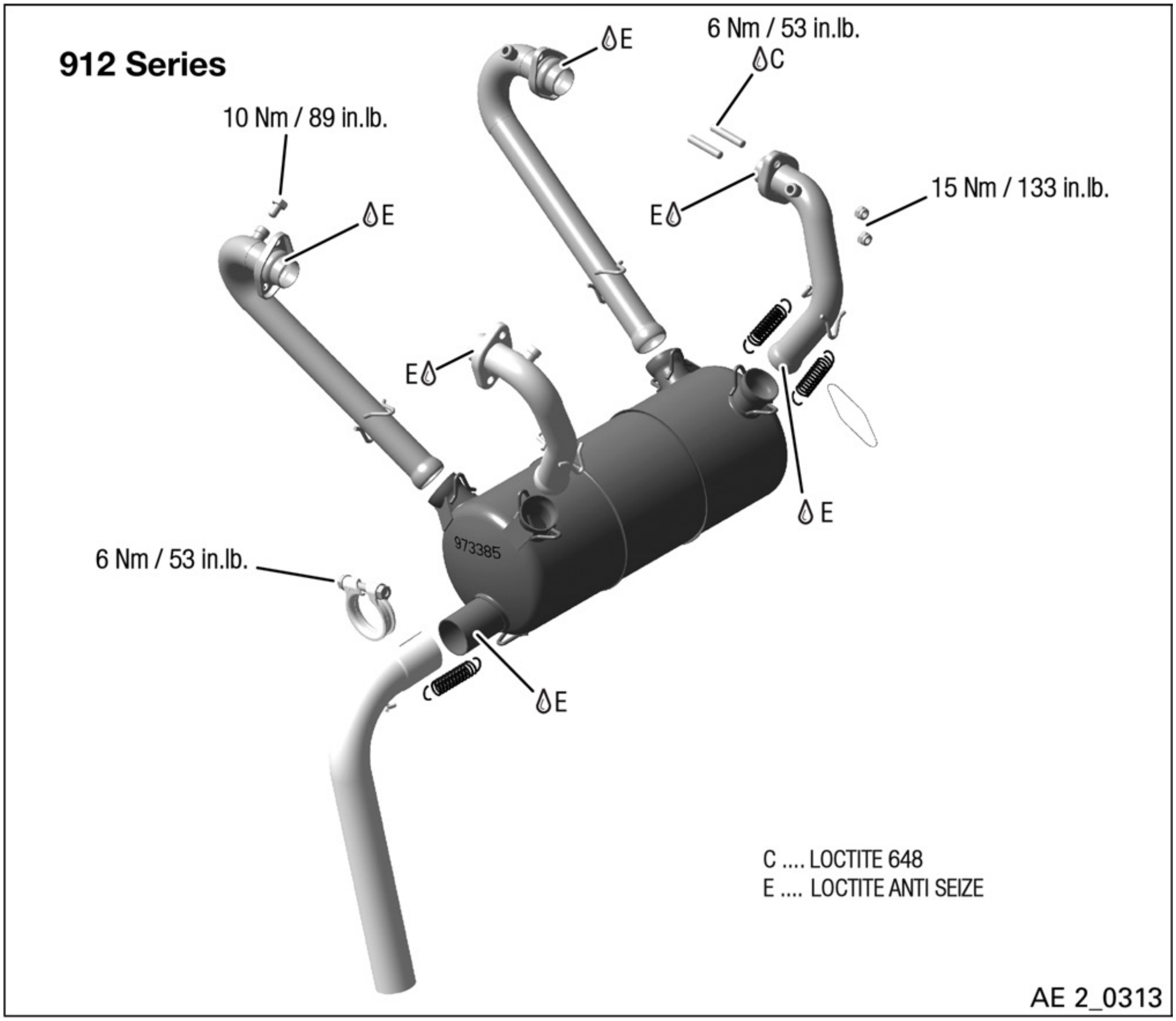


Figure 23.2

1 *Muffler assy.*	2 *Exhaust bracket*
3 *Turbocharger bracket*	4 *Turbocharger assy.*
5 *Exhaust manifold assy.*	6 *Exhaust pipe*
7 *Exhaust flange*	8 *Exhaust temperature sensor (EGT) socket*

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 648	899788
LOCTITE ANTI SEIZE	297434


912 Series
10 Nm / 89 in.lb.
E
E
6 Nm / 53 in.lb.
C
15 Nm / 133 in.lb.
E
E
E
973385
6 Nm / 53 in.lb.
E
C .... LOCTITE 648
E .... LOCTITE ANTI SEIZE
AE 2_0313

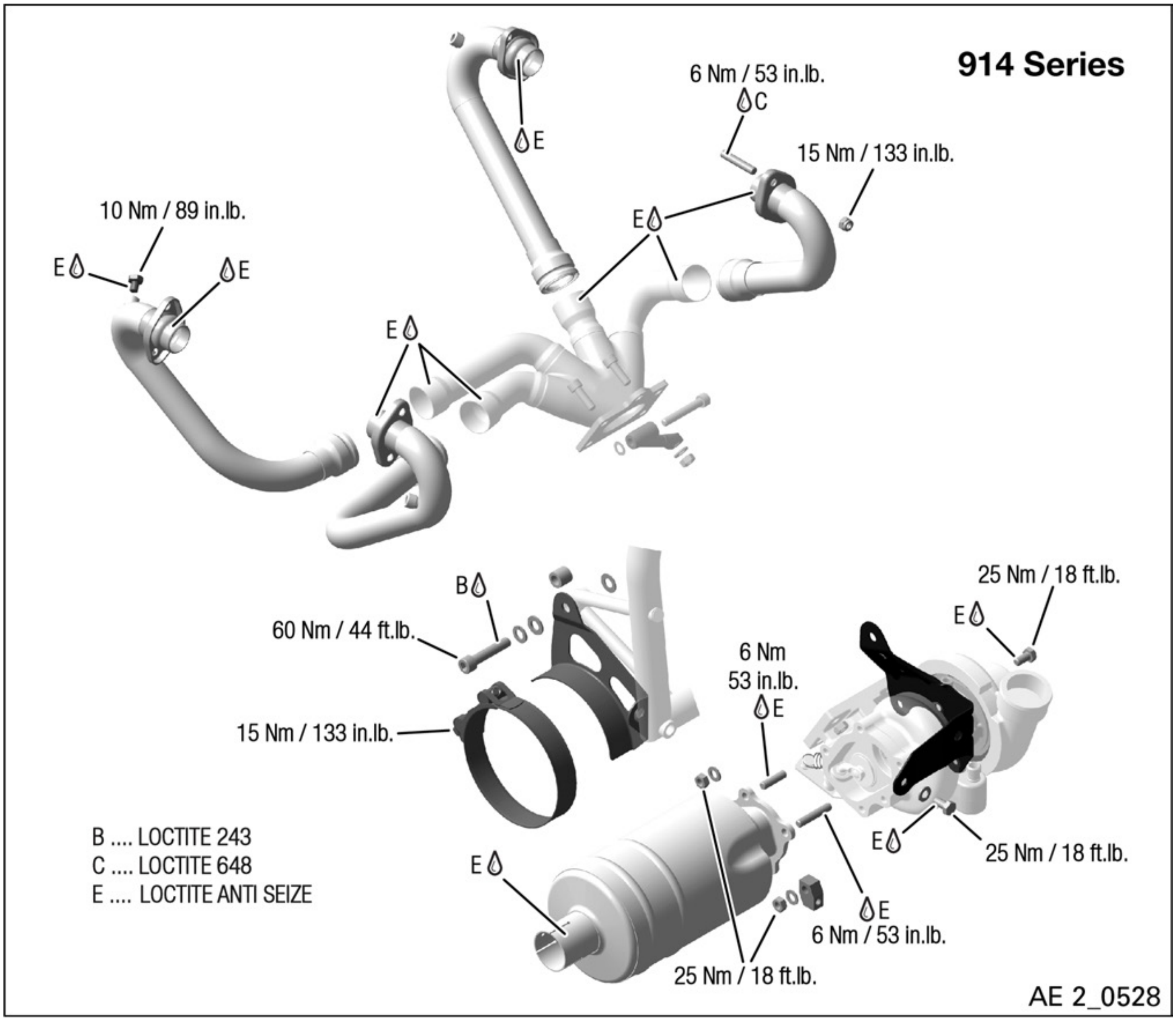

914 Series
6 Nm / 53 in.lb.
C
E
15 Nm / 133 in.lb.
10 Nm / 89 in.lb.
E
E
E
E
B
60 Nm / 44 ft.lb.
15 Nm / 133 in.lb.
6 Nm
53 in.lb.
E
25 Nm / 18 ft.lb.
E
E
25 Nm / 18 ft.lb.
E
E
6 Nm / 53 in.lb.
25 Nm / 18 ft.lb.
B .... LOCTITE 243
C .... LOCTITE 648
E .... LOCTITE ANTI SEIZE
AE 2_0528

Figure 23.3

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 current Maintenance Manual Line (MML) for the respective engine type.

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.

EXHAUST ASSY. — REMOVAL

Preparation
See Chapter 76-70-00 Sensors and actuators.

- Remove the temperature sensor (EGT).

EXHAUST PIPE — REMOVAL (912 SERIES ONLY)

Step	Procedure
1	Remove 2 lock nuts M8.

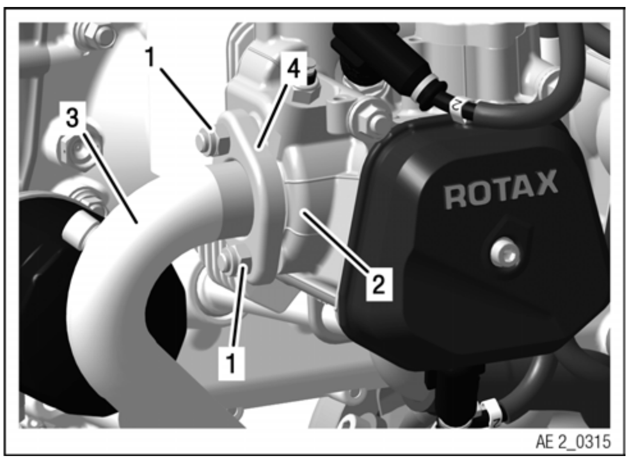


Figure 23.4

1	*Lock nuts*	2	*Cylinder head*
3	*Exhaust pipe*	4	*Exhaust flange*

MUFFLER ASSY. — REMOVAL (912 SERIES ONLY)

Step	Procedure
1	Remove the safety wire and the springs at the exhaust pipes.
2	Remove the spring and the clamp at the exhaust bend.

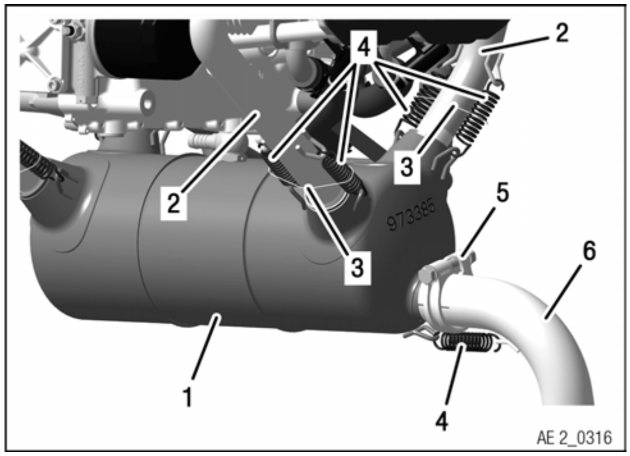


Figure 23.5

1	*Muffler assy.*	2	*Exhaust pipes*
3	*Safety wire*	4	*Springs*
5	*Clamp*	6	*Exhaust bend*

EXHAUST PIPE — REMOVAL (914 SERIES ONLY)

Step	Procedure
1	Remove 2 lock nuts M8.

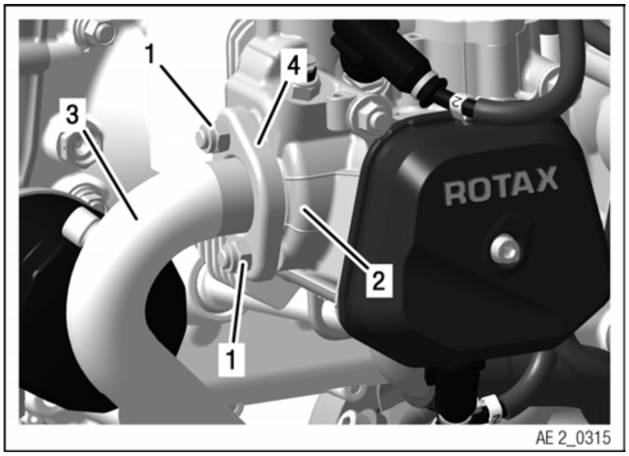


Figure 23.6: Typical

1	*Lock nuts*	*2*	*Cylinder head*
3	*Exhaust pipe*	*4*	*Exhaust flange*

Step	Procedure
2	Remove the exhaust pipes from the exhaust manifold assy.

EXHAUST MANIFOLD ASSY. – REMOVAL (914 SERIES ONLY)

For removal of the exhaust manifold assy. see Chapter Chapter 78-20-00 Turbocharger.

MUFFLER ASSY. — REMOVAL (914 SERIES ONLY)

Step	Procedure
1	Remove the hex. screw M8x16 and washer.
2	Remove hex. nuts with washers of the muffler assy.
3	Loosen screw of the clamp.
4	Take out the support plate and remove muffler assy. with clamp.

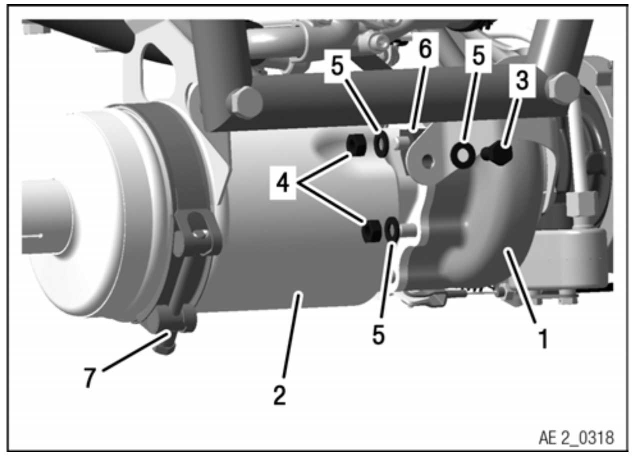


Figure 23.7

1	*Turbocharger*	*2*	*Muffler assy.*
3	*Hex. screw*	*4*	*Hex. nut*
5	*Washer*	*6*	*Support plate*
7	*Clamp*		

EXHAUST BRACKET - REMOVAL (914 SERIES ONLY)

NOTE

There is no need to disassemble the complete unit of muffler - turbocharger - exhaust manifold assy. for the removal of the exhaust bracket.

NOTE

On cylinder 2/4 side thrust washers may be installed for tension free assembly. Do not lose them!

Step	Procedure
1	Loosen screw of the clamp and remove clamp.
2	Loosen screw on engine suspension frame for the exhaust bracket, follow the aircraft manufacturer's instruction.
3	Remove Allen screw with lock washer and washer.

4	Remove exhaust bracket and distance sleeve from engine suspension frame.
5	Remove the thrust washer behind the suspension frame.

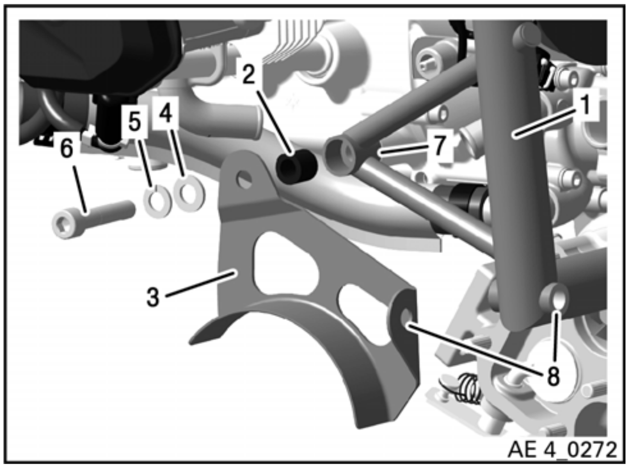


Figure 23.8

1	*Engine suspension frame*	*2*	*Distance sleeve 10.5/ 17/15*
3	*Exhaust bracket*	*4*	*Washer*
5	*Lock washer*	*6*	*Allen screw*
7	*Thrust washer*	*8*	*Connection exhaust bracket - engine suspension frame*

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

NOTICE

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.

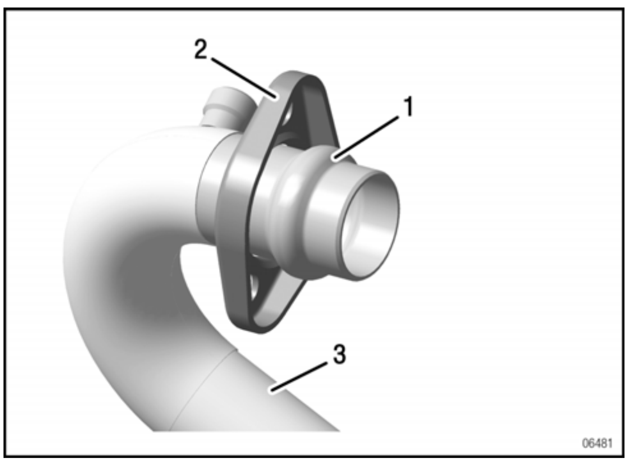


Figure 23.9: Typical

1 Conical seal *2 Exhaust flange*
3 Exhaust pipe

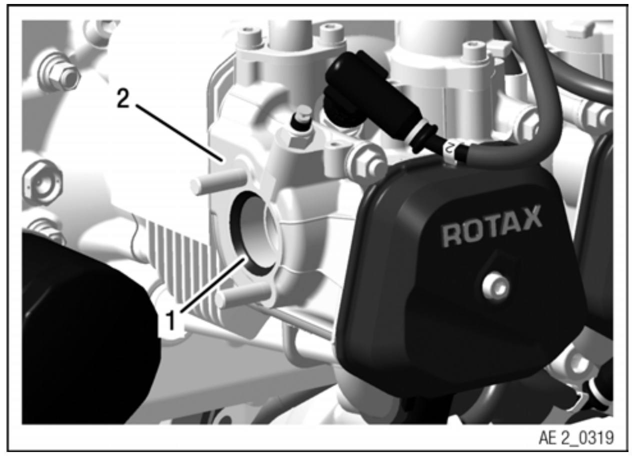


Figure 23.10

1 Conical seal *2 Cylinder head*

MUFFLER ASSY. — INSPECTION

Step	Procedure
1	Check the muffler assy. for damage and wear.

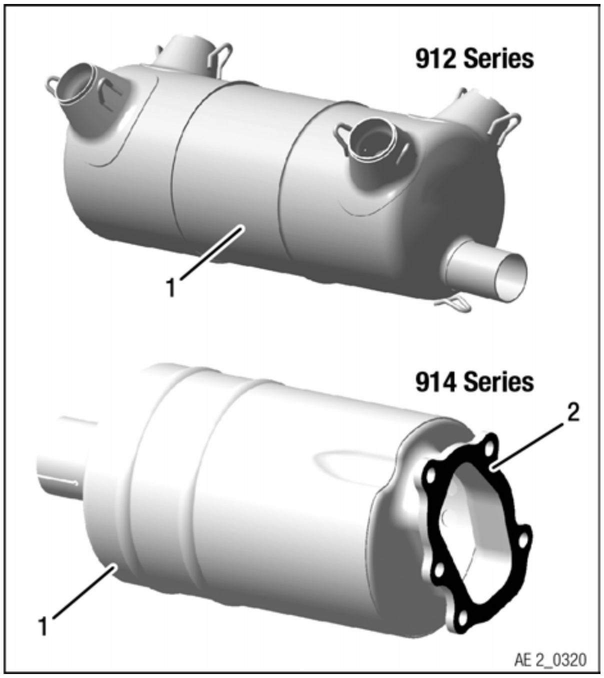


Figure 23.11

1	*Muffler assy.*	2	*Contact surfaces*

INSTALLATION

Follow the aircraft manufacturer's instructions for installation.

MUFFLER ASSY. — INSTALLATION (912 SERIES ONLY)

Step	Procedure
1	Apply LOCTITE Anti Seize to socket and fit in the spring at the exhaust pipes and muffler assy.
2	Apply LOCTITE Anti Seize to socket and fit in the spring and the clamp at the exhaust bend.

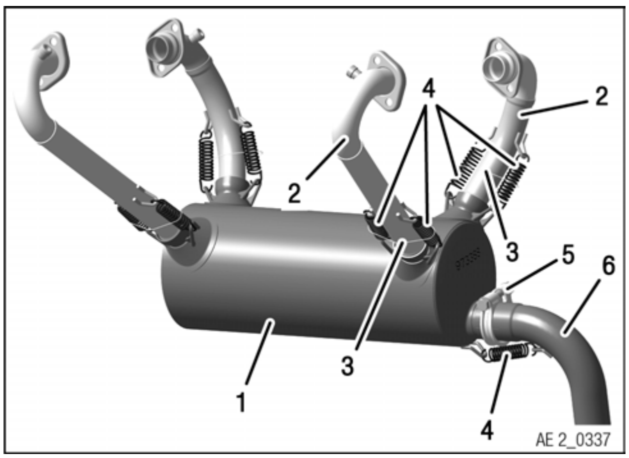


Figure 23.12

1 *Muffler assy.*	2 *Exhaust pipes*
3 *Safety wire*	4 *Springs*
5 *Clamp*	6 *Exhaust bend*

EXHAUST PIPE — INSTALLATION (912 SERIES ONLY)

Step	Procedure
1	Check if studs M8 are firmly in place. If necessary, secure and tighten them with LOCTITE 648. Tightening torque 6 Nm (53 in. lb)
2	Apply LOCTITE Anti Seize to socket and fasten the exhaust flange to the cylinder head with 2 new lock nuts M8. Tightening torque 15 Nm (133 in. lb)

NOTE

The exhaust flange must be parallel to the screw face on the cylinder head but must not touch the cylinder head.

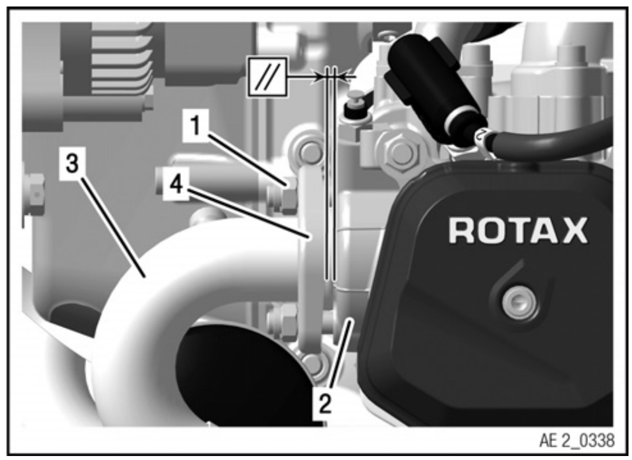


Figure 23.13

1 *Lock nut M8*	2 *Cylinder head*
3 *Exhaust pipe*	4 *Exhaust flange*

Step	Procedure
3	Check the springs and fit the safety wire.
4	Position exhaust bend and fasten with clamp. Tightening torque 6 Nm (53 in. lb)
5	Install the springs and fit the safety wire.

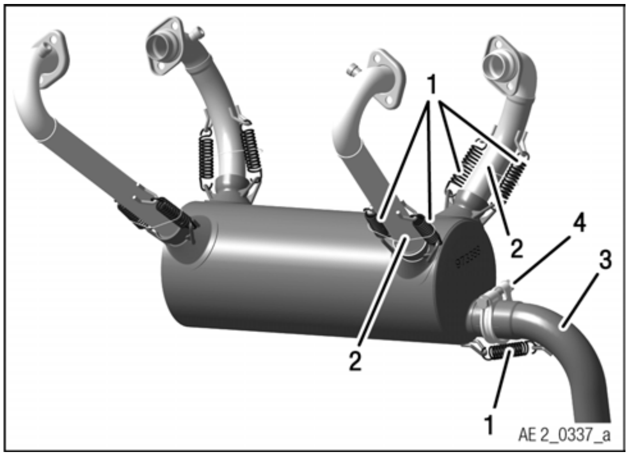


Figure 23.14

1	*Springs*	2	*Safety wire*
3	*Exhaust bend*	4	*Clamp*

EXHAUST BRACKET - INSTALLATION (914 SERIES ONLY)

NOTE

On cylinder 2/4 side thrust washers may be installed for tension free assembly. Use as required.

Step	Procedure
1	Install thrust washer (if needed) behind engine suspension frame. **NOTE** *Maximum allowed shimming distance is 2 mm (0.08 in.)*
2	Place distance sleeve 10.5/17/15 into left arm of engine suspension frame..
3	Install exhaust bracket with washer 10.5, lock washer A10 and Allen screw M10x50. Secure and tighten them with LOCTITE 243. Tightening torque 60 Nm (44 ft. lb.).
4	Install exhaust bracket on engine suspension frame, follow the aircraft manufacturer's instruction for installation.

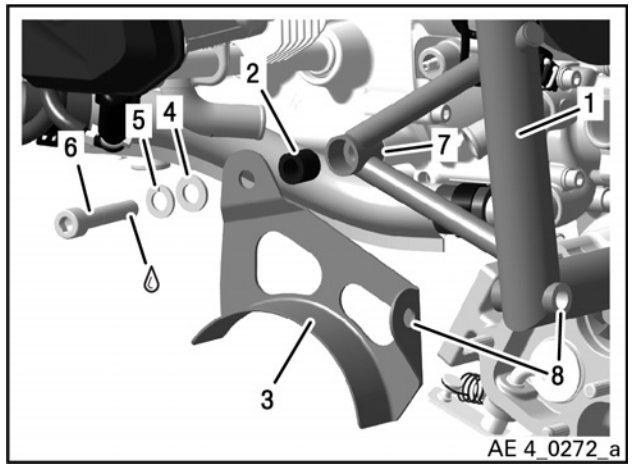


Figure 23.15

1	*Engine suspension frame*	2	*Distance sleeve 10.5/ 17/15*
3	*Exhaust bracket*	4	*Washer 10.5*
5	*Lock washer A10*	6	*Allen screw M10x50*
7	*Thrust washer*	8	*Connection exhaust bracket - engine suspension frame*

MUFFLER ASSY. — INSTALLATION (914 SERIES ONLY)

NOTE

Studs M8 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 is screwed into the turbocharger. Lubricate studs with LOCTITE ANTI SEIZE and tighten them. Tightening torque 6 Nm (53 in. lb).

Step	Procedure
1	Lubricate the turbocharger stud M8 with LOCTITE ANTI SEIZE.
2	Slide the muffler assy. through the clamp and mount muffler assy. on the studs of turbocharger including the support plate in the correct position.
3	Hand-tighten the support plate with washer 8.4 and hex. screw M8x16.

Step	Procedure
4	Tighten muffler assy. with washers 8.4 and nuts M8 on turbocharger. Tightening torque 25 Nm (18 ft. lb.).
5	Tighten the support plate with washer 8.4 and hex. screw M8x16. Tightening torque 25 Nm (18 ft. lb.)

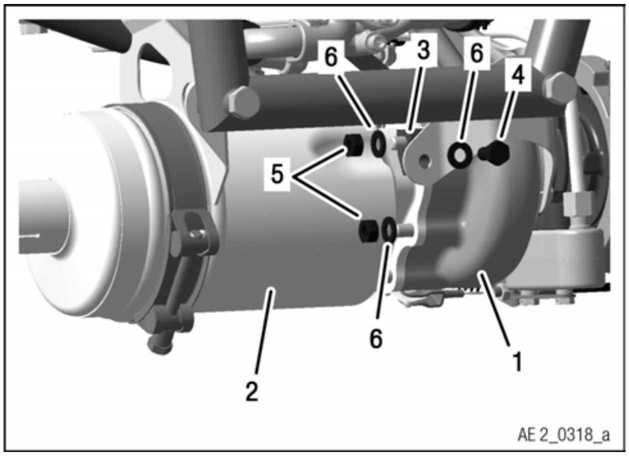


Figure 23.16

1 Turbocharger
2 Muffler assy.
3 Support plate
4 Hex. screw M8x16
5 Hex. nuts M8
6 Washer 8.4

Step	Procedure
6	Tighten the clamp. Tightening torque 15 Nm (133 in. lb.) **NOTE** *Position the clamp so that the tension free zone rests on the edge of the exhaust bracket.*

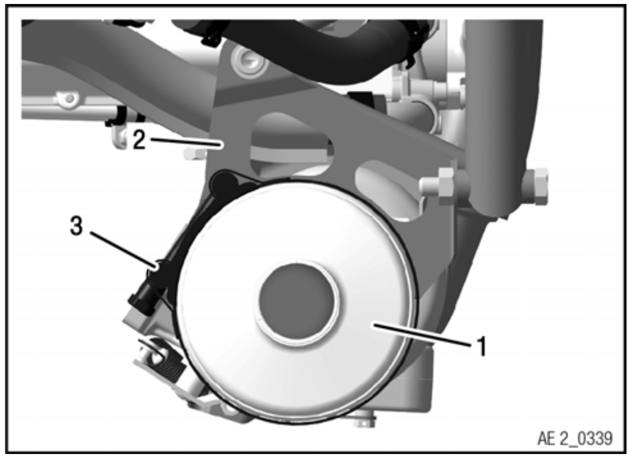


Figure 23.17

1 Muffler assy.
2 Exhaust bracket
3 Clamp

EXHAUST MANIFOLD ASSY. — INSTALLATION (914 SERIES ONLY)

For installation of the exhaust manifold assy. see Chapter Chapter 78-20-00 Turbocharger.

EXHAUST PIPE — INSTALLATION (914 SERIES ONLY)

Step	Procedure
1	Apply LOCTITE Anti Seize to socket and fasten the exhaust pipes in the exhaust manifold assy.
2	Check if studs M8 are firmly in place. If necessary, secure and tighten them with LOCTITE 648. Tightening torque 6 Nm (53 in. lb)
3	Apply LOCTITE Anti Seize to socket and fasten the exhaust flange to the cylinder head with 2 new lock nuts M8. Tightening torque 15 Nm (133 in. lb)

NOTE

The exhaust flange must be parallel to the screw face on the cylinder head but must not touch the cylinder head.

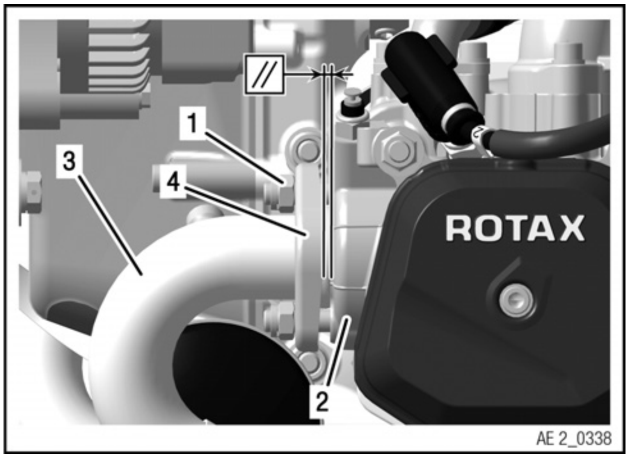


Figure 23.18

1	*Lock nut M8*	*2*	*Cylinder head*
3	*Exhaust pipe*	*4*	*Exhaust flange*

NOTE

Check if screws and nuts on the exhaust manifold assy. are tightened to the specified tightening torque of 25 Nm (18 ft. lb).

FINISHING WORK

Follow the aircraft manufacturer's instructions.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

Chapter: 78–20–00
TURBOCHARGER (914 SERIES ONLY)

TOPICS IN THIS CHAPTER

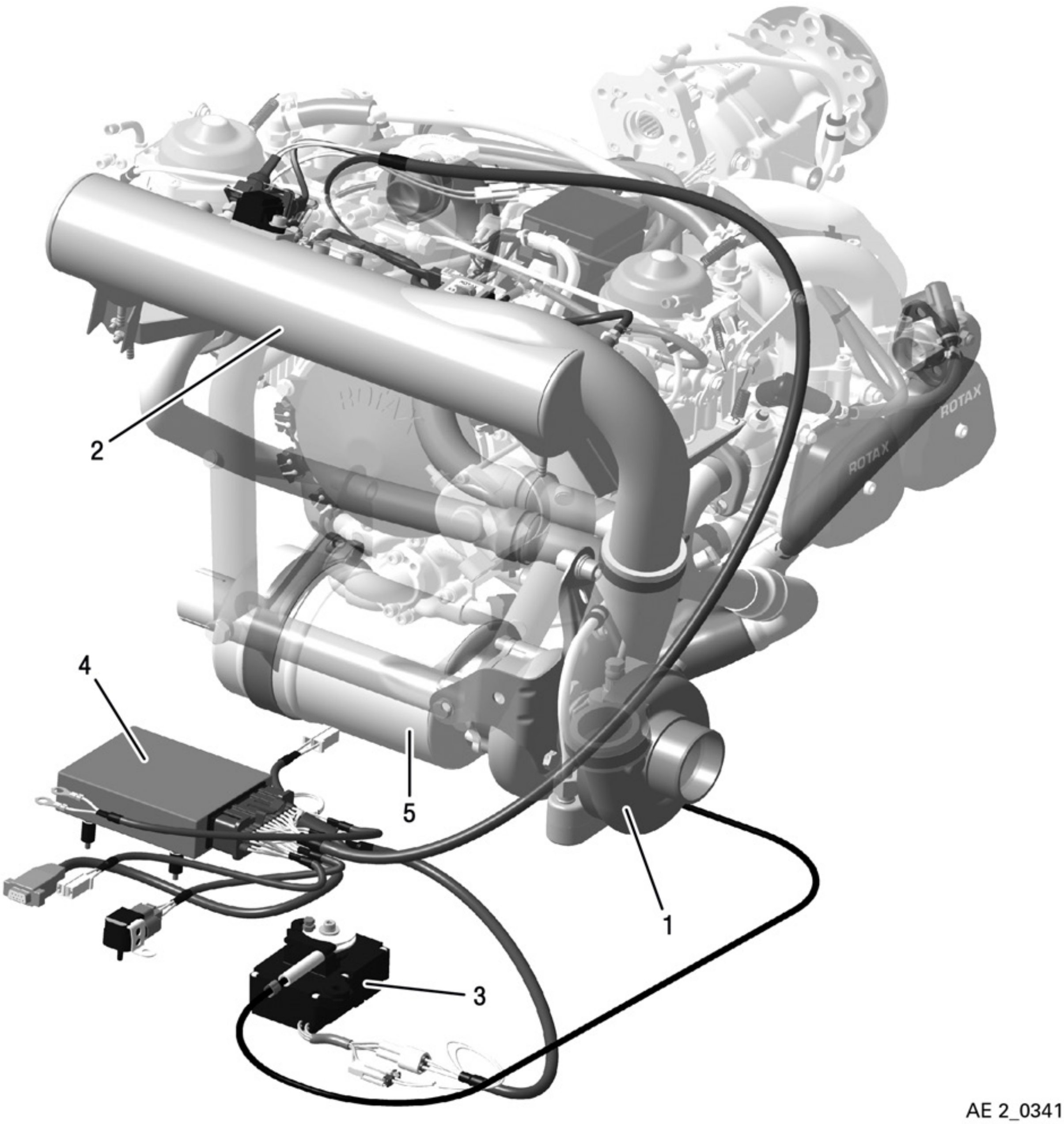


Figure 24.1

1	*Turbocharger*	2	*Airbox assy.*
3	*Servo motor (wastegate)*	4	*Turbocharger Control Unit (TCU)*
5	*Muffler assy.*		

SERVICE PRODUCTS

Description	Part number
LOCTITE 243	897651
LOCTITE 648	899788
LOCTITE ANTI SEIZE	297434

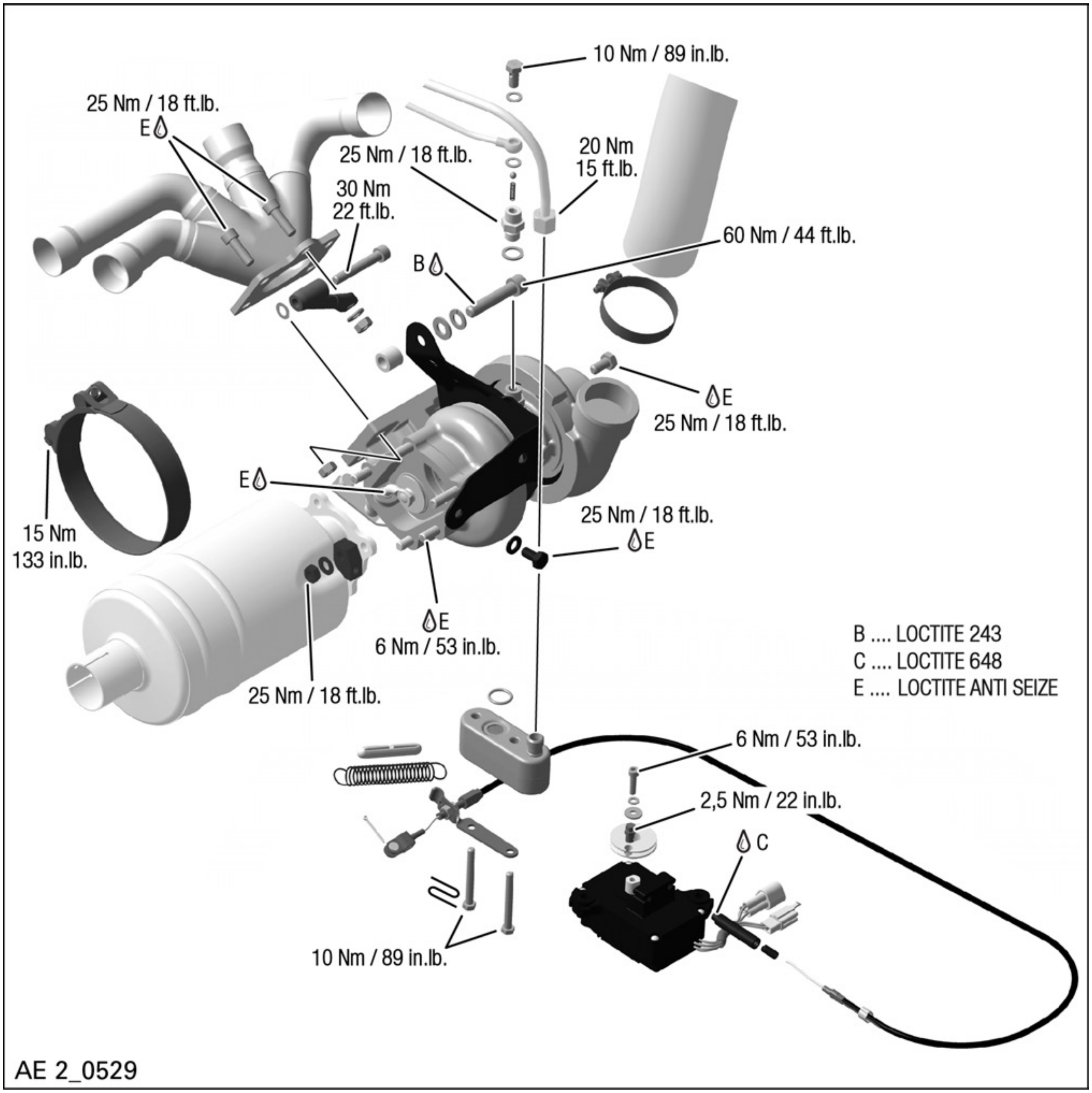

10 Nm / 89 in.lb.
25 Nm / 18 ft.lb.
E
25 Nm / 18 ft.lb.
20 Nm
15 ft.lb.
30 Nm
22 ft.lb.
60 Nm / 44 ft.lb.
B
E
25 Nm / 18 ft.lb.
E
15 Nm
133 in.lb.
25 Nm / 18 ft.lb.
E
E
6 Nm / 53 in.lb.
B .... LOCTITE 243
C .... LOCTITE 648
E .... LOCTITE ANTI SEIZE
25 Nm / 18 ft.lb.
6 Nm / 53 in.lb.
2,5 Nm / 22 in.lb.
C
10 Nm / 89 in.lb.
AE 2_0529

Figure 24.2

SYSTEM DESCRIPTION

ROTAX® engines of the 914 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 control of the airbox pressure is controlled by an electronically controlled flap (waste gate) at the exhaust gas turbine. The waste gate is actuated by an electric servo motor via a Bowden cable.

Exhaust turbocharger
The exhaust turbocharger is basically an arrangement of two turbo machines, a turbine and a blower, on a common shaft. The turbine transforms the energy of the hot exhaust gases and drives a blower which uses 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.

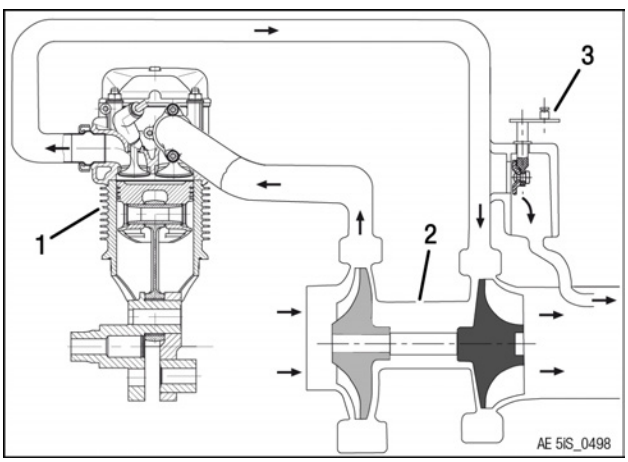


Figure 24.3: Schematic of a boost pressure

1 *Engine*
2 *Exhaust turbocharger*
3 *Boost pressure regulating valve (waste gate)*

NOTE

The figure shows a schematic arrangement of a boost pressure control with the waste gate 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 waste gate directs part of the engine exhaust gases so that they bypass the turbine and flow directly into the exhaust (by-pass).

NOTE

With the waste gate completely open, the engine performance can reach up to approx. 70 kW since not all of the exhaust gases bypass the turbine.

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

Servo motor
actuates correct position of wastegate linked to the TCU mapping.

CONNECTIONS FOR DISPLAY SYSTEMS

NOTICE
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.

Preparation

Drain oil, see current Maintenance Manual Line (MML) of the respective engine type.

Remove the air filter, see current Maintenance Manual Line (MML) of the respective engine type.

- Remove air intake hose from turbocharger.
- Remove exhaust pipes. See Chapter 78-10-00 Exhaust system.
- Disconnect servo motor cable from turbocharger - wastegate lever.
- Remove coolant hoses, if necessary. See Chapter 75-00-00 Cooling system.
- Disconnect the turbo pressure oil line and the turbo oil suction line. Remove the cable clamp (Allen screw M5x12 and lock nut) for supporting the turbo oil suction line on the turbo bracket. See Chapter 79-00-00 Lubrication.
- Remove muffler assy., if necessary. See Chapter 78-10-00 Exhaust system.

Step	Procedure
1	Slacken clamp but do not detach or remove it from the exhaust bracket.
2	Remove the Allen screw with washers and hex nut from the exhaust manifold assy.
3	Remove the Allen screw (attachment of the turbo bracket) together with lock washer and washer.

⚠ CAUTION

Risk of dropping down components.
Make sure you have a second person or a possibility to prevent the turbocharger / muffler / exhaust manifold assy. from drop down.

Step	Procedure
4	Loosen the connection turbo bracket - engine suspension frame, follow the aircraft manufacturer's instruction for installation.

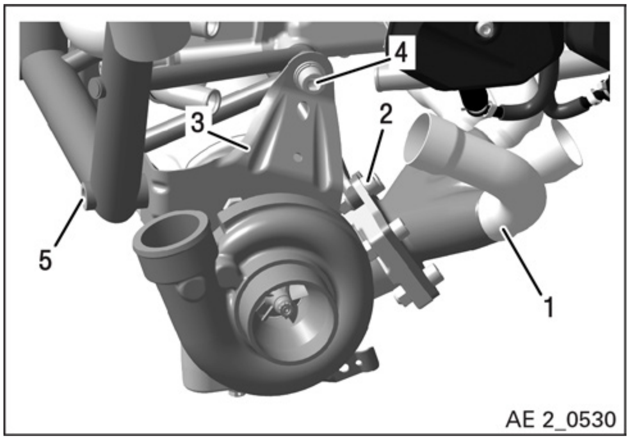


Figure 24.4

1	*Exhaust manifold assy.*	2	*Allen screw, washers and hex. nut*
3	*Turbo bracket*	4	*Allen screw, lock washer and washer*
5	*Connection turbo bracket – engine suspension frame*		

Step	Procedure
5	Support the complete unit of exhaust - turbocharger - exhaust manifold assy., remove the clamp and take the complete unit off.
6	Remove the distance sleeve from the engine suspension frame.

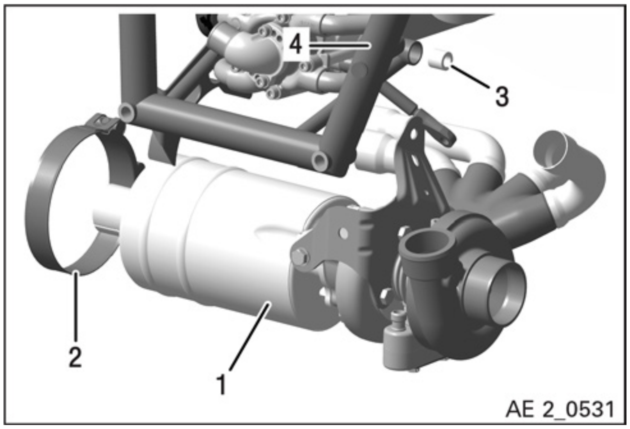


Figure 24.5

1	*Turbocharger assy.*	2	*Clamp*
3	*Distance sleeve*	4	*Engine suspension frame*

Step	Procedure
7	Remove muffler assy. See Chapter 78-10-00, section Muffler assy. - removal for the respective engine type.
8	Remove 4 Allen screws with hex nuts from the exhaust manifold assy.
9	Remove 3 hex. screws and remove turbo bracket.

NOTICE

Ensure correct positioning.
Mark the turbo housing together with the turbo cartridge assy.

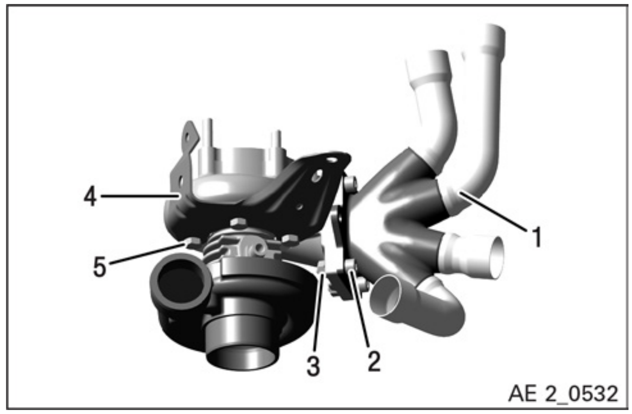


Figure 24.6

1	*Exhaust manifold assy.*	2	*Allen screw*
3	*Hex. nut*	4	*Turbo bracket*
5	*Hex. screw*		

NOTE

These screws cannot be removed completely straight away as they touch the bearing housing.

NOTE

For complete removal it is necessary to slacken the fourth attachment screw slightly.

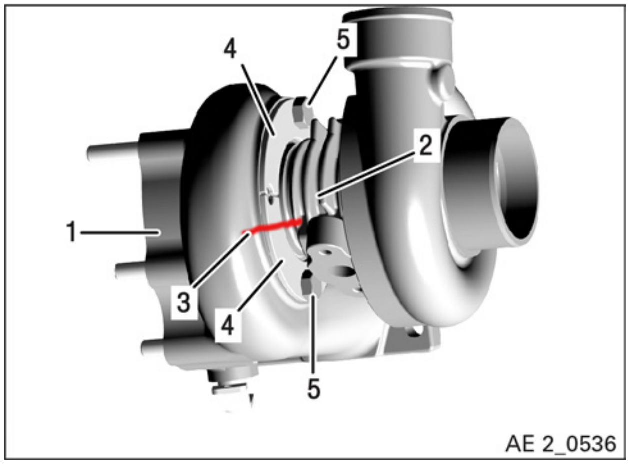


Figure 24.7

1	*Turbo housing*	*2*	*Turbo cartridge assy.*
3	*Marking*	*4*	*Clamp*
5	*Hex. screw*		

NOTICE

To prevent any damage to the turbine impeller, fit the attachment screws again. This will ensure that the turbine housing will not separate from the impeller. Ensure that the two retaining ring halves are in position.

SERVO MOTOR AND WASTEGATE CONTROL COMPONENTS — REMOVAL

Follow the aircraft manufacturer's instructions for removal.

NOTE

*After the automatic self test of the servo motor, position the throttle lever into idle position to make sure that the servo motor will remain always in position with wastegate **closed**. The servo motor is self locking. Position finding is absolutely necessary for correct adjustment of the bowden cable.*

Preparation

- After switching on the TCU, ensure that the automatic self check of the servo motor is performed. During this auto test the complete operating range is traversed and afterwards the engine remains in position corresponding to throttle lever position.
- Disconnect servo motor from wiring harness. See Chapter 76-50-00 Wiring harness.

Step	Procedure
1	Remove tension spring with a suitable tool from cable support and spring pin (wastegate lever) and cut wire of the Bowden cable.

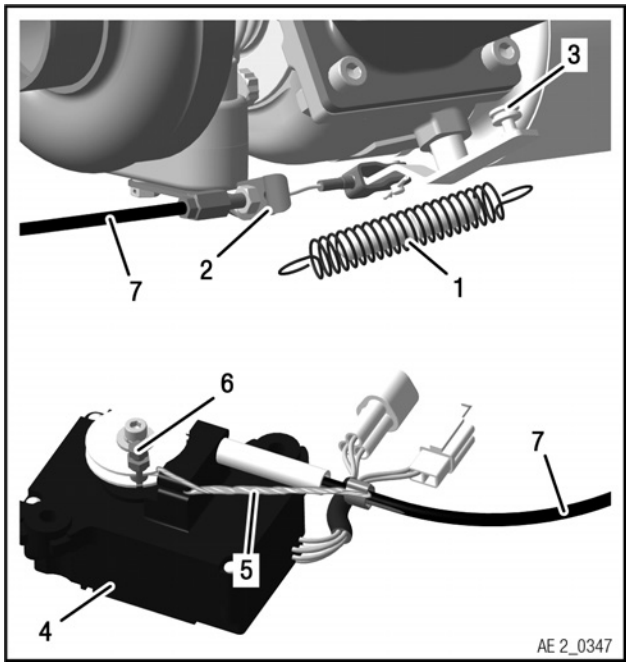


Figure 24.8

1	*Tension spring*	*2*	*Cable support*
3	*Spring pin*	*4*	*Servo motor*
5	*Wire*	*6*	*Screw nipple*
7	*Bowden cable*		

Step	Procedure
2	Loosen set screw of screw nipple and pull Bowden cable out of the cable retainer. **NOTE** *Be careful not to loose the small brass disc inside the screw nipple.*
3	Do not loose the pressure spring. Remove spring and store in a safe place.

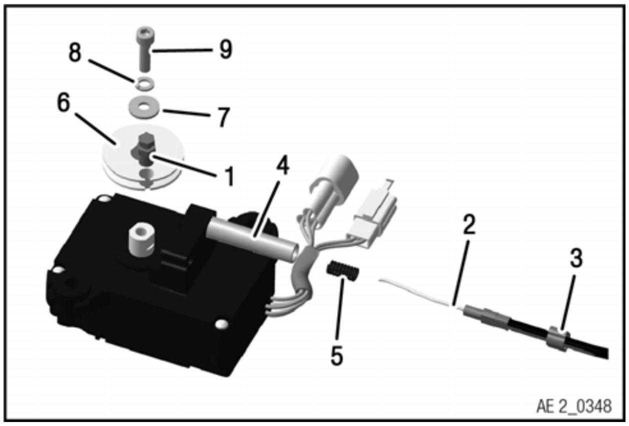


Figure 24.9

1	*Screw nipple*	2	*Bowden cable*
3	*Clamp*	4	*Cable retainer*
5	*Compression spring*	6	*Rope sheave*
7	*Washer*	8	*Lock washer*
9	*Allen screw*		

Step	Procedure
4	If required, remove rope sheave after removal of the Allen screw along with lock washer and washer.
5	Remove cotter pin and pin from waste gate lever.
6	Pull out the Bowden cable form the conduit.
7	Unscrew hex. nut and remove conduit from the cable support.

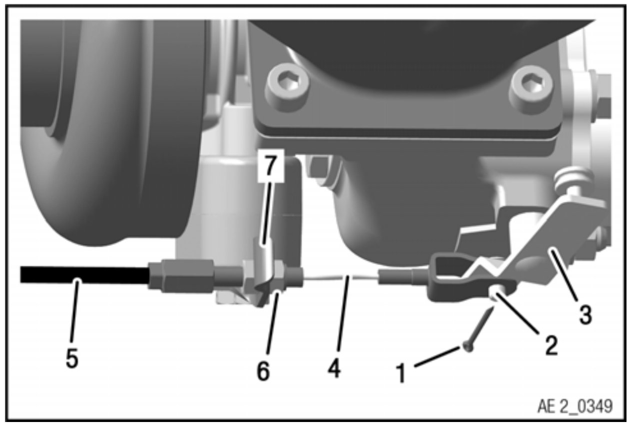


Figure 24.10

1	*Cotter pin*	2	*Pin*
3	*Wastegate lever*	4	*Bowden cable*
5	*Conduit*	6	*Hex. nut*
7	*Cable support*		

OIL SUMP ASSY. – REMOVAL

Step	Procedure
1	If necessary disconnect the turbo oil suction line. Remove the cable clamp (Allen screw M5x12 and lock nut) for supporting the suction line on the turbo bracket. See Chapter 79-00-00 Lubrication.
2	Remove tension spring with a suitable tool from cable support and wastgate lever. **NOTE** *If the Bowden cable should be removed from the cable holder, see Chapter 78-20-00 section Servo Motor and wastegate control components - removal.*
3	Remove hex. screws with cable support, oil sump assy and O-ring.

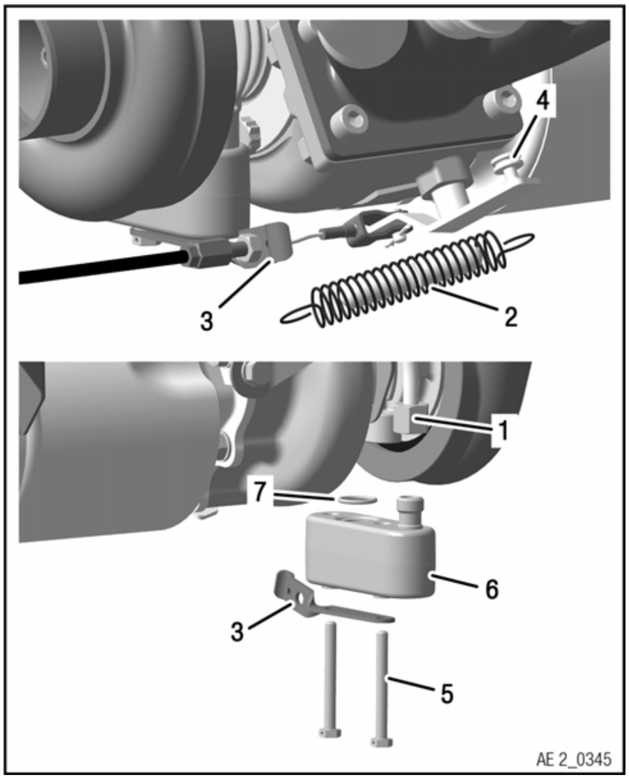


Figure 24.11

1	*Suction oil line*	2	*Tension spring*
3	*Cable support*	4	*Wastegate lever*
5	*Hex. screw*	6	*Oil sump assy.*
7	*O-ring*		

INSPECTION

EXHAUST MANIFOLD ASSY. – INSPECTION (914 SERIES ONLY)

Step	Procedure
1	Check the exhaust manifold assy. for deformation.

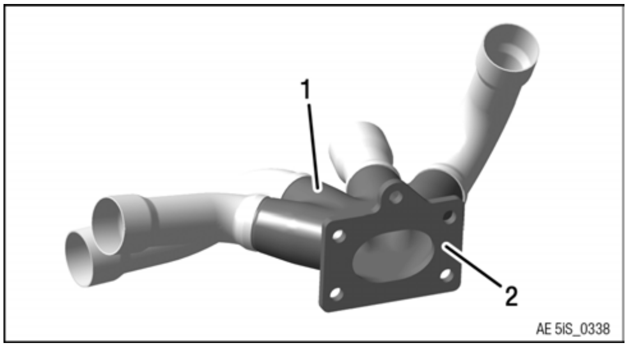


Figure 24.12

1	*Exhaust manifold assy.*
2	*Flange for turbocharger*

TURBOCHARGER— INSPECTION

Follow the aircraft manufacturer's instructions for inspection.

Preparation

Clean all parts carefully. See current Maintenance Manual Line (MML) for the respective engine type.

General visual inspection. See current Maintenance Manual Line (MML) for the respective engine type.

NOTE

The turbocharger is handled as a complete unit, i.e. no spare parts are available from ROTAX®. In the event of damage, the complete unit has to be replaced.

THREADED HOLE — INSPECTION

NOTICE

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.

PLAN SURFACES OF THE TURBINE OPENING — INSPECTION

Step	Procedure
1	Use a straight edge to test for distortion. A distortion of max. 0.1 mm (0.004 in.) is permissible. If the maximal allowed distortion is exceeded then it is possible to rework the surface up to 0.5 mm (0.02 in.). The amount of the rework has to be recorded in the appendix.

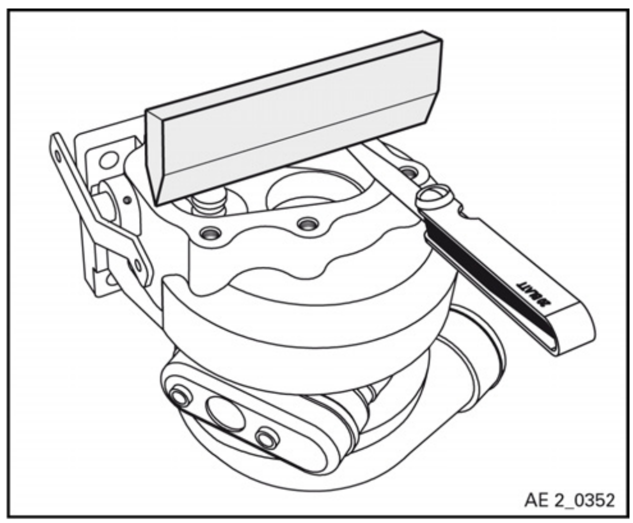


Figure 24.13

ROTOR TURBINE — INSPECTION

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 in.). Check the complete circumference of 360°.

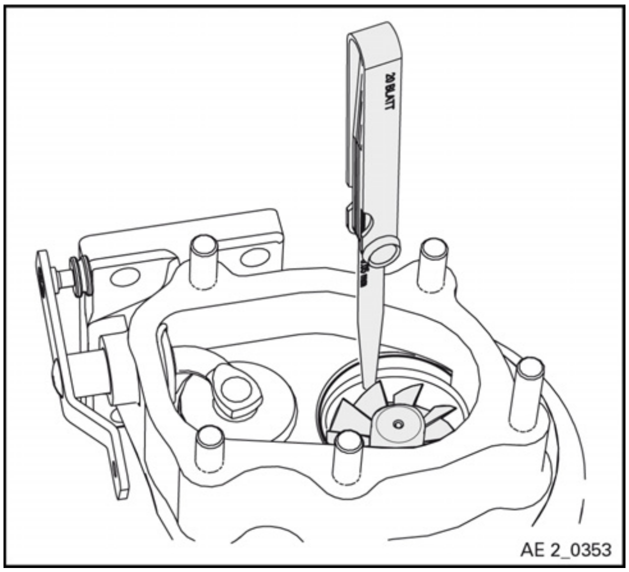


Figure 24.14

COMPRESSOR WHEEL — INSPECTION

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°.

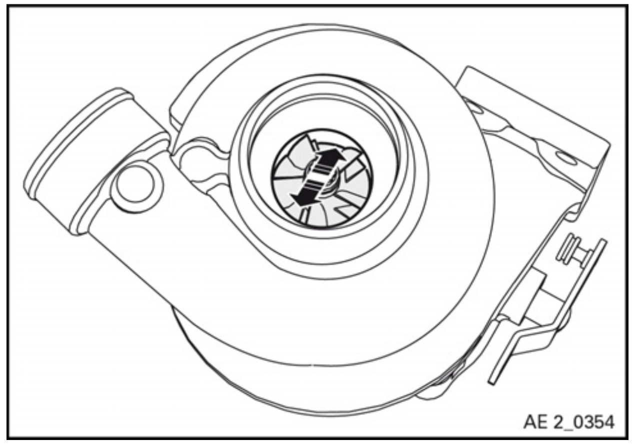


Figure 24.15

SERVO MOTOR AND WASTEGATE CONTROL COMPONENTS – INSPECTION

Step	Procedure
1	Check the component surfaces for damage.

NOTE

Deformation and deep scratches are not permissible.

Step	Procedure
2	Check Bowden cable for free movement.

NOTE

Renew Bowden cable if damaged.

General visual inspection. See current Maintenance Manual Line (MML) for the respective engine type.

Step	Procedure
3	Check spring engagement holes for wear.

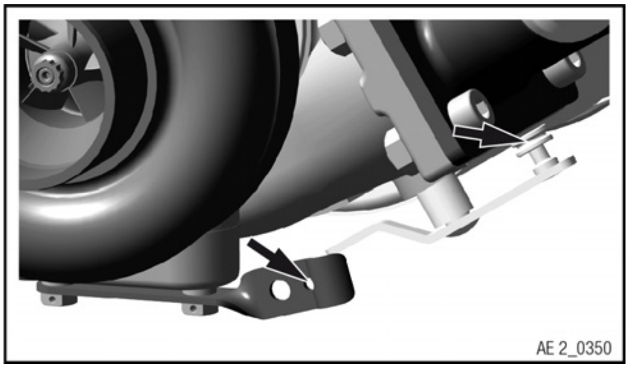


Figure 24.16

NOTE

On older engine versions, observe SB-914–008.

SERVO MOTOR — INSPECTION

NOTICE

Replace parts in the event of physical damage or resistance readings out of the wear limits.

Step	Procedure
1	Inspection for physical damage.
2	Disconnect the plug connection from the wiring harness. See Chapter 76–50–00 Wiring harness. **NOTE** *When taking the following steps, the plug connection with the wiring harness must be disconnected and re established immediately after completion of the check.*
3	Measure the nominal resistance between the terminals (E) and (C). Nominal resistance: 4.4 to 5.5 kΩ
4	Measure resistance between terminals (E) and (D) with wastegate closed (0% position). Resistance value: 0 to 70 Ω
5	Measure resistance between terminals (C) and (D) with wastegate closed (0% position). Resistance value: 4.6 to 5.4 kΩ
6	Measure power supply between terminals (A) and (B) with wastegate closed (0% position). Resistance value: 5 to 20 Ω

NOTE

When replacing the servo motor, verification of the relevant values using of the communication program (monitoring) is required.

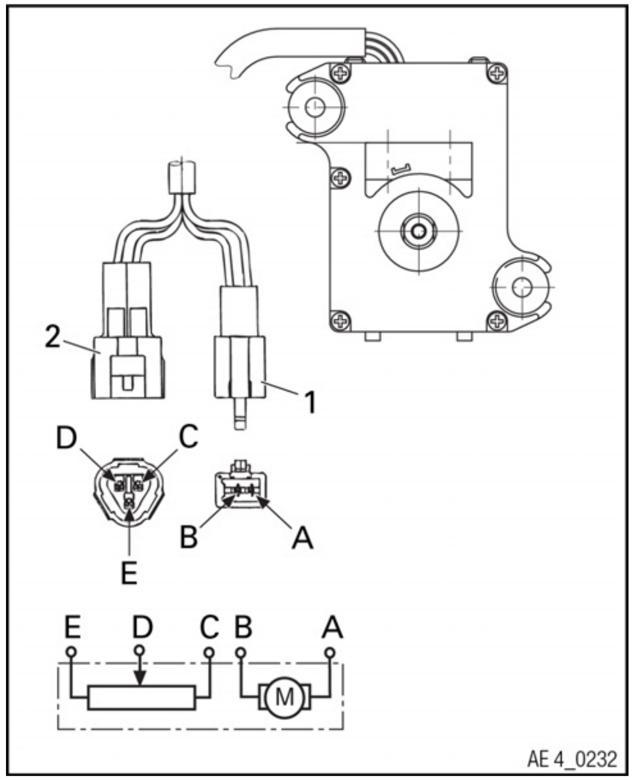


Figure 24.17

1	*Connector (power supply)*	2	*Connector (position)*

NOTICE

When replacing the servo motor, verification of the relevant values using of the communication program (monitoring) is required. See Chapter 76-10-00.

⚠ WARNING

If a check reveals shortcomings, the engine must not be taken into operation until the cause is found and rectified.

CIRCUIT BREAKER FOR SERVO MOTOR — INSPECTION

⚠ CAUTION

The circuit breaker is not included in the delivery range of the engine. Check circuit breaker according to the aircraft manufacturers instructions.

NOTICE

Replace parts in the event of physical damage or resistance readings out of the wear limits.

NOTE

The location of the circuit breaker depends on the aircraft type, but is limited by the length of the wiring harness.

Step	Procedure
1	Check of physical damage.
2	• Circuit breaker closed. • Switch on TCU. The servo motor self test is performed.
3	• Circuit breaker open. • Switch on TCU. No self test of servo motor is performed.

NOTE

When the circuit breaker is open, the servo motor must not start turning. The orange caution lamp starts flashing.

NOTICE

If the required boost pressure cannot be reached or if the circuit breaker does not act correctly, locate the cause. Until the cause has been found and rectified, engine operation is only permitted for ground testing.

INSPECTING THE WASTEGATE LEVER

Step	Procedure
1	Inspect the wastegate lever for free movement. If it does not move freely, lubricate the axle of the waste gate with LOCTITE ANTI SEIZE.

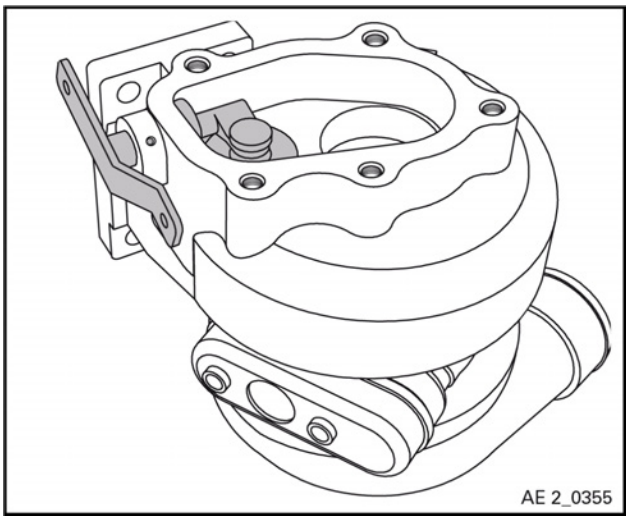


Figure 24.18

On older engine versions, also observe SB-914–005, “Introduction of a turbo charger with a modified waste gate”, latest issue.

TURBOCHARGER SHAFT — INSPECTION

Step	Procedure
1	Record the readings in the appendix.

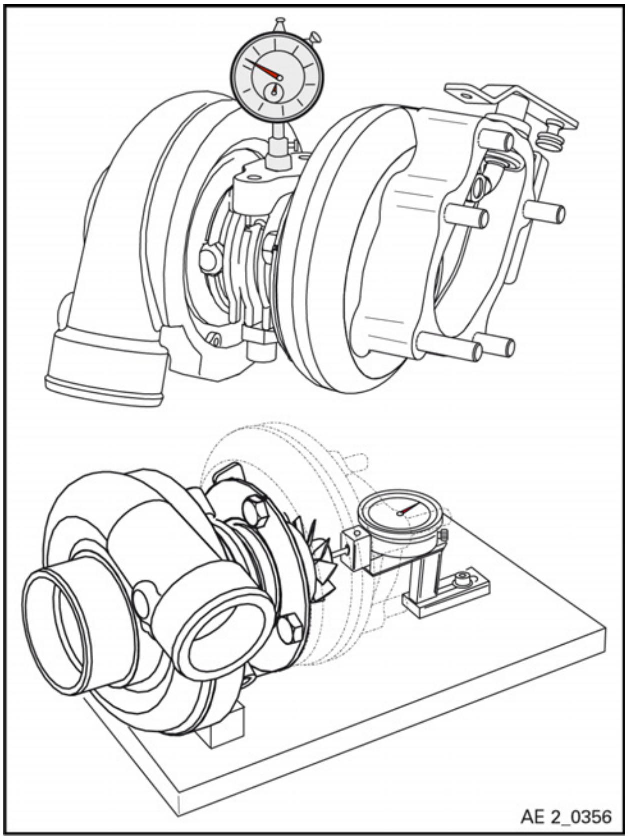


Figure 24.19

IMPELLER SHAFT — INSPECTION

The bearings are tested by means of the pressure drop measuring method.

NOTE

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 (0.039 in.) / length = 3 mm (0.12 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.

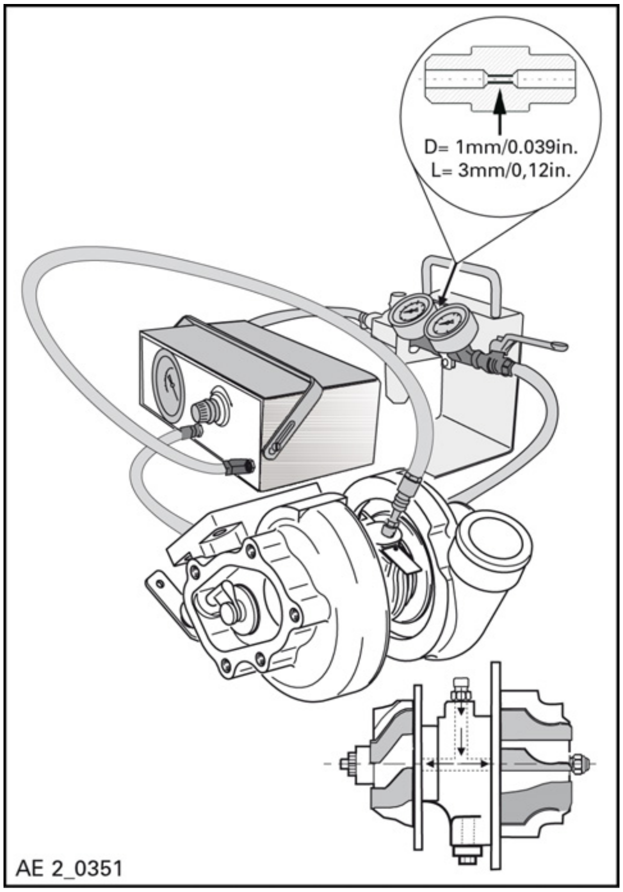


Figure 24.20

WEAR LIMITS

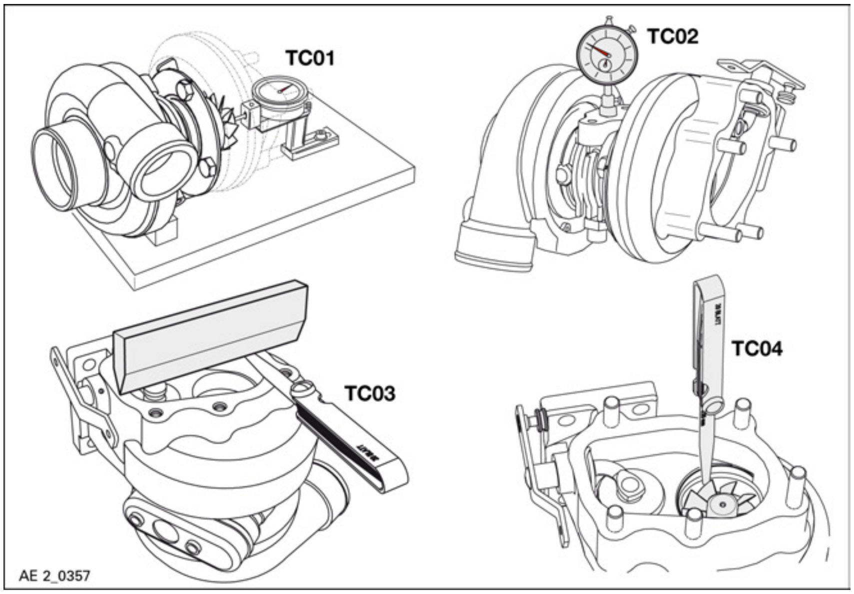


Figure 24.21

Description	Code	Reading new		Wear limit			Readings
		min	max	100 %	50 %		
Turbocharger							
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.)	actual	
						renewed	
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.)	actual	
						renewed	
Rework turbine housing flange	TC03			0.5 mm (0.0020 in.)		actual	
						renewed	
Rotor turbine	TC04			0.1 mm (0.004 in.)		actual	
						renewed	

INSTALLATION

OIL SUMP ASSY. – INSTALLATION

Step	Procedure
1	Install oil sump assy. with hex. screws M6x55, cable support and new O-ring 15.9-2.3 and install safety wire between both screws. Tightening torque 10 Nm (89 in.lb).
2	Install tension spring with a suitable tool to the cable support and spring pin (wastgate lever). **NOTE** *If the Bowden cable has been removed from the cable holder, see Chapter 78-20-00 section Servo motor and wastegate control components - installation..*
3	If turbocharger assy. has not been removed, connect the turbo oil suction line. Install the cable clamp (Allen screw M5x12 and lock nut) for supporting the turbo oil suction line on the turbo bracket. See Chapter 79-00-00 Lubrication.

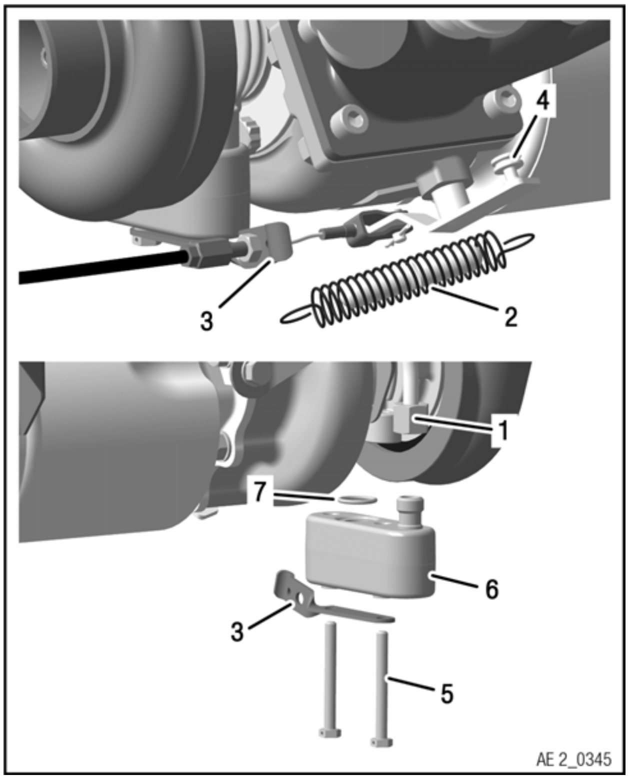


Figure 24.22

1	*Turbo oil suction line*	2	*Tension spring*
3	*Cable support*	4	*Wastegate lever*
5	*Hex. screw M6x55*	6	*Oil sump assy.*
7	*O-ring 15.9-2.3*		

TURBOCHARGER ASSY.— INSTALLATION

Step	Procedure
1	If required, fit the turbocharger with 4 studs M8x19.5/13 and 1 stud M8x30/13 with the longer threaded end (19.5 mm / 0.76 in.) into turbine housing. Lubricate studs with LOCTITE ANTI SEIZE and tighten them. Tightening torque 6 Nm (53 in.lb).

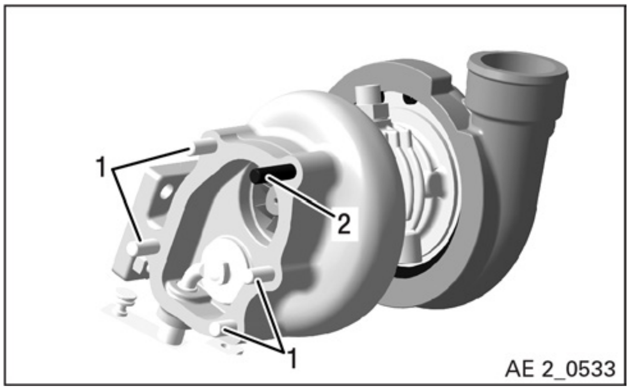


Figure 24.23

1	*Stud M8x19.5/13*	*2*	*Stud M8x30/13*

NOTE

For installation it is necessary to slacken the fourth attachment screw slightly.

Step	Procedure
2	Hand-tighten hex. screws M8x16 lubricated with LOCTITE ANTI SEIZE and install turbo bracket.
3	Fit the exhaust manifold assy. onto the turbocharger flange with Allen screws M8x25 and hand-tighten the with hex. nuts M8.

NOTICE

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.

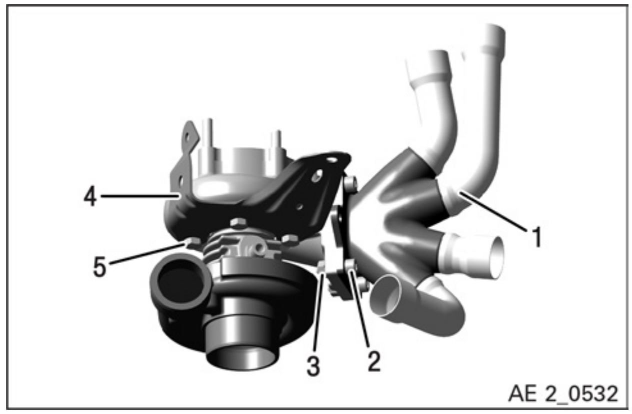


Figure 24.24

1	*Exhaust manifold assy.*	*2*	*Allen screw*
3	*Hex. nut*	*4*	*Turbo bracket*
5	*Hex. screw*		

Step	Procedure
4	Install muffler assy., see Chapter 78-10-00, section Muffler assy. – installation .
5	If manifold bracket assy. has been replaced, install thrust washer (if needed) and manifold bracket assy. on engine housing with Allen screw M8x50 hand-tight. **NOTE** *If needed, install thrust washer around the exhaust bracket assy. with the hole to the exhaust manifold assy. Maximum allowed shimming distance is 2 mm (0.08 in.)*

⚠ CAUTION

Risk of dropping components.
Make sure you have a second person or a possibility to prevent the turbocharger / muffler / exhaust manifold assy. from dropping.

Step	Procedure
6	Support the complete unit of turbocharger / muffler / exhaust manifold assy. and mount clamp on exhaust bracket.
7	Lubricate Allen screw with LOCTITE ANTI SEIZE. Tighten turbocharger assy. with Allen screw M8x25, 2 washers 8.4 and hex. nut M8 on manifold bracket assy. Tightening torque 25 Nm (18 ft.lb).
8	Install Allen screw M10x50 (attachment of the turbo bracket) together with lock washer A10 and washer 10.5. Secure and tighten them with LOCTITE 243. Tightening torque 60 Nm (44 ft. lb.).
9	Install the connection turbo bracket - engine suspension frame, follow the aircraft manufacturer's instruction for installation.

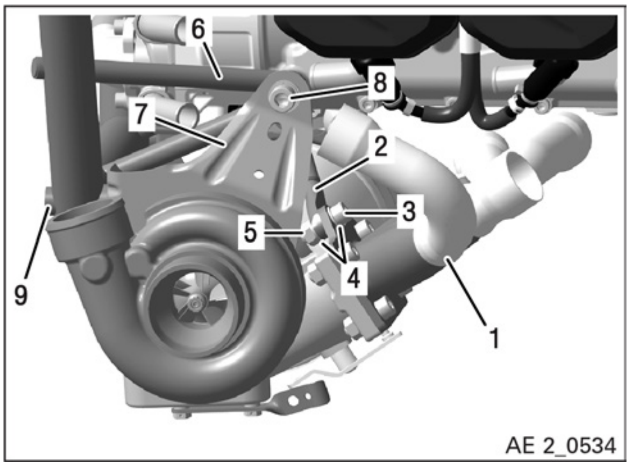


Figure 24.25

1	*Exhaust manifold assy.*	2	*Manifold bracket assy.*
3	*Allen screw M8x25*	4	*Washer 8.4*
5	*Hex. nut M8*	6	*Engine suspension frame*
7	*Turbo bracket*	8	*Allen screw M10x50, lock washer A10, washer 10.5*
9	*Connection turbo bracket – engine suspension frame*		

NOTICE

Ensure correct positioning.
Install turbo cartridge assy. with compressor housing to the pre-marked position on turbo housing.

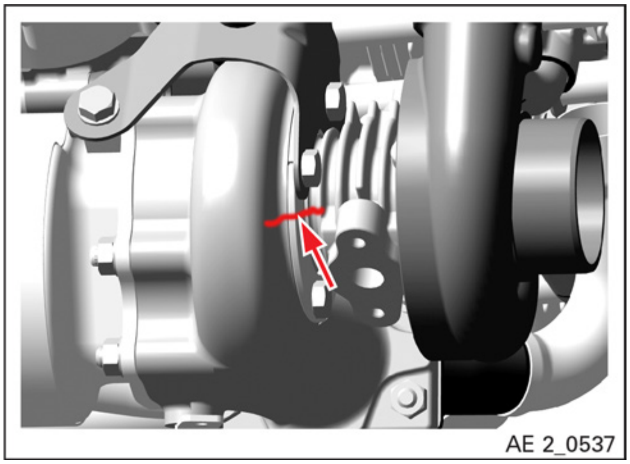


Figure 24.26

NOTICE

After the exhaust is completely mounted, tighten 4 hex. screws M8x16 on turbine housing and Allen screws M8x25 on exhaust manifold assy. to 25 Nm (18 ft.lb.).

NOTICE

If manifold bracket assy. has been replaced, secure and tighten Allen screw M8x50. Tightening torque 30 Nm (22 ft. lb.).

Step	Procedure
10	Install exhaust pipes, see Chapter 78-10-00 Exhaust.
11	Install air intake hose on turbocharger.
12	If required install oil sump assy., see Chapter 78-20-00 section Oil sump assy. - installation.

Step	Procedure
13	Install the turbo pressure oil line and the suction oil line. Install the cable clamp (Allen screw M5x12 and lock nut) for supporting the suction line on the turbocharger bracket. See Chapter 79-00-00 Lubrication.
14	Connect servo motor with turbocharger.

SERVO MOTOR AND WASTEGATE CONTROL COMPONENTS — INSTALLATION

Follow the aircraft manufacturer's instructions for installation.

NOTE

The installation location of the servo motor depends on the aircraft type but is limited by the length of the wiring harness as well as the length of the bowden cable to the waste gate.

Ascertaining the position of the servo motor

- To ascertain the servo motor position, power-up the TCU. For TCU details see Chapter 76-10-00 Turbocharger control unit

Preparation
While assembling the rope sheave, interrupt the voltage supply to the TCU or unplug the 2-pin plug connection. Risk of destroying the servo motor if it is activated by the TCU during assembly.

Step	Procedure
1	Fit rope sheave and secure with washer A5.2x14.8x1.5, lock washer A5 and Allen screw M5x20. The rope sheave has to be fixed to prevent rotating of the output shaft when the rope sheave is tightened. Tightening torque 6 Nm (53 in.lb)
2	If the cable retainer has been removed, apply LOCTITE 648 on cable retainer and press it into servo motor housing.

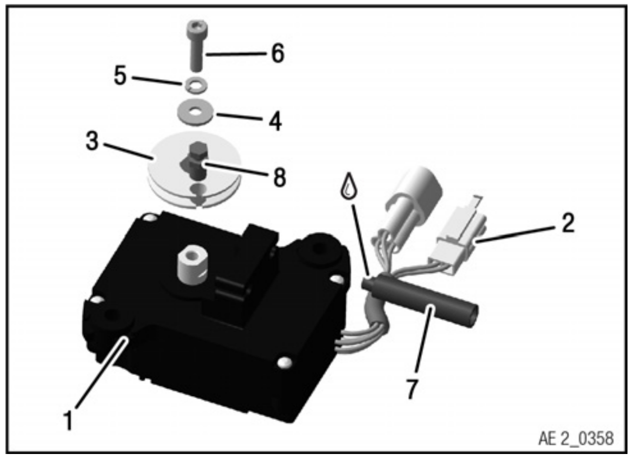


Figure 24.27

1	*Servo motor*	*2*	*2-pin plug connector*
3	*Rope sheave*	*4*	*Washer A5.2x14.8x1.5*
5	*Lock washer A5*	*6*	*Allen screw M5x20*
7	*Cable retainer*	*8*	*Screw nipple*

Step	Procedure
3	Fit Bowden cable to wastegate lever with pin and new cotter pin.
4	Install new hex. nut M6 onto the Bowden cable and feed the Bowden cable through the cable support. Then install another hex nut M6 onto the conduit.
5	Feed Bowden cable through flexible conduit.

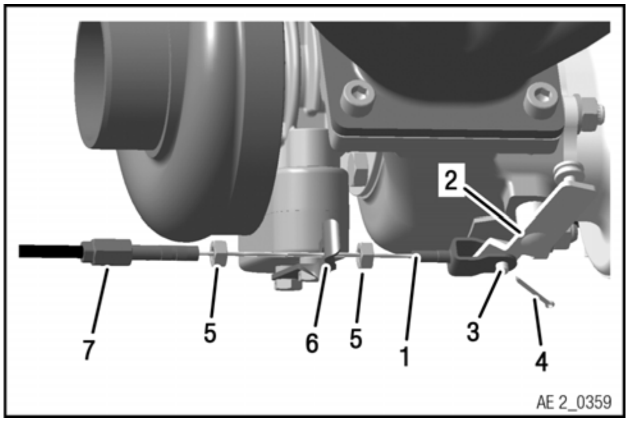


Figure 24.28

1	*Bowden cable*	2	*Wastegate lever*
3	*Pin*	4	*Cotter pin*
5	*Hex. nut M6*	6	*Cable support*
7	*Conduit*		

Step	Procedure
6	Use a suitable tool to fit clamp on the Bowden cable for tension relief. (25-30 mm/ 1-1.2 in.)
7	Insert compression spring in cable retainer, thread Bowden cable through and around the rope sheave and fix with a screw nipple. Tightening torque 2.5 Nm (22 in.lb)

NOTE

Insure cable is routed between brass shim and nipple (not against screw).

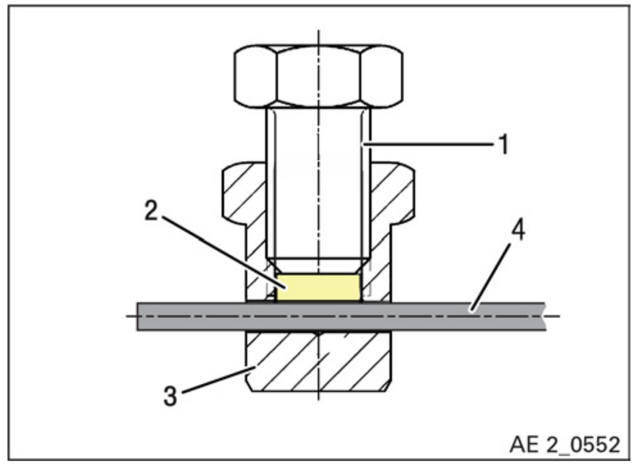


Figure 24.29

1	*Hex. screw M5x8*	2	*Brass shim*
3	*Nipple*	4	*Cable*

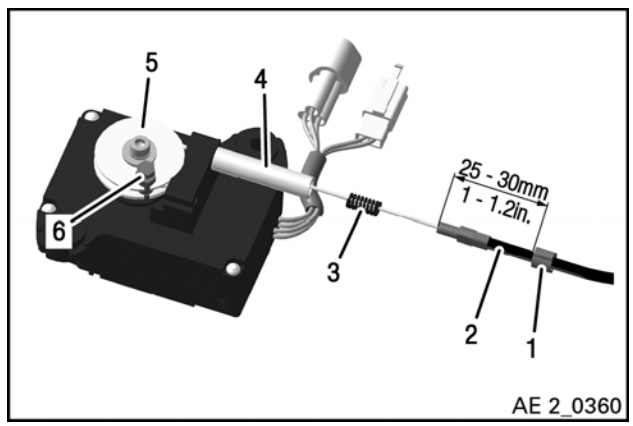


Figure 24.30

1	*Clamp*	2	*Bowden cable*
3	*Compression spring*	4	*Cable retainer*
5	*Rope sheave*	6	*Screw nipple*

Step	Procedure
8	Adjust Bowden cable with hex. nut M6 so that no clearance is perceptible on waste-gate lever.
9	With this adjustment set, pretension the pressure spring by 1 to 2 mm (0.04 - 0.08 in) at straightened cable with the adjustment screw at cable support.
10	Insert silicone hose 5x8, length approx. 125 mm (4.92 in), into the tension spring.

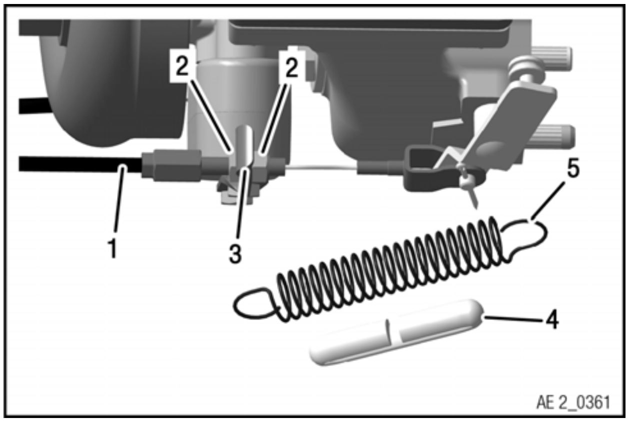


Figure 24.31

1	*Bowden cable*	2	*Hex. nut M6*
3	*Cable support*	4	*Silicone hose*
5	*Tension spring*		

NOTICE

To minimize wear on spring engagement holes, engage spring on spring pin, twist it by approx. one turn and engage other end of spring on support.

Step	Procedure
11	Engage tension spring with a suitable tool on cable support and spring pin (waste-gate lever).
12	Secure with safety wire between servo motor and traction relief so that the Bowden cable cannot escape from the cable retainer and consequently change the setting during operation.

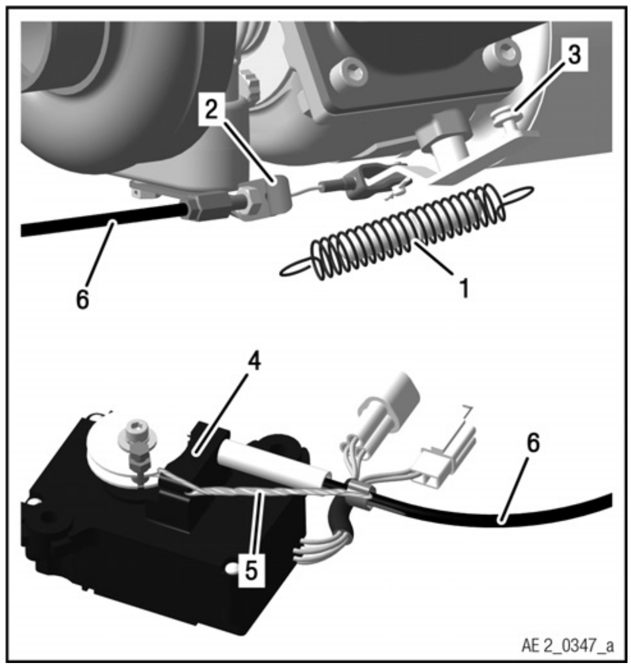


Figure 24.32

1	*Tension spring*	2	*Cable support*
3	*Spring pin*	4	*Servo motor*
5	*Safety wire*	6	*Bowden cable*

Step	Procedure
13	Connect Servo motor with wiring harness. See Chapter 76-50-00 Wiring harness..
14	To verification of the relevant values using of the communication program (monitoring) is required. See Chapter 76-10-00 Communication program.

FINISHING WORK

Complete the engine

- If necessary, install coolant hoses see Chapter 75-00-00 Cooling system.
- Install air filter, follow the instructions of the aircraft manufacturer..

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

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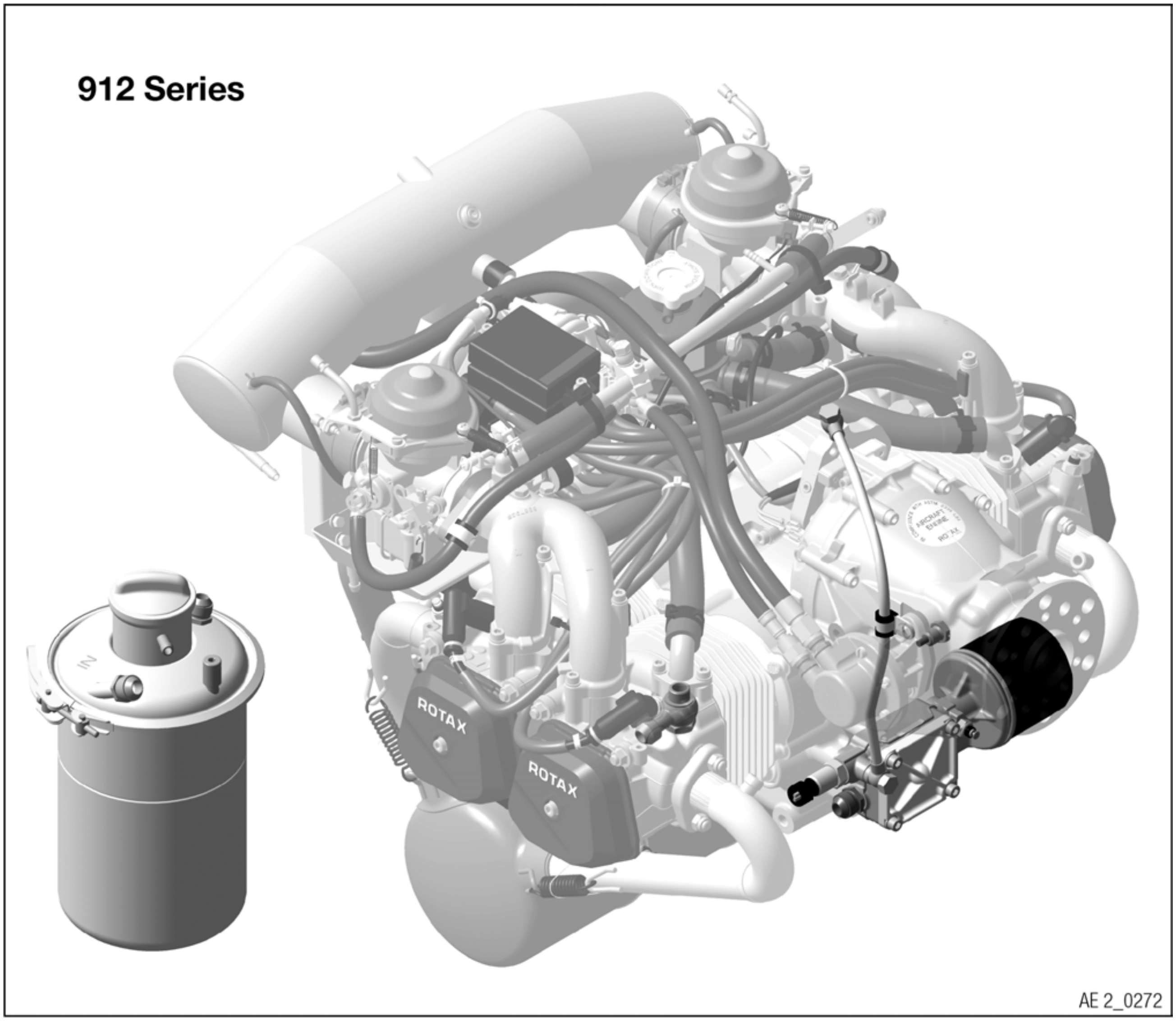
Chapter: 79–00–00
LUBRICATION SYSTEM

TOPICS IN THIS CHAPTER


912 Series
ROTAX
ROTAX
AE 2_0272

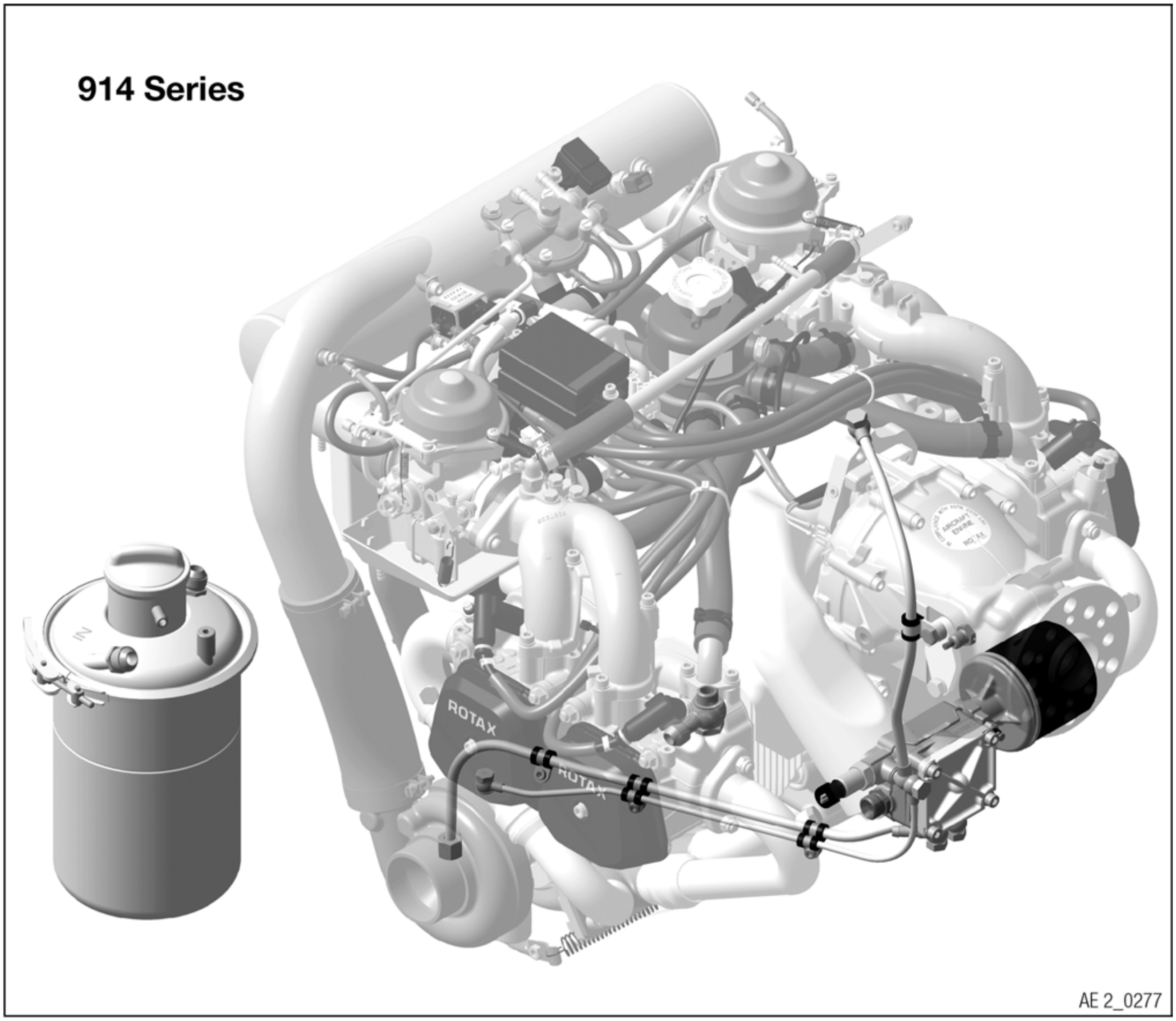


Figure 25.1

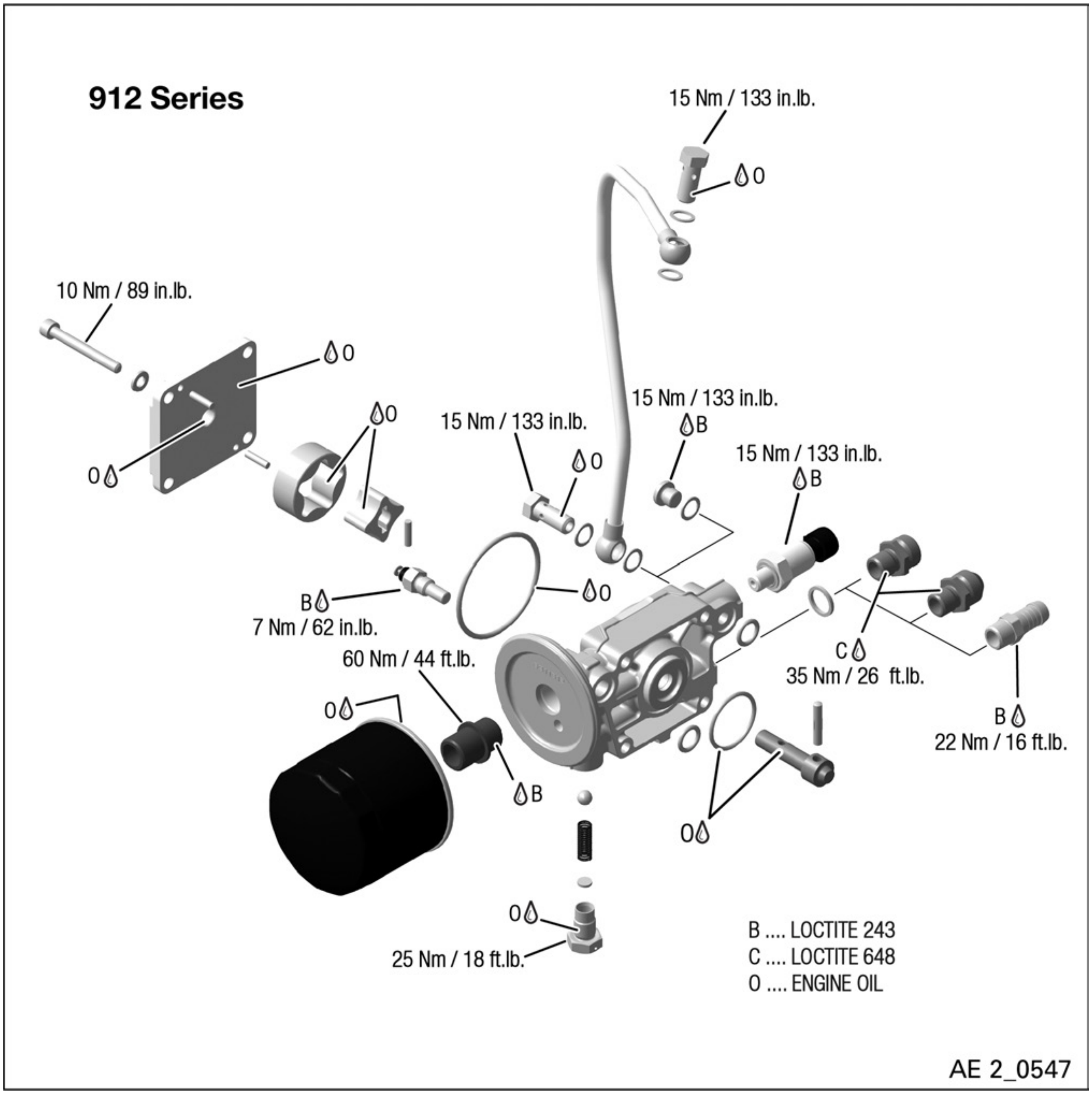
SPECIAL TOOLS

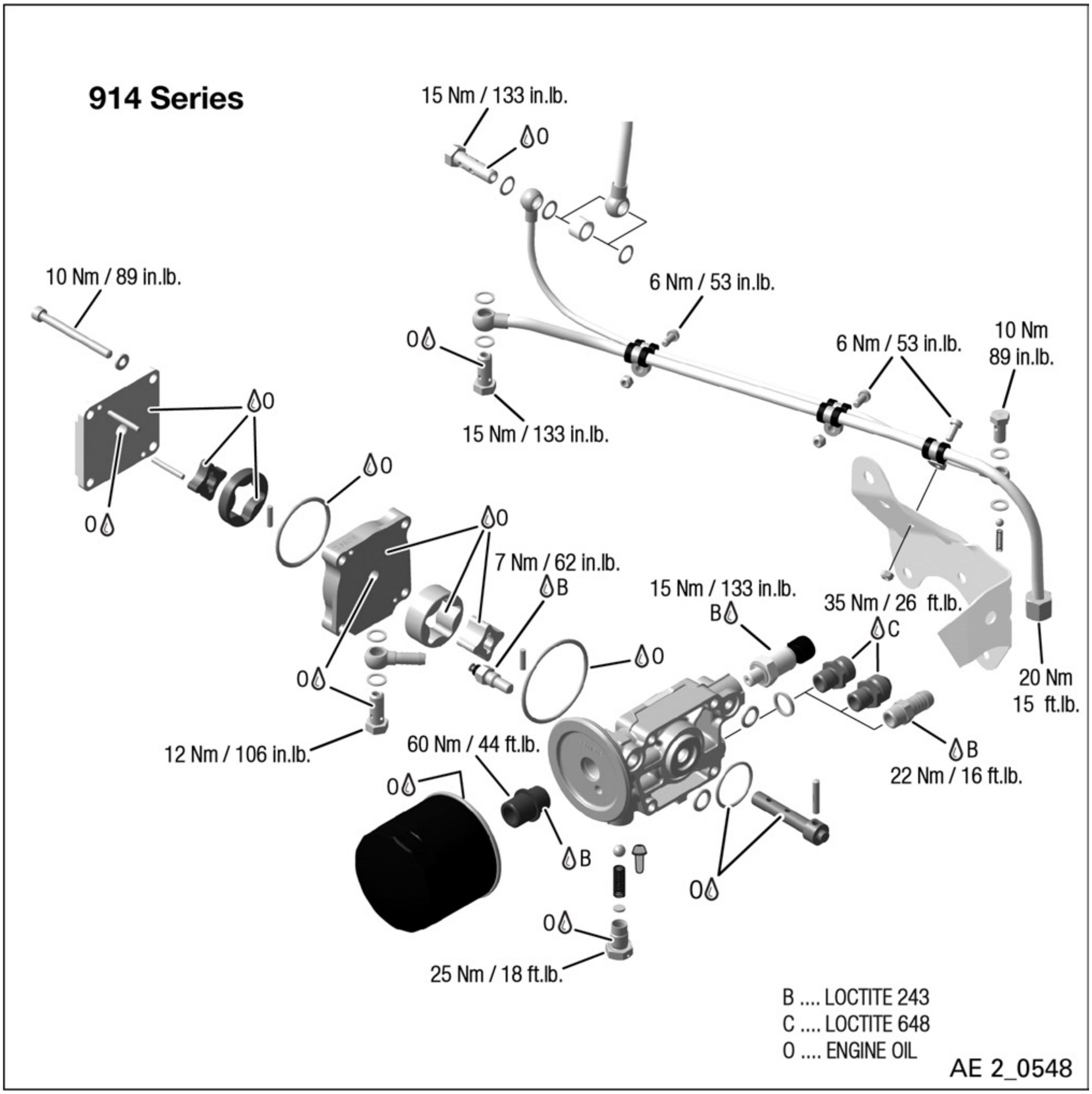
Description	Part number
Oil filter wrench	877620

Figure 25.2

SERVICE PRODUCTS

Description	Part number
LOCTITE 5910	899791
LOCTITE 243	897651
LOCTITE 648	899788
Engine oil	n.a.
Insulating tape	n.a.


912 Series
15 Nm / 133 in.lb.
0
10 Nm / 89 in.lb.
0
0
0
15 Nm / 133 in.lb.
15 Nm / 133 in.lb.
0
B
15 Nm / 133 in.lb.
B
B
7 Nm / 62 in.lb.
0
60 Nm / 44 ft.lb.
0
C
35 Nm / 26 ft.lb.
B
22 Nm / 16 ft.lb.
B
0
0
25 Nm / 18 ft.lb.
B .... LOCTITE 243
C .... LOCTITE 648
0 .... ENGINE OIL
AE 2_0547


914 Series
15 Nm / 133 in.lb.
0
10 Nm / 89 in.lb.
6 Nm / 53 in.lb.
0
6 Nm / 53 in.lb.
10 Nm
89 in.lb.
0
15 Nm / 133 in.lb.
0
0
0
0
7 Nm / 62 in.lb.
B
15 Nm / 133 in.lb.
B
35 Nm / 26 ft.lb.
C
0
0
20 Nm
15 ft.lb.
12 Nm / 106 in.lb.
60 Nm / 44 ft.lb.
B
22 Nm / 16 ft.lb.
0
B
0
0
25 Nm / 18 ft.lb.
B .... LOCTITE 243
C .... LOCTITE 648
0 .... ENGINE OIL
AE 2_0548

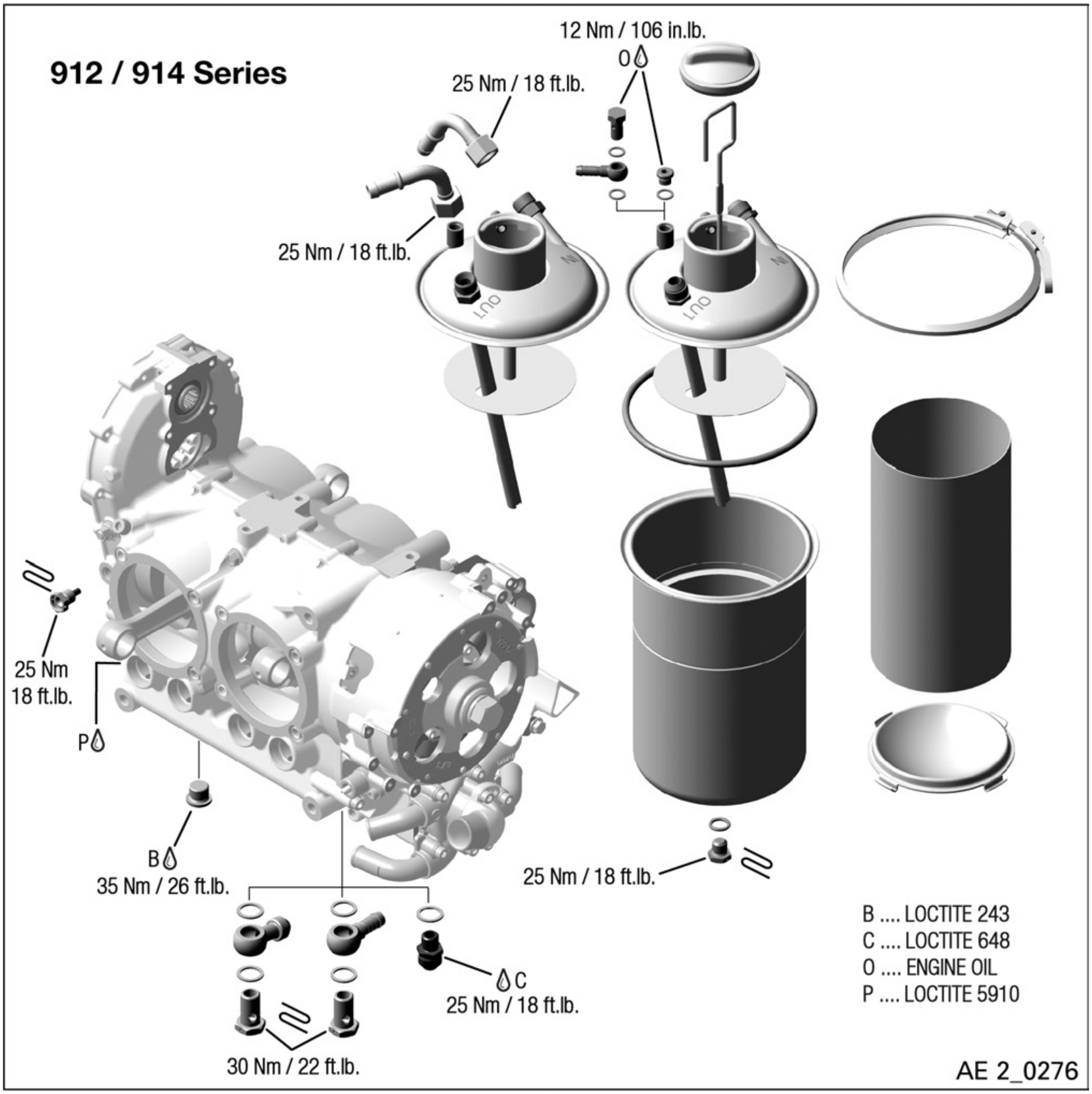

912 / 914 Series
12 Nm / 106 in.lb.
O
25 Nm / 18 ft.lb.
25 Nm / 18 ft.lb.
25 Nm
18 ft.lb.
P
B
35 Nm / 26 ft.lb.
25 Nm / 18 ft.lb.
C
25 Nm / 18 ft.lb.
30 Nm / 22 ft.lb.
B .... LOCTITE 243
C .... LOCTITE 648
O .... ENGINE OIL
P .... LOCTITE 5910
AE 2_0276

Figure 25.3

SYSTEM DESCRIPTION

The engines are provided with a dry sump forced lubrication system with a main oil pump and an integrated pressure regulator.

Oil flow
The oil pump (driven by the camshaft) sucks the engine oil from the oil tank through the oil cooler (optional) and forces it through the oil filter up to the points of lubrication in the engine and the turbocharger (engine type 914 Series only). 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 (engine type 914 Series only)
The turbocharger is lubricated via a separate oil line (from the main oil pump). The oil emerging from the turbocharger is collected in a stainless steel oil sump and sucked back to the secondary oil pump, from there it will be pumped 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 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!
- Ensure that the lubrication system is no longer pressurized!

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 fuel) 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.

OIL TEMPERATURE SENSOR (OTS)

The oil temperature sensor (OTS) is situated on the oil pump housing and measures the oil inlet temperature.
For removal, inspection and installation see Chapter Chapter 76-70-00 Sensors and actuators.

OIL PRESSURE SENSOR (OPS)

The oil pressure sensor (OPS) is situated on the oil pump housing and measures the oil pressure.
For removal, inspection and installation see Chapter Chapter 76-70-00 Sensors and actuators.

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

NOTE

Whenever the lubrication system is removed or disassembled, O-rings and other sealing elements must be replaced with new parts.

OIL PUMP

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

OIL PUMP ASSY. — REMOVAL (912 SERIES ONLY)

Preparation

- Turn the ignition switch OFF
    - Drain oil. See current Maintenance Manual Line (MML) for the respective engine type.
- Remove surrounding assemblies and detach oil lines

NOTICE
Removal of the oil lines must be carried out according to the aircraft manufacturer's instructions.

ENVIRONMENTAL NOTE
Dispose of used oil according to local environmental regulations.

NOTICE
Prevent the ingress of debris particles 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!
The oil filter nipple, screw socket M18x1.5/ M14x1.5, oil temperature sensor and oil pressure sensor are only to be removed if required, e.g. in the event of damage or for cleaning.

Step	Procedure
1	To disconnect the pressure oil line(s) remove banjo bolt and take off sealing rings. (with governor only)
2	Remove the safety wire of the plug screw (oil pressure regulator).
3	Loosen the plug screw (oil pressure regulator), otherwise it is very difficult to unscrew when the oil pump is removed.

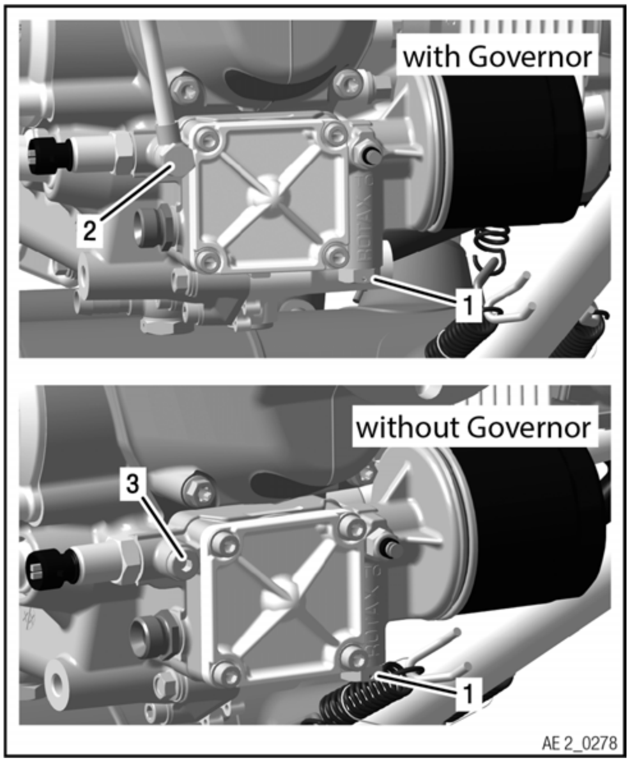


Figure 25.4

1	*Plug screw (oil pressure regulator)*	*2*	*Banjo bolt (pressure oil line)*
3	*Plug screw*		

Step	Procedure
3	Unscrew the oil filter with oil filter wrench part no. 877620.

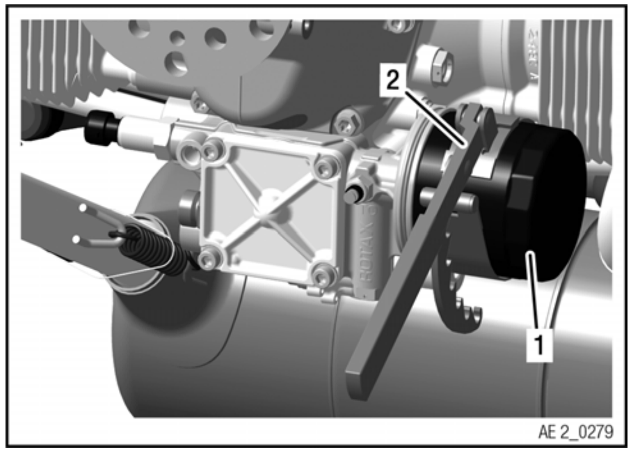


Figure 25.5

1	*Oil filter*	*2*	*Special tool 877620*

Step	Procedure
4	Loosen 4 Allen screws with washers.
5	Remove the whole oil pump assy. and O-rings.

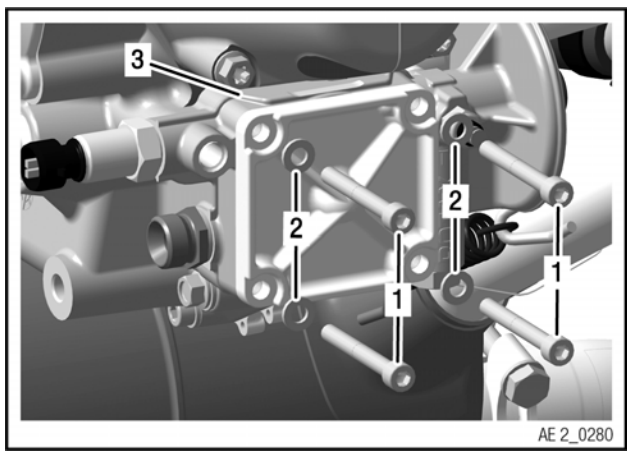


Figure 25.6

1	*Allen screws*	*2*	*Washers*
3	*Oil pump assy.*		

OIL PUMP ASSY. — REMOVAL (914 SERIES ONLY)

Preparation

- Turn the ignition switch OFF
  - Drain oil. See current Maintenance Manual Line (MML) for the respective engine type.
- Remove surrounding assemblies and detach oil lines

NOTICE

Removal must be carried out according to the aircraft manufacturer's instructions.

ENVIRONMENTAL NOTE

Dispose of used oil according to local environmental regulations.

NOTICE

Prevent the ingress of debris particles 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!
The oil filter nipple, screw socket M18x1.5/ M14x1.5, oil temperature sensor and oil pressure sensor are only to be removed if required, e.g. in the event of damage or for cleaning.

Step	Procedure
1	To disconnect the pressure oil line(s) remove banjo bolt and take off sealing rings. (with governor). To disconnect the pressure oil line remove banjo bolt and take off sealing rings and spacer. (without governor)
2	Remove the safety wire of the plug screw (oil pressure regulator).
3	Loosen the plug screw (oil pressure regulator), 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.

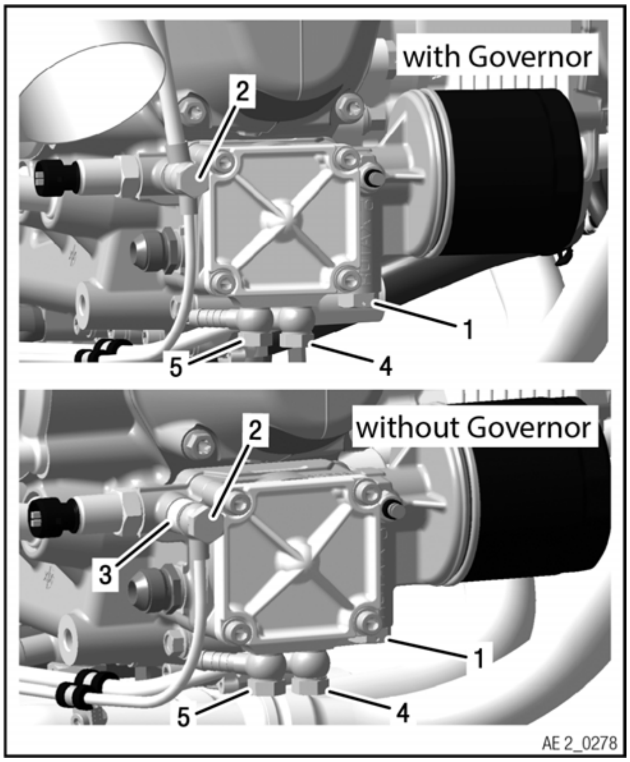


Figure 25.7

1	*Plug screw (oil pressure regulator)*	2	*Banjo bolt (Pressure oil line)*
3	*Spacer*	4	*Banjo bolt (turbo return line)*
5	*Banjo bolt (to oil tank)*		

Step	Procedure
6	Unscrew the oil filter with oil filter wrench part no. 877620.

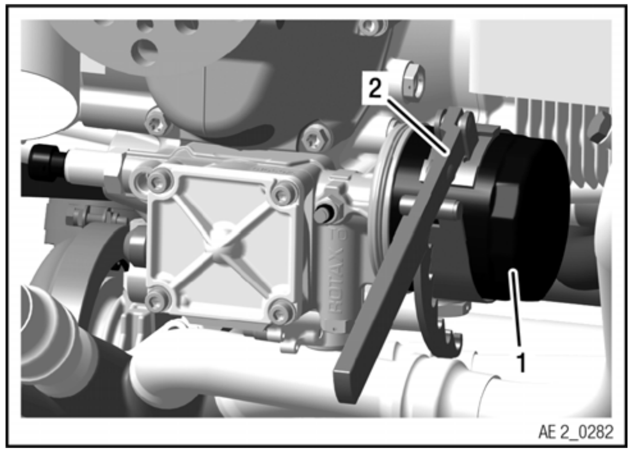


Figure 25.8

1	*Oil filter*	2	*Special tool 877620*

Step	Procedure
7	Loosen 4 Allen screws with washers.
8	Remove the whole oil pump assy. with O-rings.

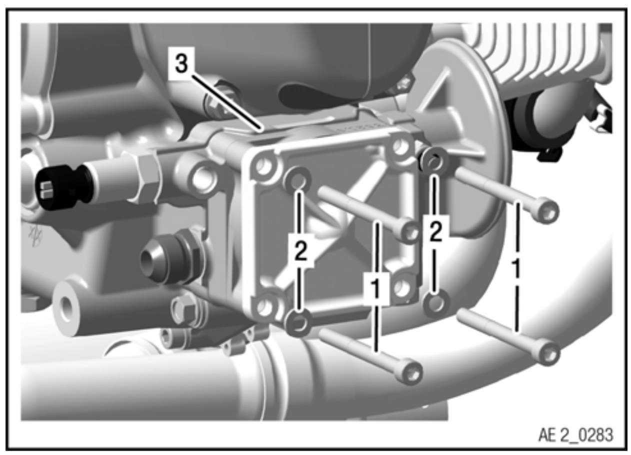


Figure 25.9

1	*Allen screws*	2	*Washers*
3	*Oil pump assy.*		

OIL PUMP — DISASSEMBLY (912 SERIES ONLY)

NOTE

The oil filter nipple, screw socket M18x1.5/ M14x1.5, oil temperature sensor and oil pressure sensor are only removed if required, e.g. in the event of damage or for cleaning.

Step	Procedure
1	Remove the plug screw, adjusting shim, pressure spring and ball or valve piston of oil pressure release valve.

NOTE

The adjusting shim is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is too low.

NOTE

Valve piston may be installed instead of the ball, see section assembly.

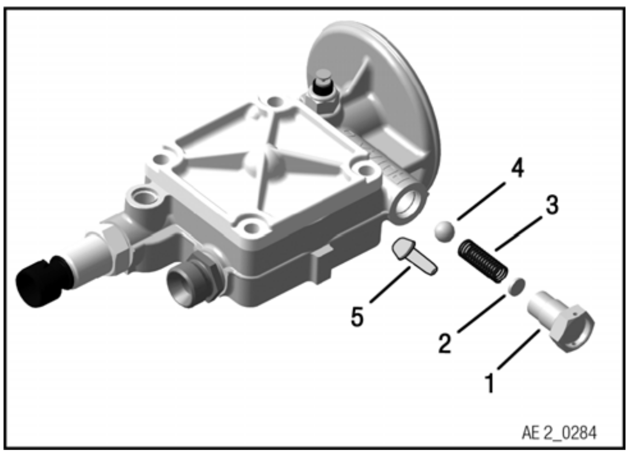


Figure 25.10

1	*Plug screw*	2	*Adjusting shim*
3	*Pressure spring*	4	*Ball*
5	*Valve piston*		

Step	Procedure
2	Remove the oil pump cover. **NOTE** *If the cover sticks, carefully release it with a soft-faced hammer.*

NOTICE

The rotary piston and rotor are marked.

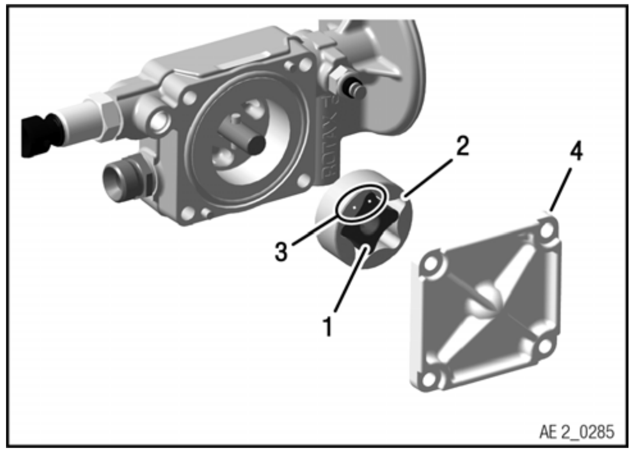


Figure 25.11

1	*Rotor (inner rotor)*	2	*Rotary piston (outer rotor)*
3	*Mark*	4	*Oil pump cover*

Step	Procedure
3	Remove rotor and rotary piston.
4	Remove the needle pin and O-ring.
5	Remove the oil pump shaft.

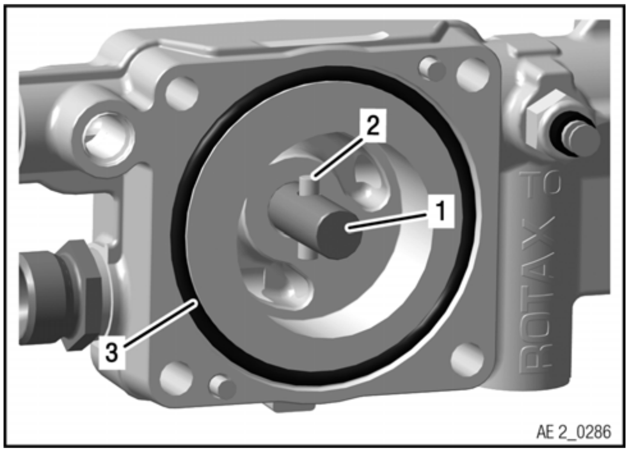


Figure 25.12

1	*Oil pump shaft*	2	*Needle pin*
3	*O-ring*		

Step	Procedure
6	Remove O-rings.

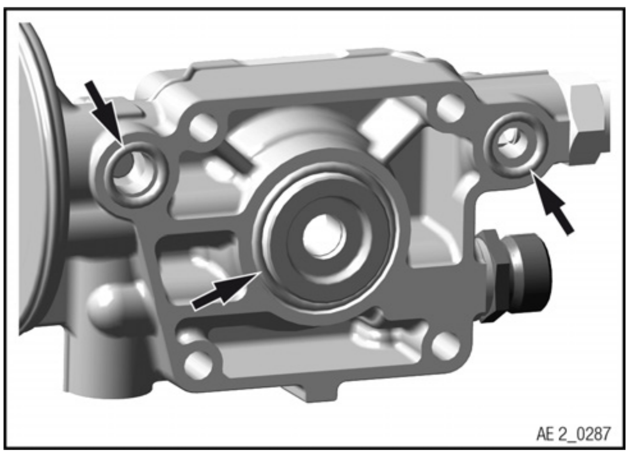


Figure 25.13

Step	Procedure
7	Remove oil pressure sensor (OPS) and oil temperature sensor (OTS), if necessary. See Chapter 76-70-00 Sensors and actuators.

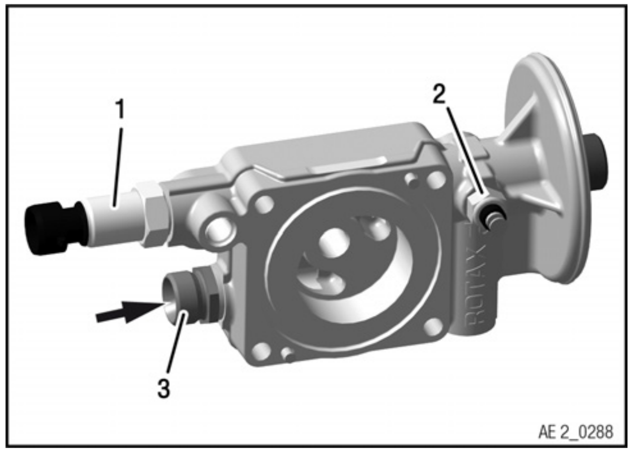


Figure 25.14

1	*Oil pressure sensor (OPS)*	2	*Oil temperature sensor (OTS)*
3	*Oil inlet*		

OIL PUMP — DISASSEMBLY (914 SERIES ONLY)

NOTE

The oil filter nipple, screw socket M18x1.5/ M14x1.5, oil temperature sensor and oil pressure sensor are only removed if required, e.g. in the event of damage or for cleaning.

Step	Procedure
1	Remove the plug screw, adjusting shim, pressure spring and ball or valve piston of oil pressure release valve.
2	Remove the oil pump cover. **NOTE** *If the cover sticks, carefully release it with a soft-faced hammer.*

NOTE

The adjusting shim is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is too low.

NOTE

Valve piston may be installed instead of the ball, see section assembly.

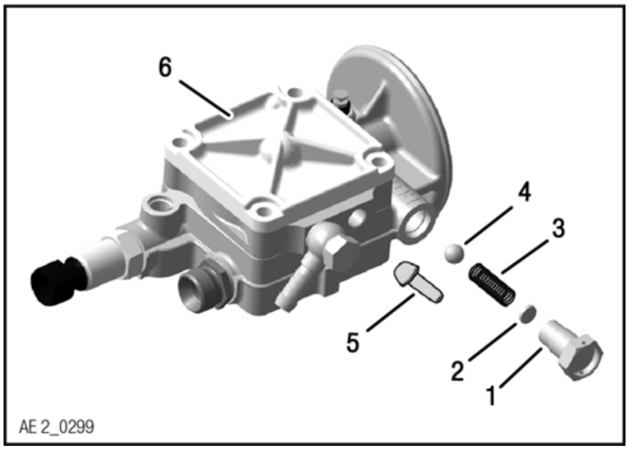


Figure 25.15

1	*Plug screw*	2	*Shim*
3	*Pressure spring*	4	*Ball or valve piston*
5	*Valve piston*	6	*Oil pump cover*

Step	Procedure
3	Pull out the rotor and rotary piston.
4	Remove the needle pin.
5	Remove the oil pump center housing with O-ring.

NOTICE

The rotary piston and rotor are marked.

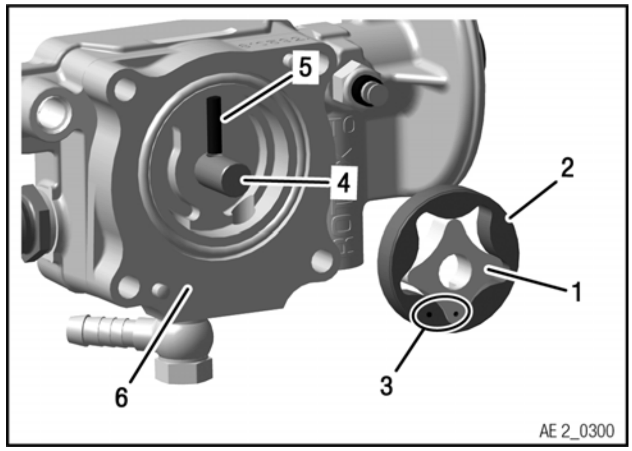


Figure 25.16

1	*Rotor (inner rotor)*	2	*Rotary piston (outer rotor)*
3	*Mark (dot)*	4	*Oil pump shaft*
5	*Needle pin*	6	*Oil pump center housing with O-ring*

Step	Procedure
6	Pull out the rotor and rotary piston.
7	Remove the needle pin and O-ring.
8	Remove the oil pump shaft.

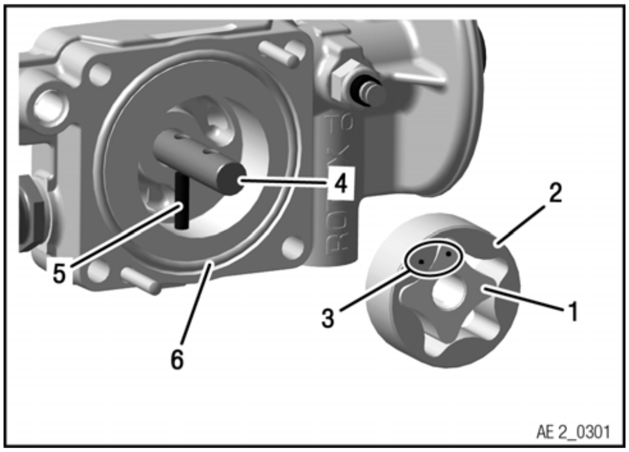


Figure 25.17

1	*Rotor (inner rotor)*	*2*	*Rotary piston (outer rotor)*
3	*Mark (dot)*	*4*	*Oil pump shaft*
5	*Needle pin*	*6*	*O-ring*

Step	Procedure
9	Remove O-rings.

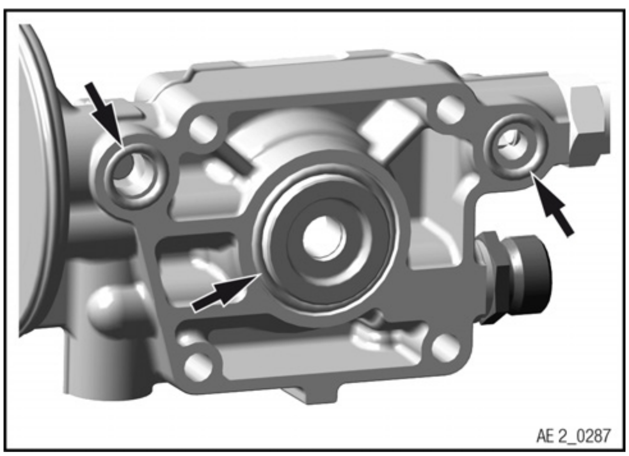


Figure 25.18

Step	Procedure
10	Remove oil pressure sensor (OPS) and oil temperature sensor (OTS), if necessary. See Chapter 76-70-00 Sensors and actuators.

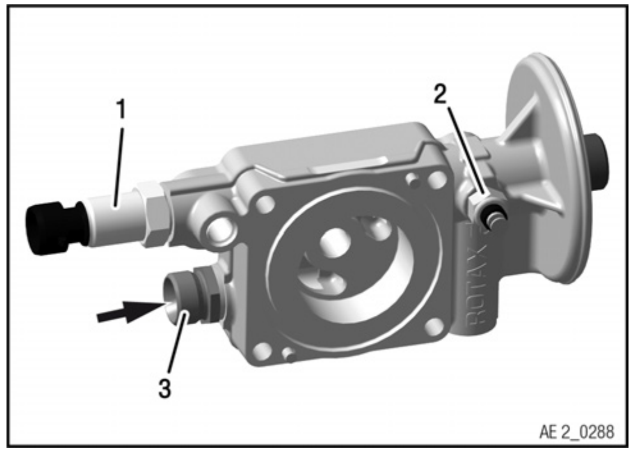


Figure 25.19

1	*Oil pressure sensor (OPS)*	*2*	*Oil temperature sensor (OTS)*
3	*Oil inlet*		

OIL PUMP SINGLE PARTS — CHECK

Preparation

Clean all parts carefully.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 05-00-00 section Procedures.

- Clear oil bores with compressed air.

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.

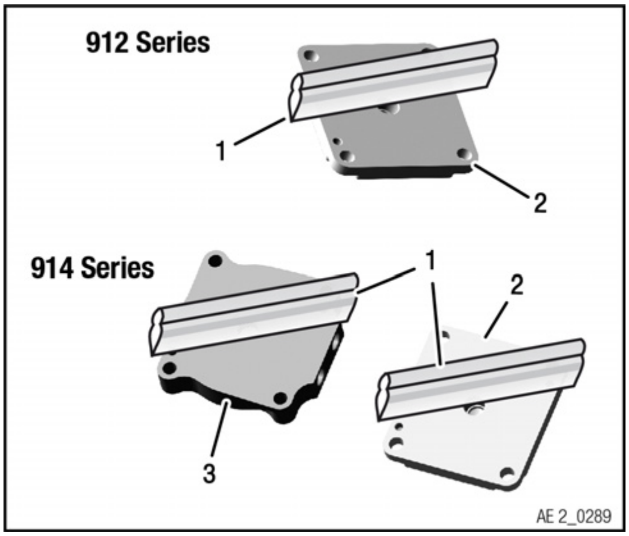


Figure 25.20

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 the surface of the cover plate on a true machinist surface plate using max. 320 grit wet/dry emery paper. Use engine oil as a lubricant on the paper and move the plate in a figure 8 pattern to avoid distorting the surface.

NOTICE

The sealing surfaces on oil pump components must not be repaired except the pump cover! 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!

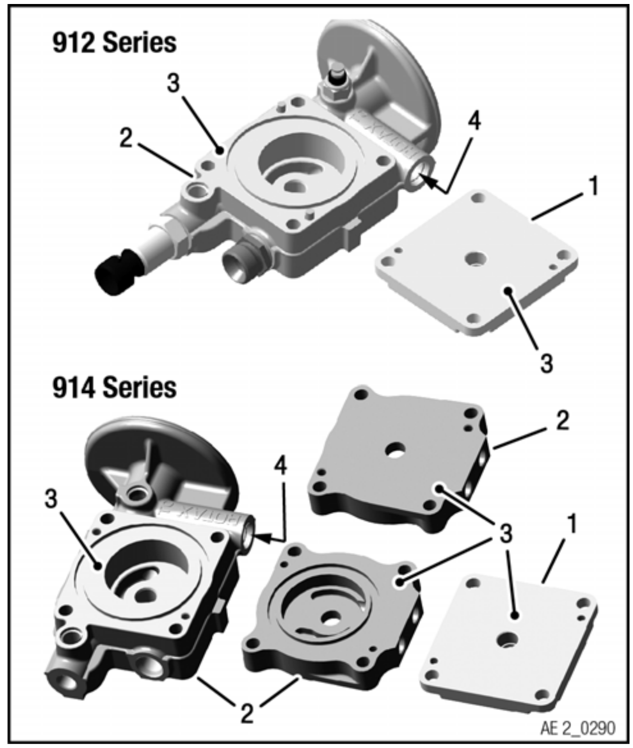


Figure 25.21

1 Oil pump cover *2 Oil pump housing*

3 Sealing surface *4 Ball seat*

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.

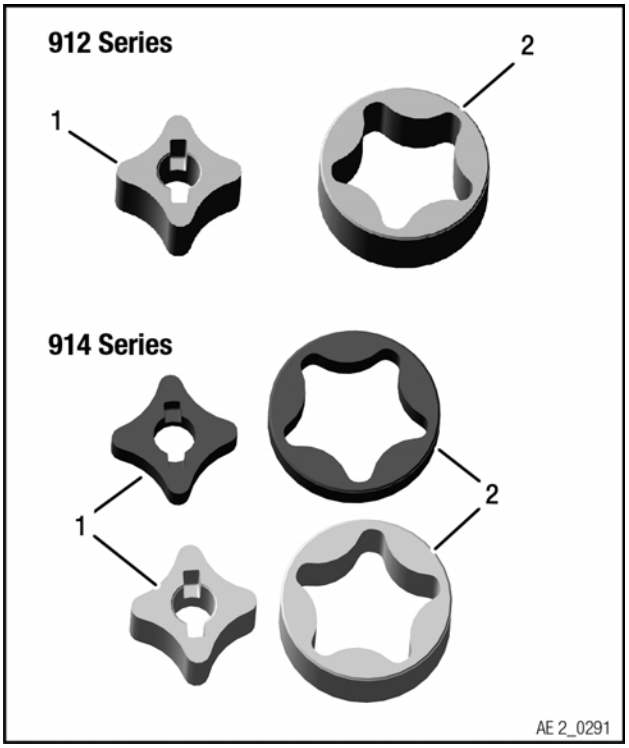


Figure 25.22

1 Rotor   *2 Rotary piston*

OIL PUMP SHAFT — INSPECTION

Step	Procedure
1	Check the oil pump shaft at the bearing points.
2	Check the needle pin.

NOTE

If there is still an older model oil pump shaft fitted on engines 912 A and 912 UL (identifiable by the roll pin on the pump shaft) the shaft must be replaced in accordance with SB-912–032 “Replacement of oil pump assy. or oil pump shaft assy.”, latest issue.

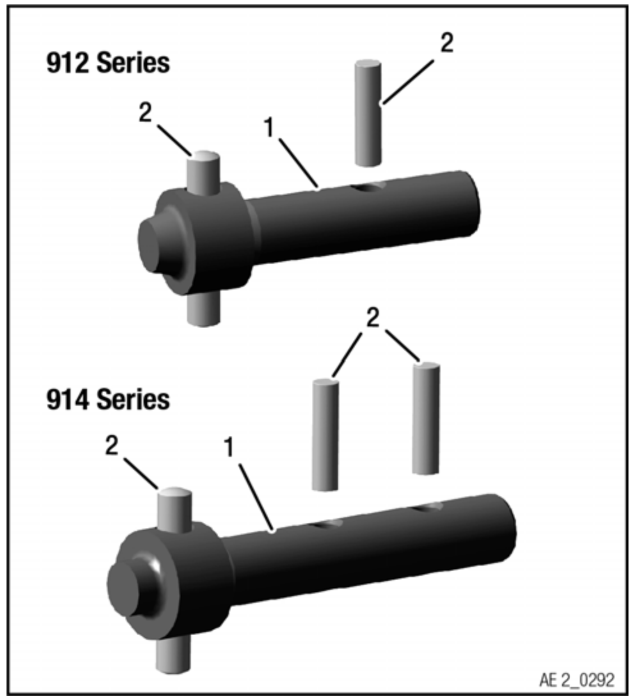


Figure 25.23

1 Oil pump shaft   *2 Needle pin*

OIL PUMP — ASSEMBLY (912 SERIES ONLY)

NOTICE

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

NOTE

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

Step	Procedure
1	Apply engine oil to the plug screw.
2	Screw the plug screw with shim, pressure spring and ball or valve piston finger-tight into the oil pump housing.

NOTE

The adjusting shim is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is too low.

NOTE

The valve piston is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is fluctuating.

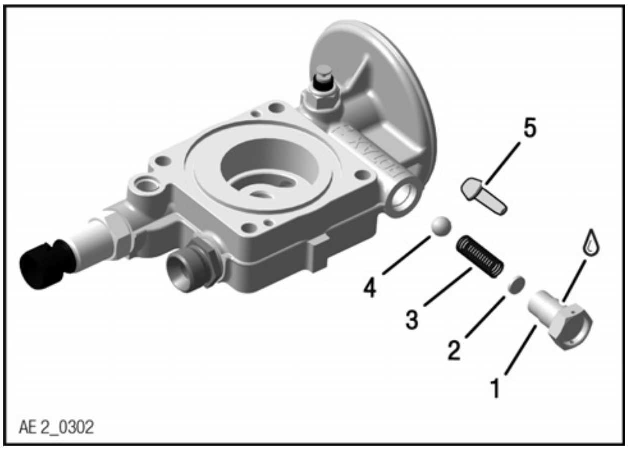


Figure 25.24

1 Plug screw *2 Shim*
3 Pressure spring *4 Ball*
5 Valve piston

Step	Procedure
3	Lubricate bearing bore for pump shaft in oil pump housing with engine oil and install pump shaft.

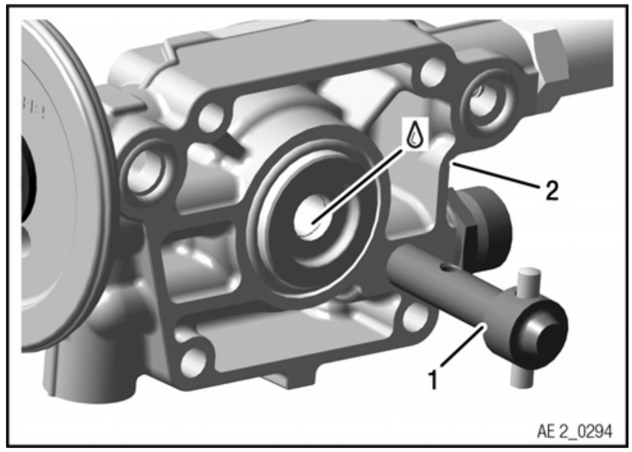


Figure 25.25

1 Oil pump shaft *2 Oil pump housing*

NOTE

Models from the year 1995 onwards have a suction inner and outer rotor of height 16 mm (0.63 in) instead of 13 mm (0.51 in).

Step	Procedure
4	Push needle pin 4x15.8 into the pump shaft.

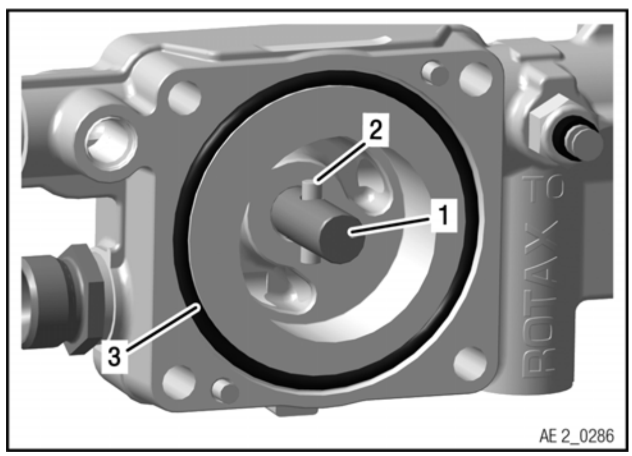


Figure 25.26

1 Oil pump shaft *2 Needle pin 4x15.8*
3 O-ring

NOTICE
The rotor and rotary piston have a mark (dot). The mark must be visible after inserting both rotors.

NOTE

Apply engine oil to the rotor and rotary piston.

Step	Procedure
5	Push on the rotor (inner rotor).
6	Insert the rotary piston (outer rotor).
7	Install new O-ring 57x3
8	Insert two needle pins 4x15.8.

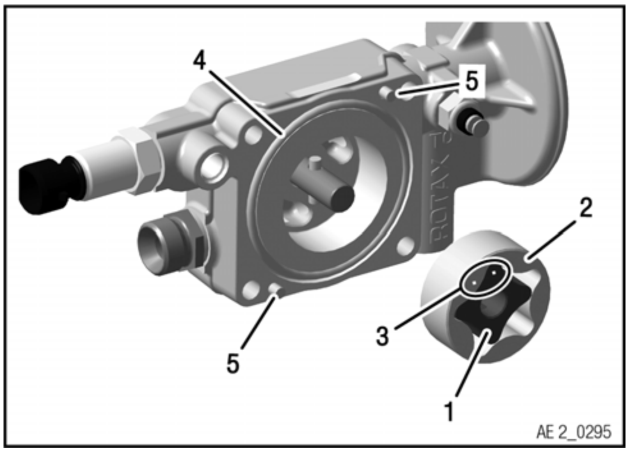


Figure 25.27

1	*Rotor (inner rotor)*	*2*	*Rotary piston (outer rotor)*
3	*Mark (dot)*	*4*	*O-ring 57x3*
5	*Needle pin 4x15.8*		

OIL PUMP — ASSEMBLY (914 SERIES ONLY)

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

NOTE

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

Step	Procedure
1	Apply engine oil to the plug screw.
2	Screw the plug screw with shim, pressure spring and ball or valve piston finger-tight into the oil pump housing.

NOTE

The adjusting shim is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is too low.

NOTE

The valve piston is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is fluctuating.

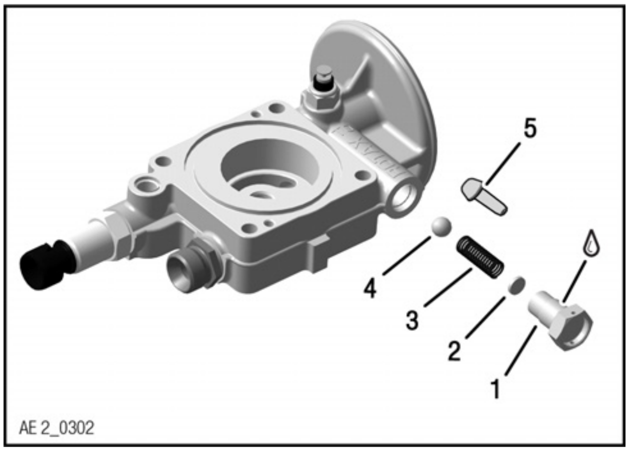


Figure 25.28

1	*Plug screw*	2	*Shim*
3	*Pressure spring*	4	*Ball*
5	*Valve piston*		

Step	Procedure
3	Lubricate bearing bore for pump shaft in oil pump housing with engine oil and install pump shaft.

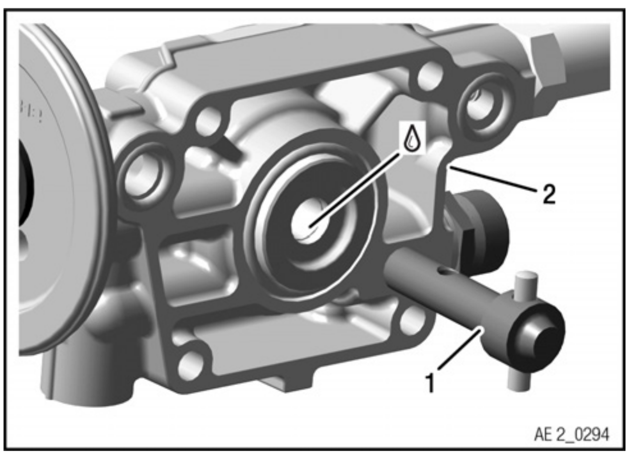


Figure 25.29: TYPICAL

1	*Oil pump shaft*	2	*Oil pump housing*

NOTE

Models from the year 1995 onwards have a suction inner and outer rotor of height 16 mm (0.63 in) instead of 13 mm (0.51 in).

Step	Procedure
4	Push needle pin 4x15.8 into the pump shaft.

NOTICE

The rotor and rotary piston have a mark (dot). The mark must be visible after inserting both rotors.

NOTE

Apply engine oil to the rotor and rotary piston.

Step	Procedure
5	Push on the rotor (inner rotor).
6	Insert the rotary piston (outer rotor).
7	Install new O-ring 57x3 and two needle pins 4x29.8.

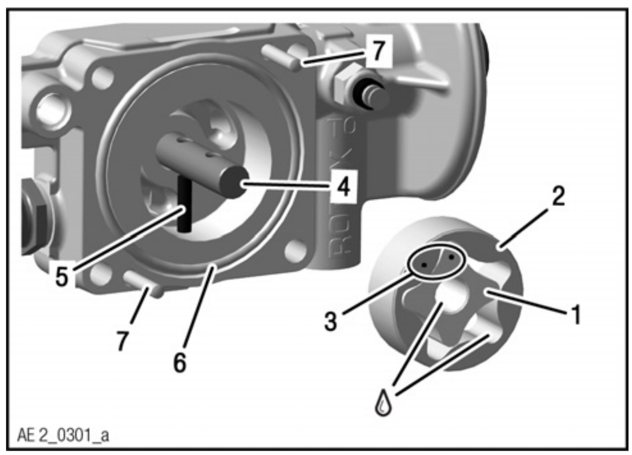


Figure 25.30

1	*Rotor (inner rotor)*	2	*Rotary piston (outer rotor)*
3	*Mark (dot)*	4	*Oil pump shaft*

5	*Needle pin 4x15.8*	6	*O-ring 57x3*
7	*Needle pin 4x29.8*		

Step	Procedure
8	Apply engine oil to the bearing point and contact surface of oil pump center housing and install it with a new O-Ring 46x3.

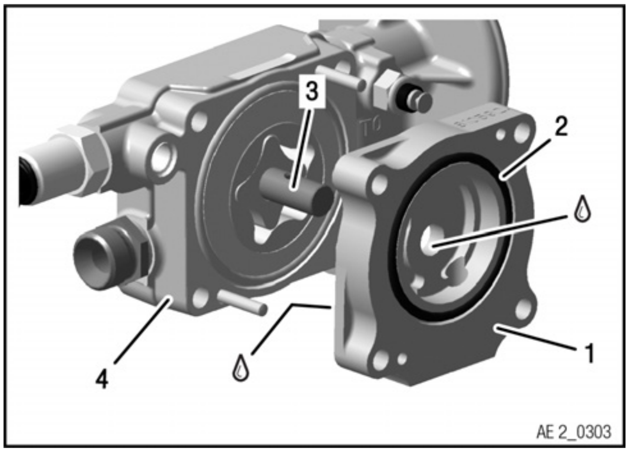


Figure 25.31

1	*Oil pump center housing*	2	*O-ring 46x3*
3	*Oil pump shaft*	4	*Oil pump housing*

NOTE

Apply engine oil to the rotor and rotary piston.

Step	Procedure
9	Push needle pin 4x15.8 into the pump shaft.
10	Push on the rotor (inner rotor).
11	Insert the rotary piston (outer rotor).

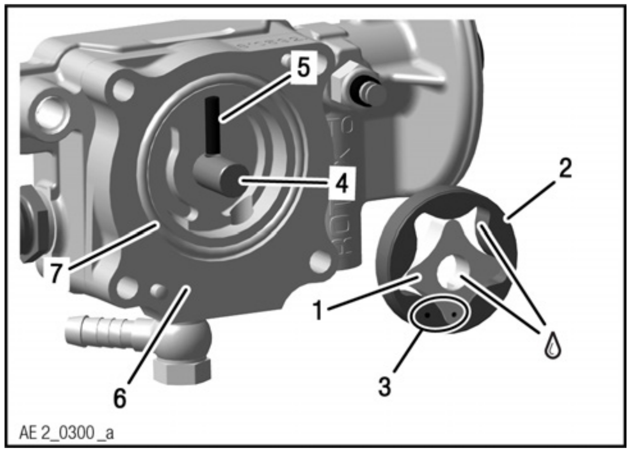


Figure 25.32

1	*Rotor (inner rotor)*	2	*Rotary piston (outer rotor)*
3	*Mark (dot)*	4	*Oil pump shaft*
5	*Needle pin 4x15.8*	6	*Oil pump center housing*
7	*O-ring 46x3*		

OIL PUMP HOUSING O-RINGS

NOTICE

All the O-rings must be replaced!

Step	Procedure
1	Insert new O-rings in the oil pump housing.

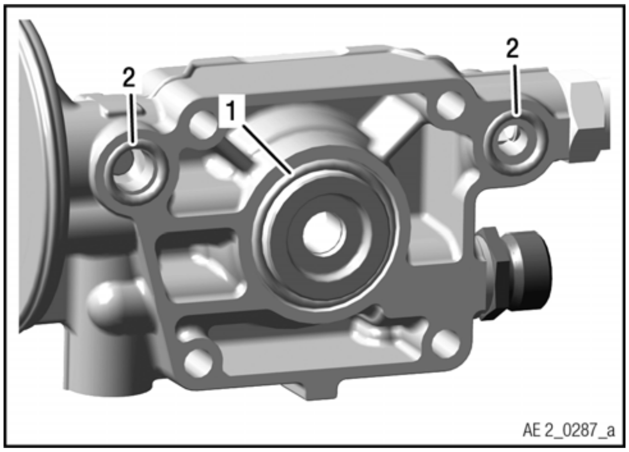


Figure 25.33

1	*O-ring 30x2.5*	*2*	*O-ring 11x2.7*

OIL PUMP COVER

Preparation

- Apply engine oil to the bearing point and flat.

NOTICE
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.

Step	Procedure
1	Place the oil pump cover on the oil pump center housing.

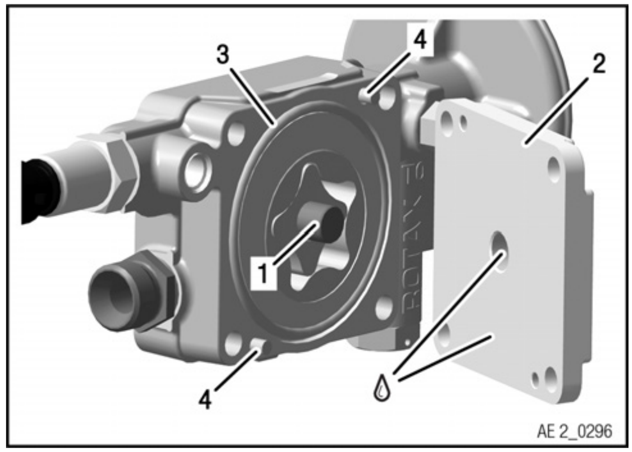


Figure 25.34: 912 Series

1	*Oil pump cover*	*2*	*Oil pump center housing*
3	*O-ring 46x3*	*4*	*Pin*

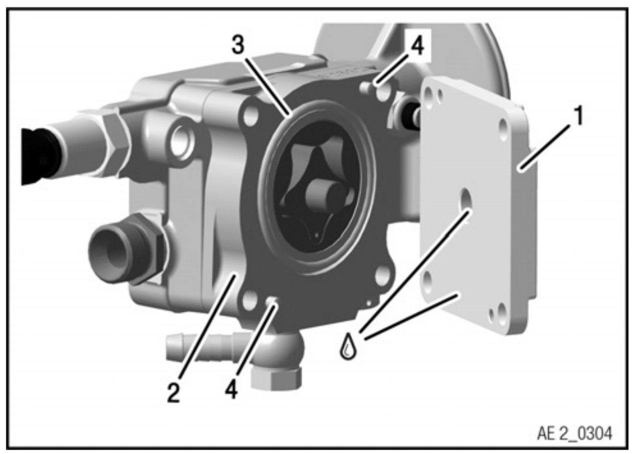


Figure 25.35: 914 Series

1	*Oil pump cover*	*2*	*Oil pump center housing*
3	*O-ring 46x3*	*4*	*Pin*

OIL PUMP — INSTALLATION (912 SERIES ONLY)

Preparation

- Check the fit of the O-rings on the oil pump housing.

NOTICE

Ensure that the oil pump shaft is in the correct installation position.

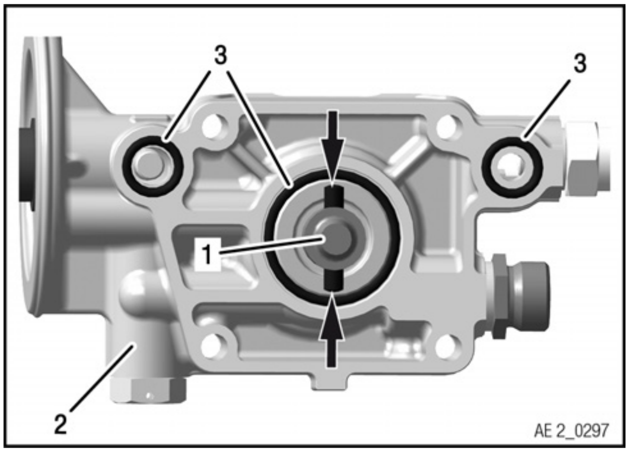


Figure 25.36

1 *Oil pump shaft* 2 *Oil pump housing*

3 *O-rings*

Step	Procedure
1	Apply LOCTITE 5910 to the support area on the crankcase.

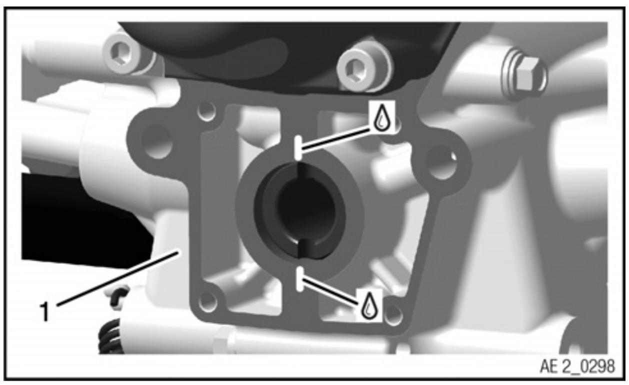


Figure 25.37

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.).

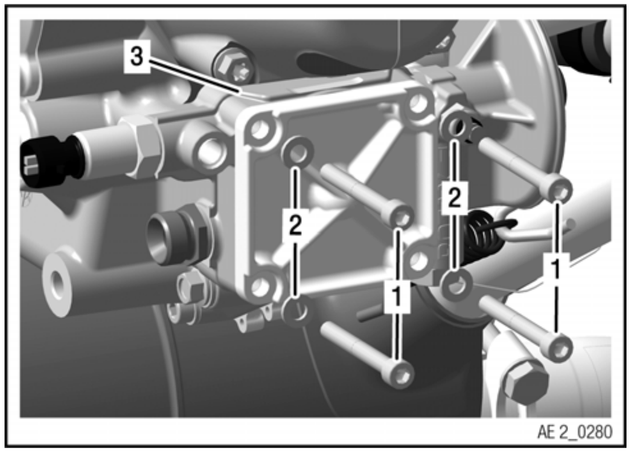


Figure 25.38

1 *Allen screws M6x50* 2 *Washers 6.4*

3 *Oil pump assy.*

Step	Procedure
3	Install the oil filter. See current Maintenance Manual Line (MML) for the respective engine type. **NOTE** *Oil the rubber gasket of the oil filter.*

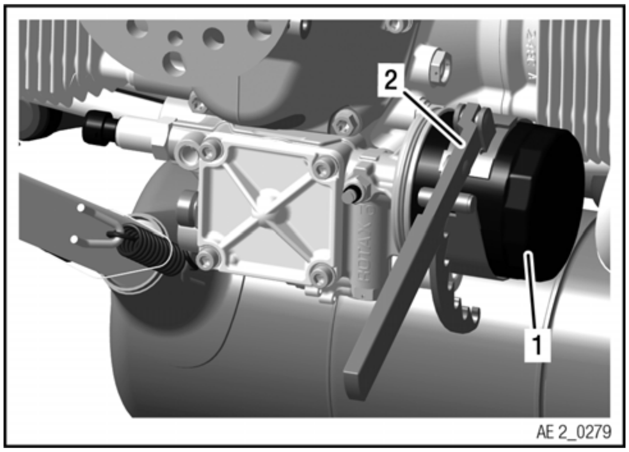


Figure 25.39

1	*Oil filter*	*2*	*Oil filter wrench 877620*

Step	Procedure
4	Tighten plug screw M12x1. Tightening torque with oiled thread 25 Nm (18 ft. lb.).
5	Attach the safety wire.
6	Install pressure oil line, see Chapter 61-20-00 section Governor - installation.

NOTE

If no governor is installed, a plug screw M10x1 with sealing ring 10x14 has to be installed. Tightening Torque 10 Nm (89 in. lb), use LOCTITE 243.

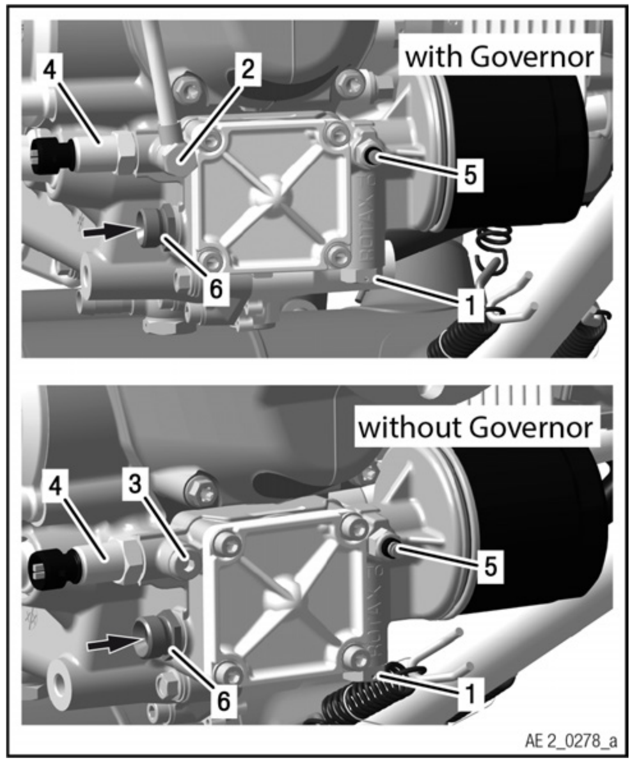


Figure 25.40

1	*Plug screw M12x1 (oil pressure regulator)*	*2*	*Banjo bolt M10x1x23 (pressure oil line)*
3	*Plug screw M10x1 and sealing ring 10x14*	*4*	*Oil pressure sensor (OPS)*
5	*Oil temperature sensor (OTS)*	*6*	*Oil inlet*

Step	Procedure
7	Install oil pressure sensor (OPS) and oil temperature sensor (OTS), if necessary. See Chapter 76-70-00 Sensors and actuators.
8	Install oil lines and surrounding assemblies.

OIL PUMP — INSTALLATION (914 SERIES ONLY)

Preparation

- Check the fit of the O-rings on the oil pump housing.

NOTICE

Ensure that the oil pump shaft is in the correct installation position.

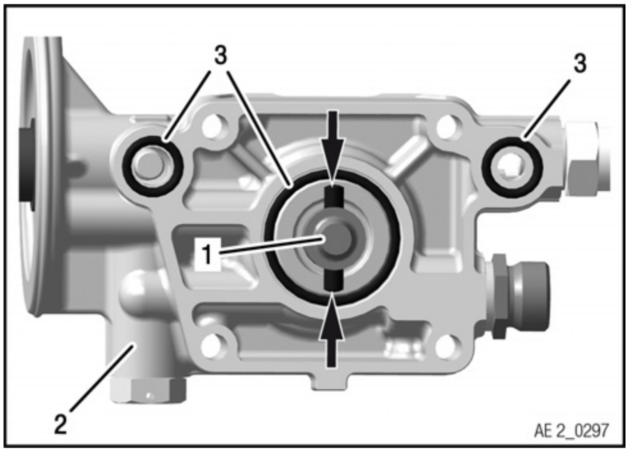


Figure 25.41

1 Oil pump shaft *2 Oil pump housing*

3 O-rings

Step	Procedure
1	Apply LOCTITE 5910 to the support area on the crankcase.

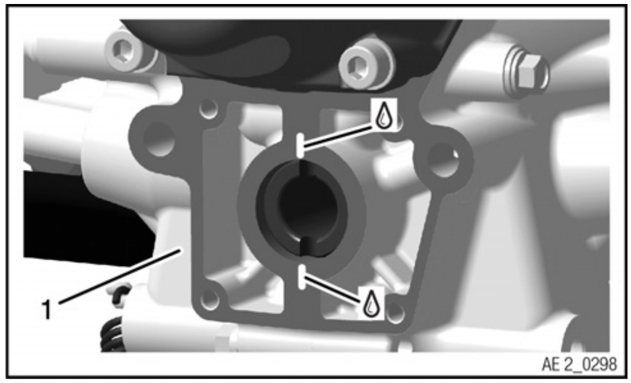


Figure 25.42

1 Crankcase

Step	Procedure
2	Install the oil pump housing with Allen screws M6x65 and washers 6.4 crosswise and by hand. Then tighten the Allen screws crosswise. Tightening torque 10 Nm (89 in. lb.).

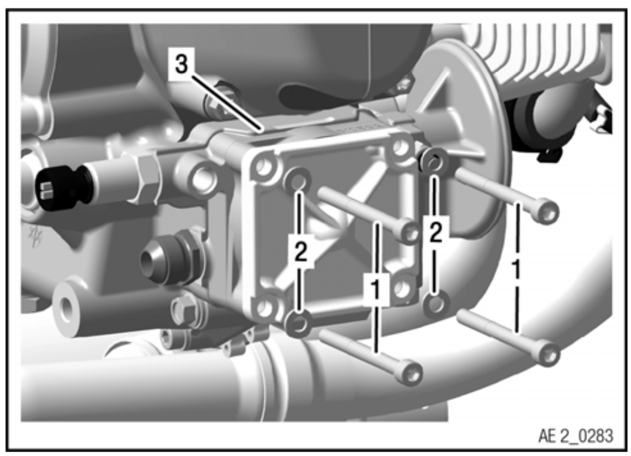


Figure 25.43

1 Allen screws M6x65 *2 Washers 6.4*

3 Oil pump assy.

Step	Procedure
3	Install the oil filter. See current Maintenance Manual Line (MML) for the respective engine type. **NOTE** *Oil the rubber gasket of the oil filter.*

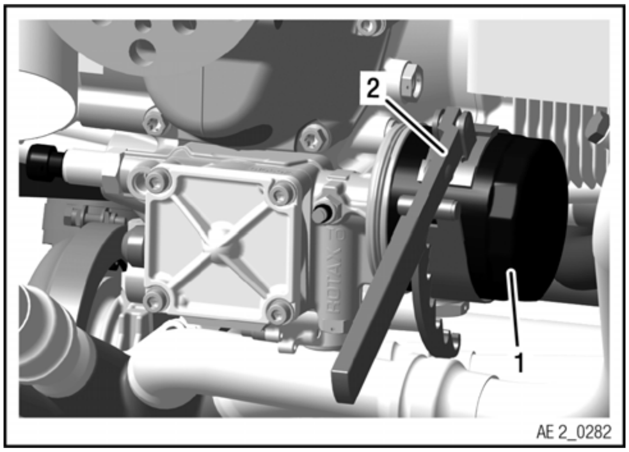


Figure 25.44

1	*Oil filter*	2	*Oil filter wrench 877620*

Step	Procedure
4	Tighten plug screw M12x1. Tightening torque with oiled thread 25 Nm (18 ft. lb.).
5	Attach the safety wire.
6	With governor: Install the pressure oil line(s) with oiled banjo bolt M10x1x34 and 3 sealing rings 10x14. Tightening torque 15 Nm (133 in. lb). See Chapter 61-20-00 section Governor - installation. Without governor: Install the pressure oil line and spacer 10.5/15/10 with oiled banjo bolt M10x1x34 and 3 sealing rings 10x14. Tightening torque 15 Nm (133 in. lb)

Step	Procedure
7	Install the turbo return line with oiled banjo bolt M10x1x23 and sealing rings 10x14. Tightening torque 15 Nm (133 in. lb)
8	Install the hose nipple 4/6 with oiled banjo bolt M10x1x23 and sealing rings 10x14. Tightening torque 15 Nm (133 in. lb)

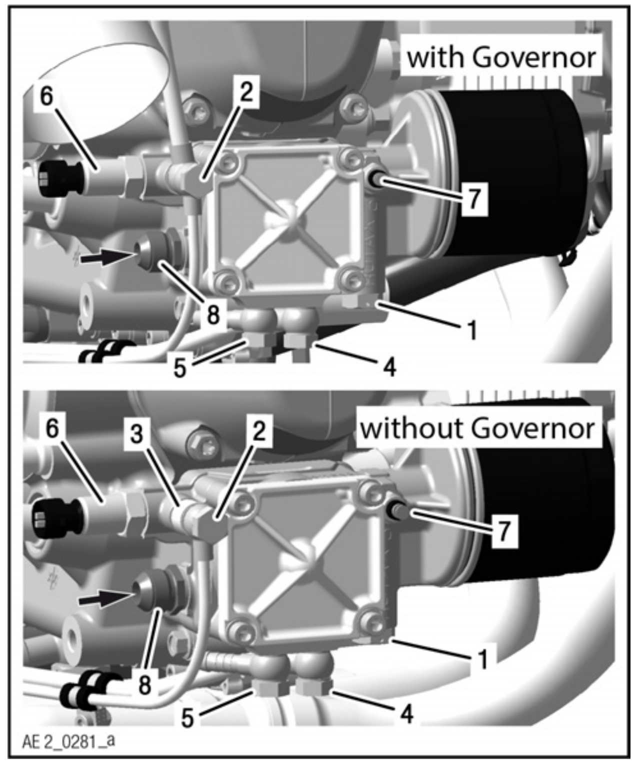


Figure 25.45

1	*Plug screw M12x1 (oil pressure regulator)*	2	*Banjo bolt M10x1x34 (pressure oil line)*
3	*Spacer 10.5/15/10*	4	*Banjo bolt M10x1x23 (turbo return line)*
5	*Banjo bolt M10x1x23 (to oil tank)*	6	*Oil pressure sensor (OPS)*
7	*Oil temperature sensor (OTS)*	8	*Oil inlet*

Step	Procedure
9	Install oil pressure sensor (OPS) and oil temperature sensor (OTS), if necessary. See Chapter 76-70-00 Sensors and actuators.
10	Install oil lines and surrounding assemblies.

FINISHING WORK

- Complete the engine

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

NOTE

After test run check, if the oil filter is securely fitted. Retighten, if necessary.

WEAR LIMITS

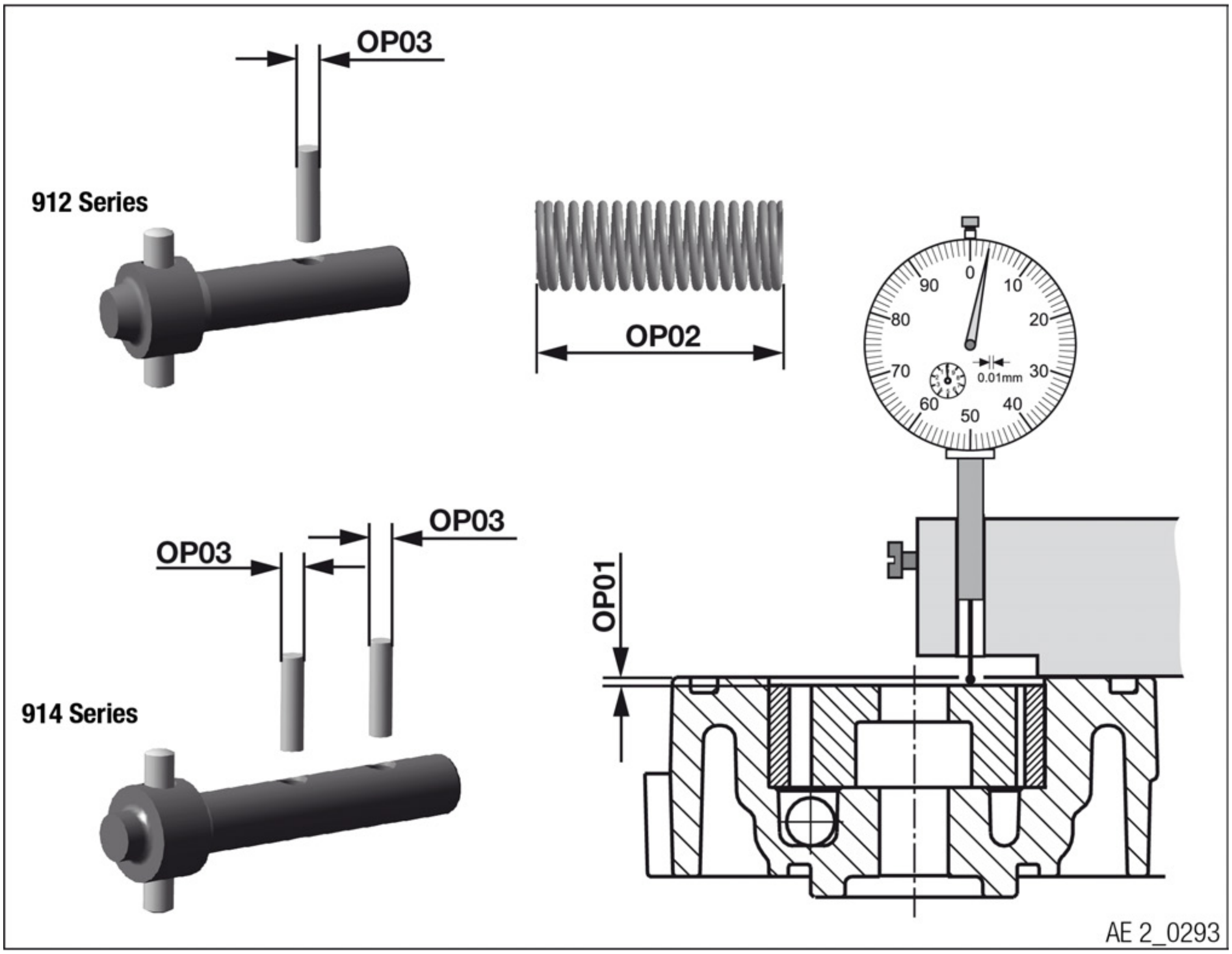


Figure 25.46: Oil pump

Description	Code	Reading new		Wear limit			Read-ings
		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)	actual	
						renewed	
Pressure spring length	OP02	65.6 mm (2.58 in)		62.6 mm (2.46 in)	64.1 mm (2.52 in)	actual	
						renewed	
Needle pin	OP03	4 mm (0.158 in)		3.20 mm (0.126 in)	3.60 mm (0.142 in)	actual	
						renewed	

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

- 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.

NOTICE

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!

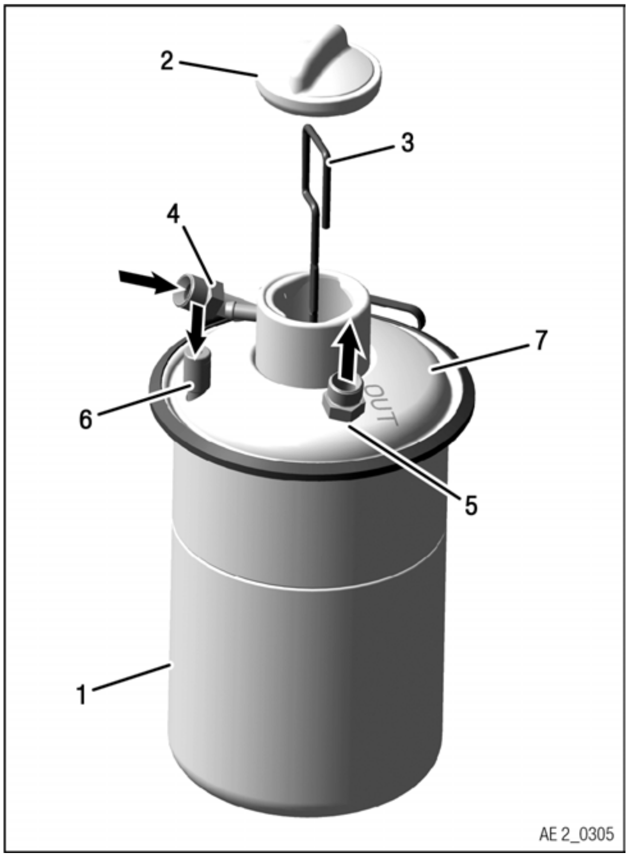


Figure 25.47

1	*Oil tank*	2	*Oil tank cover*
3	*Oil dipstick*	4	*Oil return lines*
5	*Oil pump supply*	6	*Turbo scavenge (914 Series only)*
7	*Cover*		

OIL TANK — DISASSEMBLY

Step	Procedure
1	Open profile clamp.
2	Remove the oil tank cover assy. and O-ring.

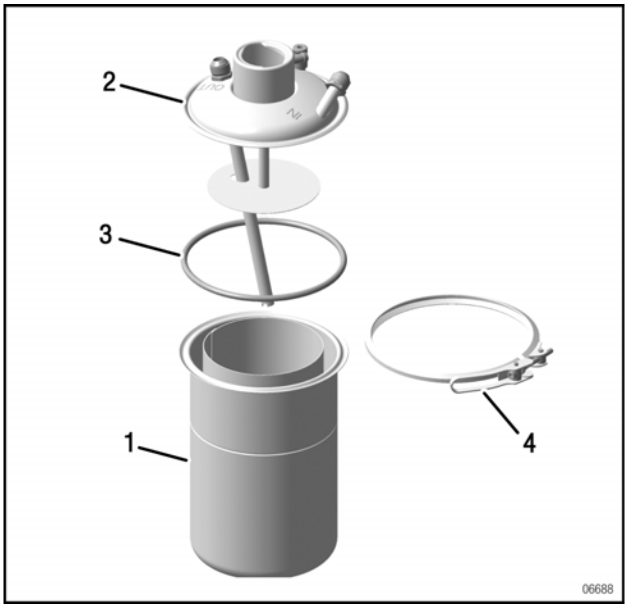


Figure 25.48: Typical

1 Oil tank *2 Oil tank cover assy.*
3 O-Ring *4 Profile clamp*

Step	Procedure
3	Remove the baffle insert (screen) and partition from the oil tank.
4	Remove the hex. screw with gasket ring from the oil tank.

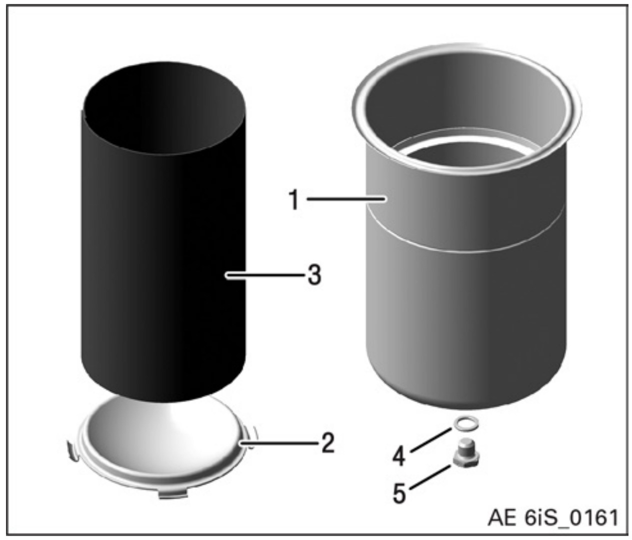


Figure 25.49

1 Oil tank *2 Partition*
3 Baffle insert (screen) *4 Gasket ring*
5 Hex. screw

OIL TANK SINGLE PARTS — CHECK

Clean all parts carefully.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 05-00-00 section Procedures.

General visual inspection.
See current Maintenance Manual Line (MML) for the respective engine type.

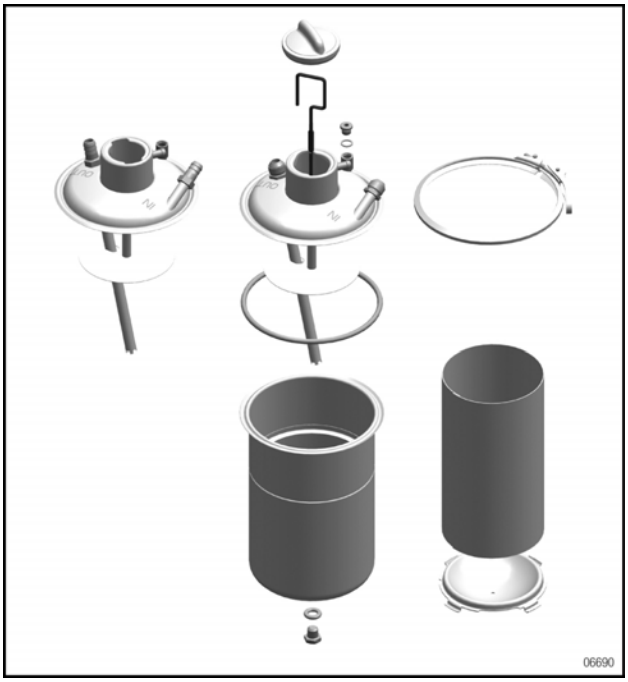


Figure 25.50: Typical

OIL TANK — ASSEMBLY

Step	Procedure
1	Place the baffle insert (screen) and partition in the oil tank.
2	Place the O-ring 145x6 and the oil tank cover assy.

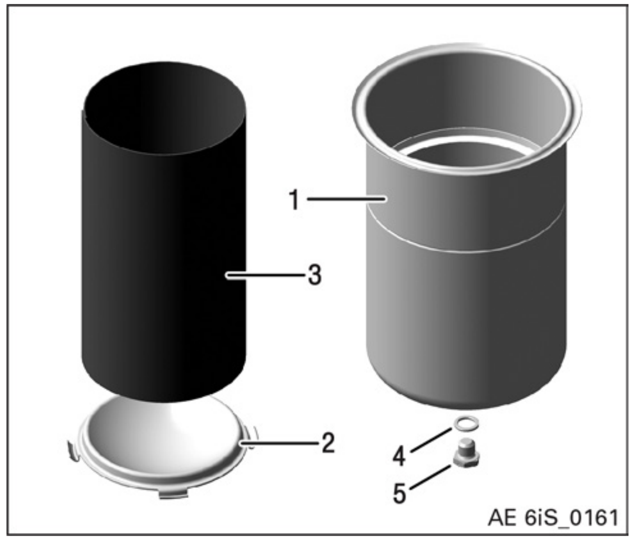


Figure 25.51

1	*Oil tank*	2	*Partition*
3	*Baffle insert (screen)*	4	*Gasket ring*
5	*Hex. screw*		

Step	Procedure
3	Close profile clamp 163.

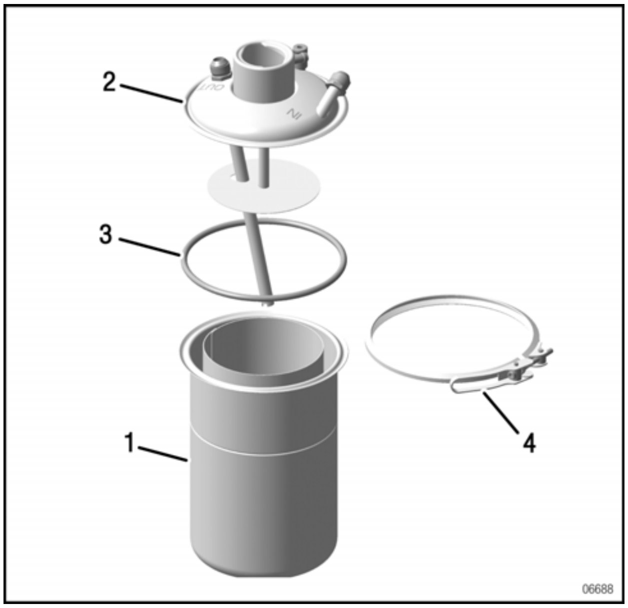


Figure 25.52: Typical

1	*Oil tank*	2	*Oil tank cover assy.*
3	*O-Ring 145x6*	4	*Profile clamp 163*

Step	Procedure
4	Install hex. screw M12x12 with a new gasket ring C 12x18. Tightening torque 25 Nm (18 ft. lb.).
5	Attach the safety wire.

OIL TANK — INSTALLATION

Preparation

Install the oil tank according to the aircraft manufacturer's specifications.

FINISHING WORK

- Complete the engine

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

NOTE

After test run check, if the oil filter is securely fitted. Retighten, if necessary.

OIL HOSES

NOTICE

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

OIL HOSES — REMOVAL

NOTICE

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.

OIL LINE (STEEL LINE) — REMOVAL

NOTICE

The steel oil lines (scope of delivery) must be removed only, if they are damaged or for maintenance and/or cleaning.

Governor pressure oil line 912 Series

- For removal of governor pressure oil line (if installed), see Chapter 61-20-00 section Governor

Governor pressure oil line 914 Series

Step	Procedure
1	Remove the cable clamp for supporting the line on the side of the gearbox.
2	Loosen the banjo bolt and gasket ring of the governor flange. See Chapter 61-20-00 section Governor.

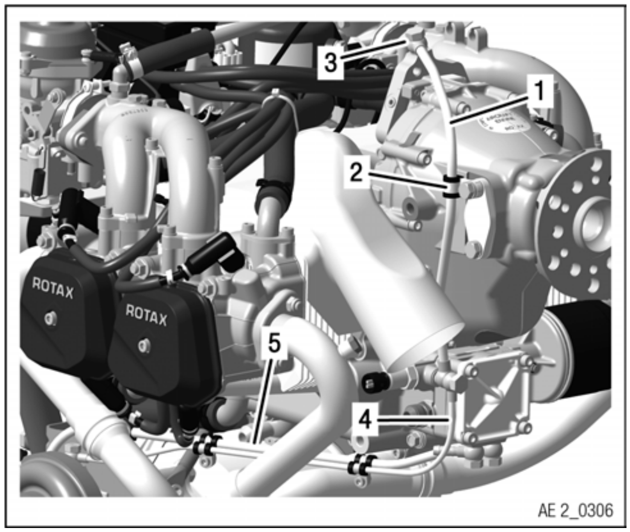


Figure 25.53

1	*Governor pressure oil line*	2	*Cable clamp*
3	*Banjo bolt (governor flange)*	4	*Turbo pressure oil line*
5	*Turbo oil suction line*		

Step	Procedure
3	Loosen the banjo bolt on the oil pump housing and remove it along with the gasket rings and sleeve (without governor). See Chapter 61-20-00 section Governor.
4	Loosen banjo bolt from the turbo oil suction line.

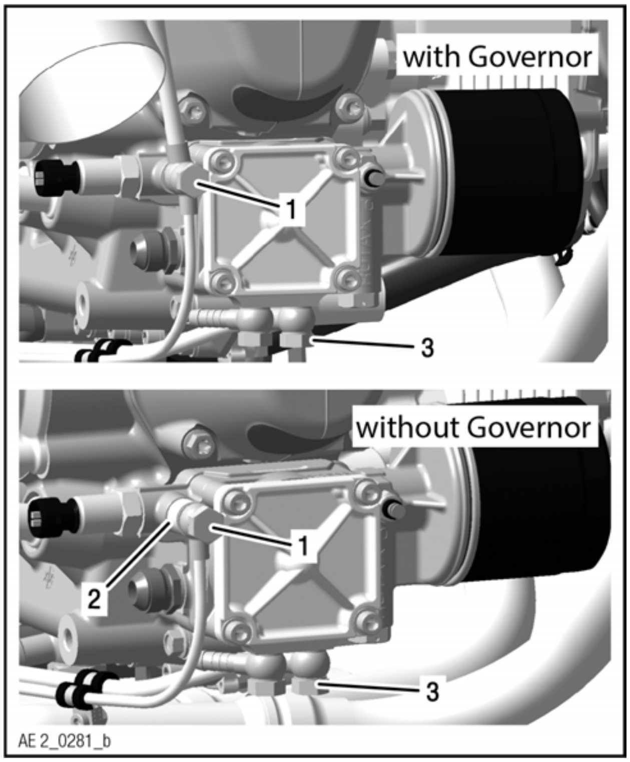


Figure 25.54

1	*Banjo bolt (pressure oil lines)*	*2*	*Sleeve*
3	*Banjo bolt (turbo oil suction line)*		

Step	Procedure
5	Remove the cable clamps from the turbo oil lines.

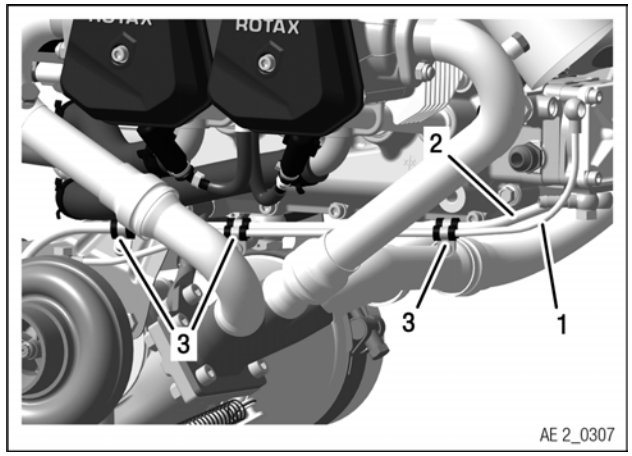


Figure 25.55

1	*Turbo pressure oil line*	*2*	*Turbo oil suction line*
3	*Cable clamps*		

NOTE

Make sure that the ball and the spring of the pressure check valve are not damaged or lost.

Step	Procedure
6	Loosen the 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.

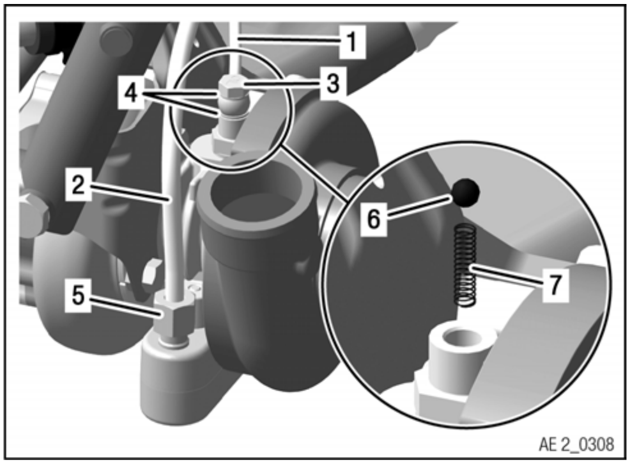


Figure 25.56

1	*Turbo pressure line*	*2*	*Turbo oil suction line*
3	*Banjo bolt*	*4*	*Sealing ring*
5	*Cap nut*	*6*	*Ball*
7	*Compression spring*		

OIL HOSE— INSPECTION

Clean all parts carefully.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 05-00-00 section Procedures.

General visual inspection.
See current Maintenance Manual Line (MML) for the respective engine type.

OIL LINE (STEEL LINE) INSTALLATION

Pressure oil line 912 Series

- For installation of governor pressure oil line, see Chapter 61-20-00 section Governor

Pressure oil lines 914 Series

Step	Procedure
1	Install the governor pressure oil line with the banjo bolt M10x1x23 and sealing rings 10x14 on the governor flange. Tightening torque 15 Nm (133 in. lb). See Chapter 61-20-00 section Governor.
2	With governor: Install the governor pressure oil line and turbo pressure oil line with the banjo bolt M10x1x34 on the oil pump housing with the sealing rings 10x14. Tightening torque 15 Nm (133 in. lb). See Chapter 61-20-00 section Governor. Without governor: Install sleeve 10.5/15/10 and turbo pressure oil line with banjo bolt M10x1x34 on the oil pump housing with sealing rings. Tightening torque 15 Nm (133 in. lb).
3	Install cable clamp for governor pressure oil line. See also Chapter 61-20-00 section Governor.

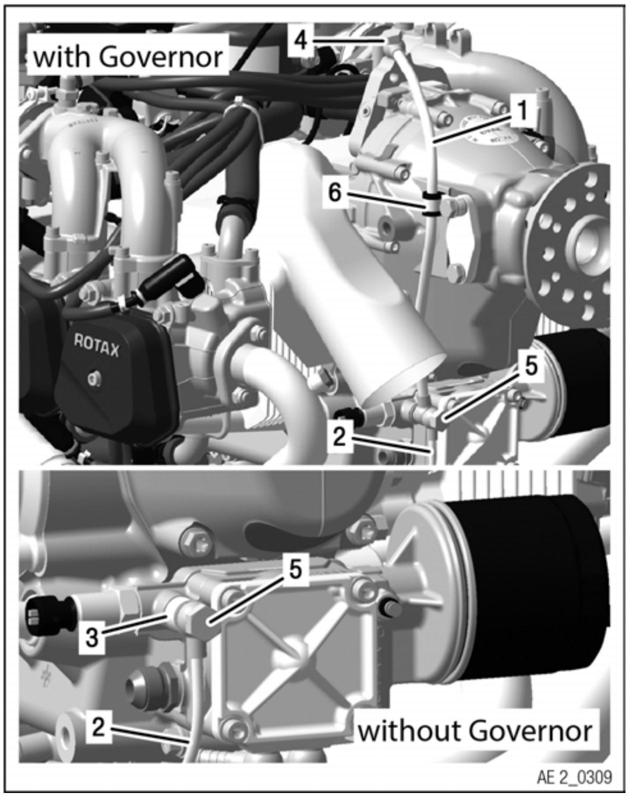


Figure 25.57

1	*Governor pressure oil line*	*2*	*Turbo pressure oil line*
3	*Sleeve 10.5/15/10*	*4*	*Banjo bolt M10x1x23*
5	*Banjo bolt M10x1x34*	*6*	*Cable clamp*

Step	Procedure
4	Install the turbo pressure oil line with sealing rings A 8x13 on the turbo housing. Tightening torque 10 Nm (89 in. lb). See Chapter 78–20–00 Turbocharger. **NOTE** *Do not forget to install the ball on top of the compression spring.*

NOTICE

Do not install ball and spring for check valve in wrong order. In this case the oil supply will be blocked completely.

Step	Procedure
5	Install the turbo suction oil line on the turbo. Tightening torque 20 Nm (15 ft. lb) See Chapter 78–20–00 Turbocharger.

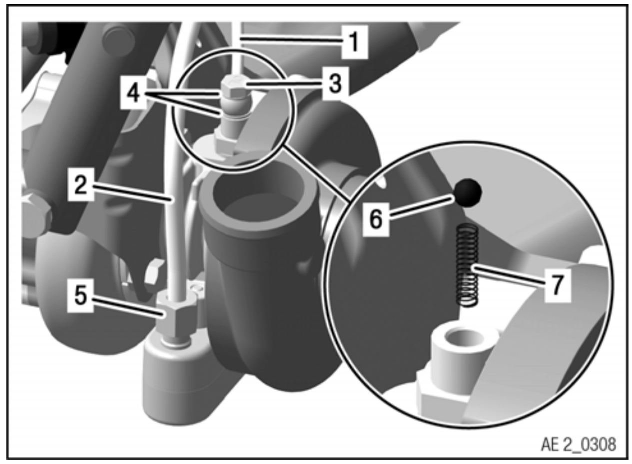


Figure 25.58

1	*Turbo pressure line*	*2*	*Turbo oil suction line*
3	*Banjo bolt M8x1x17*	*4*	*Sealing ring 8x13*
5	*Cap nut*	*6*	*Ball 5.556 mm*
7	*Compression spring 22*		

Step	Procedure
6	Install turbo suction oil line on the oil pump housing with banjo bolt M10x1x23 and sealing rings 10x14 Tightening torque 15 Nm (133 in. lb).
7	Install the cable clamp for supporting the turbo oil suction line on the turbocharger bracket. Tightening torque 6 Nm (53 in. lb).
8	Install the cable clamps on the turbo pressure and oil suction line. Tightening torque 6 Nm (53 in. lb).

NOTE

Always use new lock nuts.

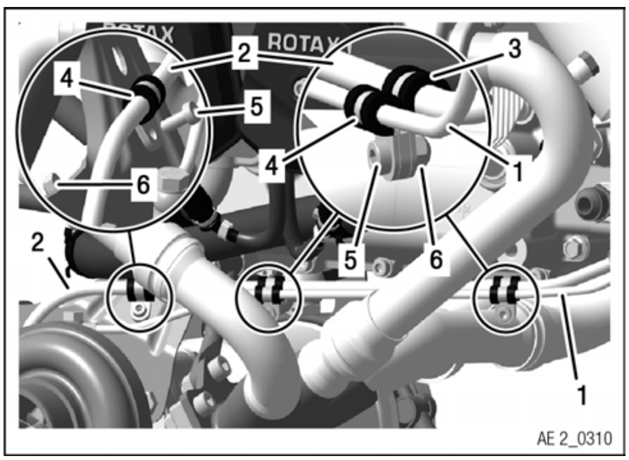


Figure 25.59

1	*Turbo pressure oil line*	2	*Turbo oil suction line*
3	*Cable clamp 8/M5*	4	*Cable clamp 5/M5*
5	*Allen screw M5x12*	6	*Lock. nut M5*

OIL HOSES — INSTALLATION

NOTICE

Ensure that the hoses are installed without tension and are not kinked. Observe minimum distances, e.g. 2 mm (0.0787 in.) from the housing.

NOTE

On the 914 Series, it is important to ensure that a shim/distance ring is fitted between the cable clamp and the gearbox housing.

Step	Procedure
1	Install the oil hoses and clamps according to the instructions in the aircraft manufacturer's manual.
2	Use genuine hoses with the corresponding aircraft manufacturers certification for replacement.
3	Only use suitable clamps, or crimp connections to fasten the hoses.

FINISHING WORK

- Complete the engine

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids.

Purge the oil system.
See current Installation Manual (IM) for the respective engine type, Chapter 79-00-00 section Purging the lubrication system. It must be carried out in accordance with SI-912-018 and SI-914-020, “Purging the lubrication system”, latest issue.

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance

NOTE

After test run check, if the oil filter is securely fitted. Retighten, if necessary.

OIL RADIATOR

NOTE

The oil cooler is not included in the delivery of the engine. Maintenance must be carried out in accordance with the aircraft manufacturer's instructions.

Chapter: 80–00–00
ELECTRIC STARTER

TOPICS IN THIS CHAPTER

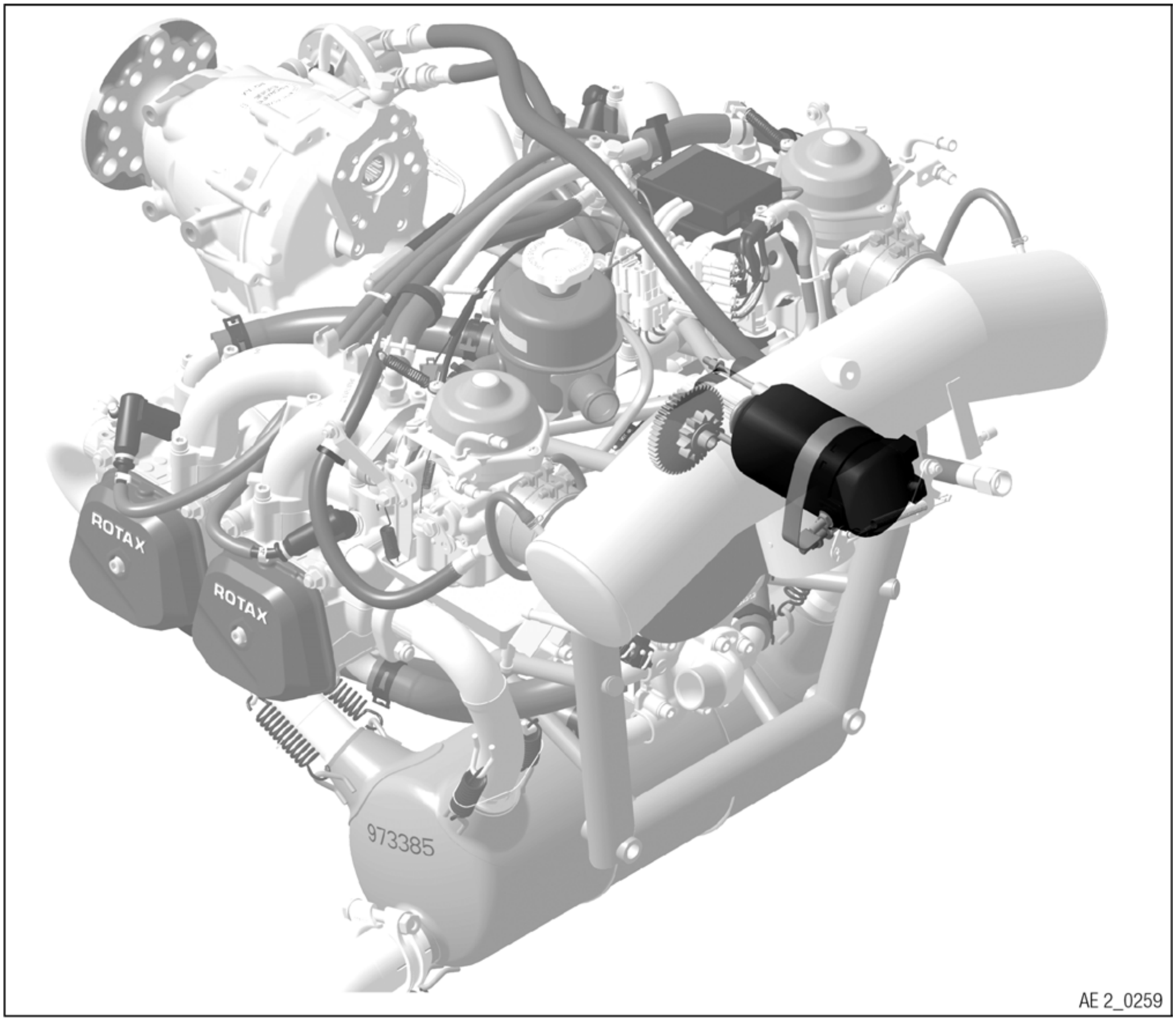


Figure 26.1: Typical

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE	297434

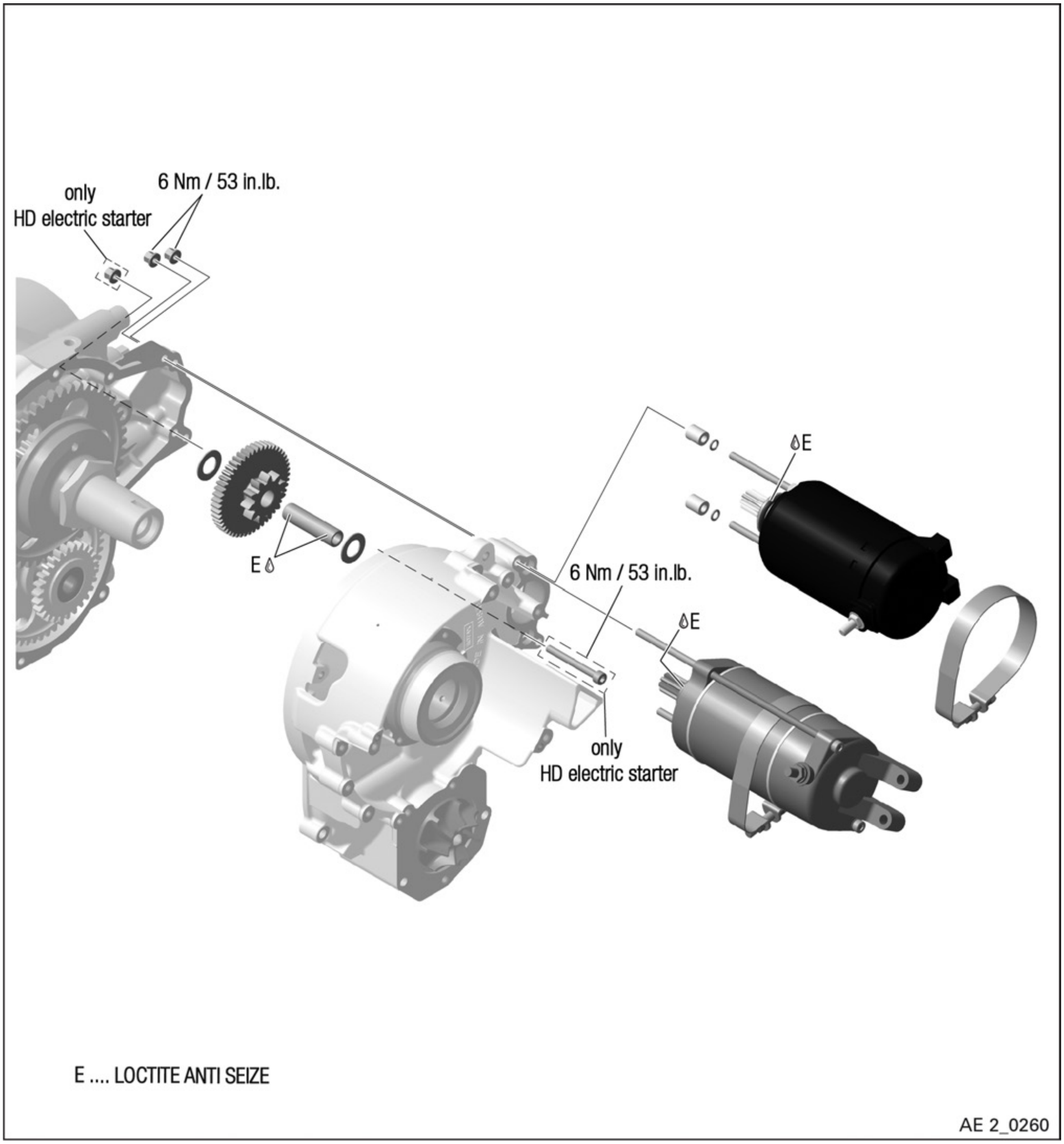


Figure 26.2: Electric starter

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.

NOTE

To improve startup, there is an optional HD (heavy duty) starter with increased power available.

See SB-912–037 and SB-914–023 “Installation of an electric starter with enhanced power”, latest issue.

SAFETY INSTRUCTION

⚠ WARNING

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

NOTICE

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!

MAINTENANCE

As well as the maintenance and special checks, see current Maintenance Manual Line (MML) for the respective engine type.

REMOVAL

Preparation

- Turn the ignition switch OFF.
- Disconnect the battery (negative pole).

STANDARD STARTER — REMOVAL

NOTE

In the course of continuous development and standardization the components hex. nuts M5 with lock washers and washers were replaced by the cap nut.

Step	Procedure
1	Disconnect the positive pole on the electric starter.

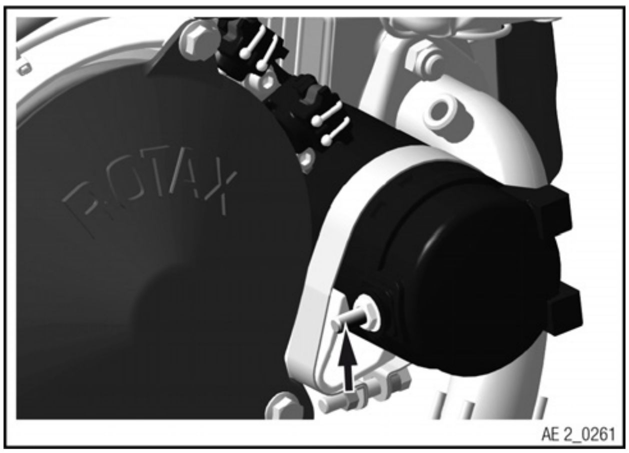


Figure 26.3

Step	Procedure
2	Remove the two hex. nuts M5 with lock washers and washers or the cap nuts from the rear side of the ignition cover.
3	Release the tension clamp to remove the electric starter.

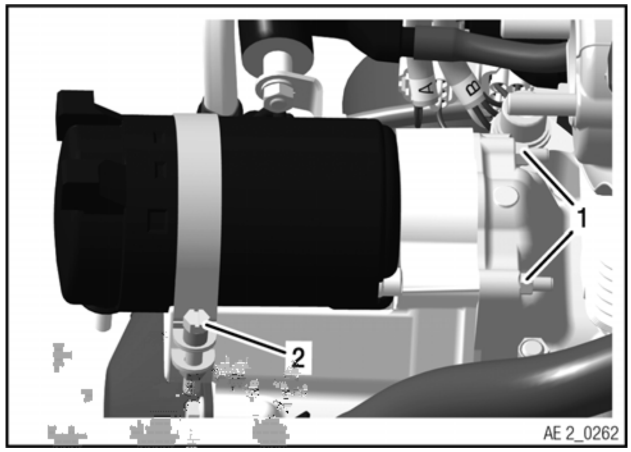


Figure 26.4

1 Cap nuts *2 Tension clamp*

NOTICE

Do not tap the electric starter with a hammer, the adhering magnets can come off.

Step	Procedure
4	The electric starter is hold in position by two distance sleeves and O-rings.

NOTE

When withdrawing the electric starter from the ignition housing, hold the bearing flange with starter housing and rotor bearing together. Otherwise the carbon brushes will jump off the commutator.

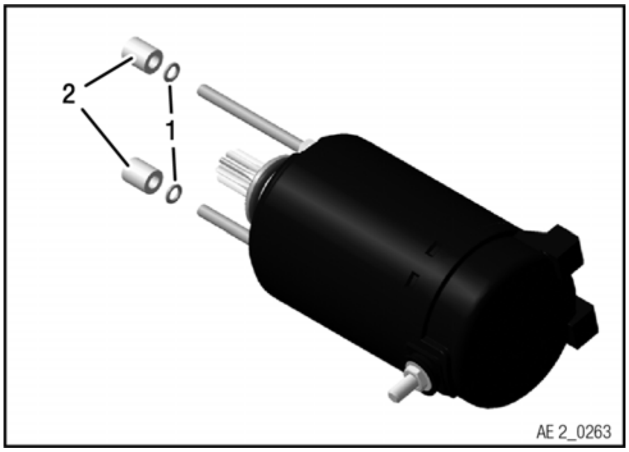


Figure 26.5

1 O-rings 5x1.5

2 Distance sleeves

HD STARTER — REMOVAL

NOTE

In the course of continuous development and standardization the components hex. nuts M5 with lock washers and washers were replaced by the cap nut.

Step	Procedure
1	Disconnect the positive pole on the electric starter.

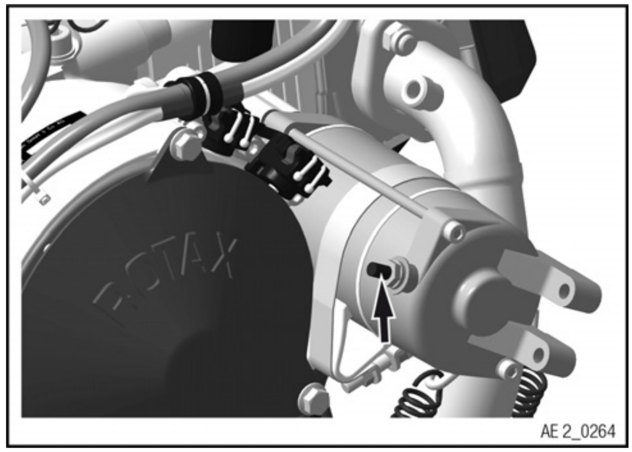


Figure 26.6

NOTICE

Do not unscrew or remove the long M5 screws!

Step	Procedure
2	Remove the two hex. nuts M5 with lock washers and washers or the cap nut from the rear side of the ignition cover.
3	Release the tension clamp to remove the electric starter.

NOTICE

Do not tap the electric starter with a hammer, the adhering magnets can come off.

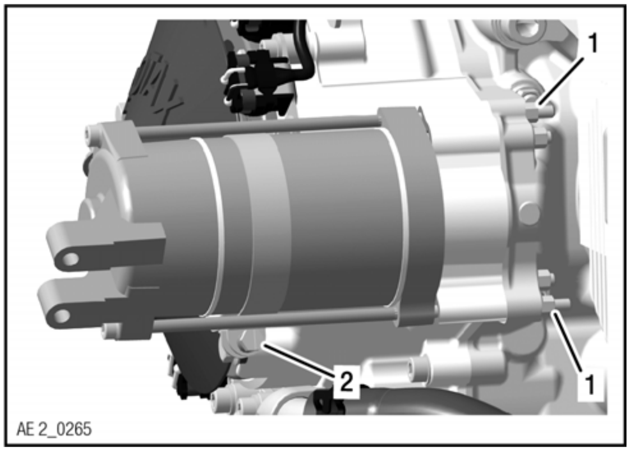


Figure 26.7

1 *Cap nuts* 2 *Tension clamp*

DISASSEMBLY

NOTICE

If the starter housing and rotor support plate are not aligned correctly the starter will not turn in the correct direction.
Mark the starter housing and rotor support plate in correct position before disassembly.

STANDARD STARTER — DISASSEMBLY

Step	Procedure
1	Unscrew combined nut and remove connector sheath with O-ring.
2	Pull bearing flange off the starter housing.
3	Carefully pull rotor support assy. a short way off the starter housing.
4	Press the positive carbon brush with the connector sheath out of the rotor support assy.
5	Remove brush holder with the carbon brushes from the rotor.
6	Pull rotor out of the starter housing together with compensating shim.

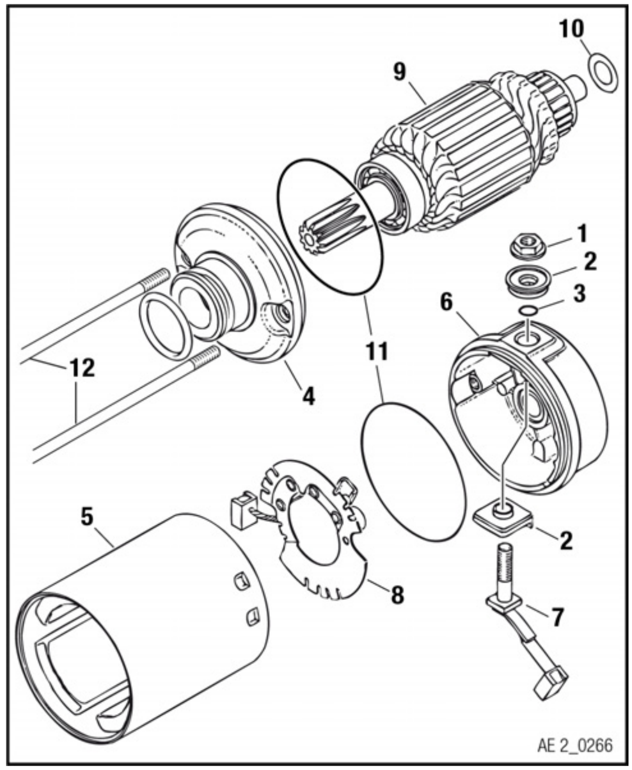


Figure 26.8

1	*Combined nut*	2	*Connector sheath*
3	*O-ring 6x1.7*	4	*Bearing flange*
5	*Starter housing*	6	*Rotor support assy.*
7	*Carbon brush*	8	*Brush holder*
9	*Rotor*	10	*Compensating shim*
11	*O-ring 62x1.5*	12	*Stud M5x150/16*

HD STARTER — DISASSEMBLY

Step	Procedure
1	Unscrew combined nut and remove connector sheath with O-ring.
2	Unscrew 2 long Allen screw M5x180.
3	Pull bearing flange off the starter housing.
4	Carefully pull rotor support assy. a short way off the starter housing.
5	Press the positive carbon brush with the connector sheath out of the rotor support assy.
6	Remove brush holder with the carbon brushes from the rotor.
7	Pull rotor out of the starter housing together with compensating shim.

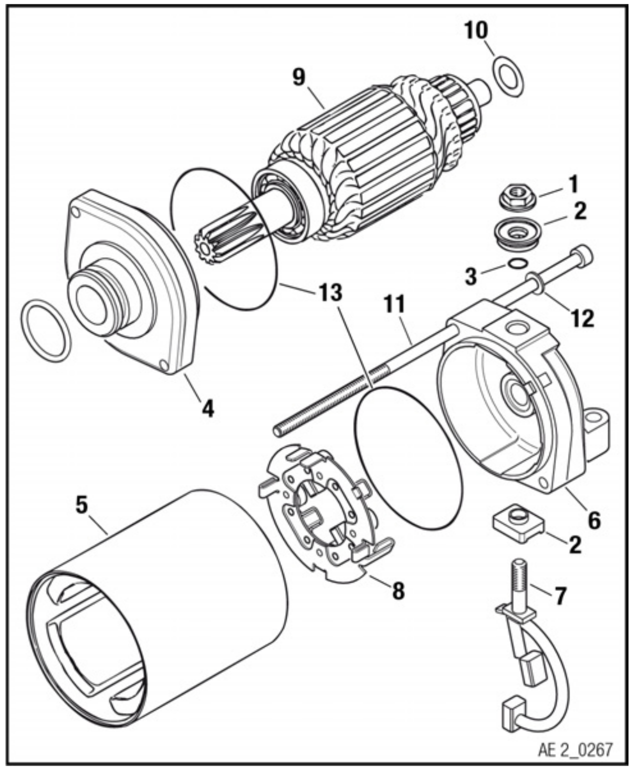


Figure 26.9

1	*Combined nut*	2	*Connector sheath*
3	*O-ring 6x1.7*	4	*Bearing flange*
5	*Starter housing*	6	*Rotor support assy.*
7	*Carbon brush*	8	*Brush holder*
9	*Rotor*	10	*Compensating shim*
11	*Allen screw M5x180*	12	*Washer 5.3*
13	*O-ring 62x1.5*		

INSPECTION

NOTE

The following work steps apply to both starter models (HD and standard starter).

Preparation

- Clean all parts thoroughly.

ROTOR – INSPECTION

Step	Procedure
1	Check commutator for run out.
2	Carry out a visual inspection of the commutator. The insulation should be 0.5 mm (0.02 in.) lower than the ribs.
3	If necessary, fine machine and undercut commutator ribs.

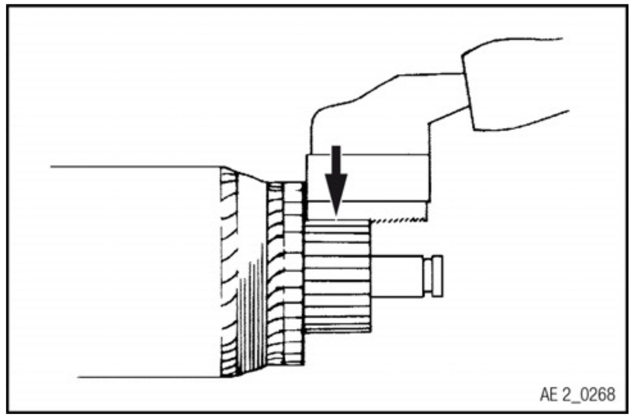


Figure 26.10

⚠ WARNING

During this machining process, material particles are released and could be inhaled.

Step	Procedure
4	Check rotor at 12 or 24 Volts with test lamp between commutator and iron core for connection to ground. **NOTE** *Replace rotor if the lamp lights up.*

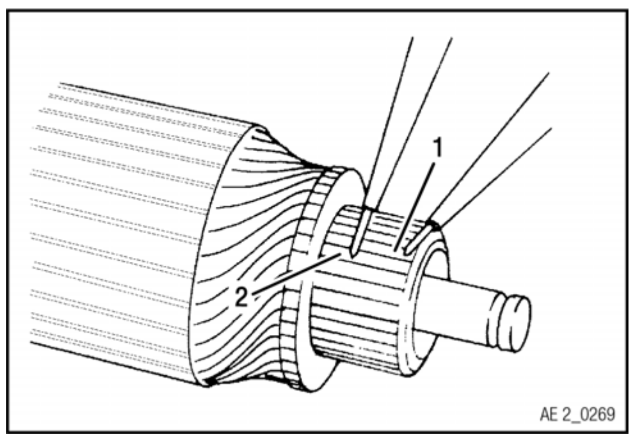


Figure 26.11

1 Commutator *2 Iron core*

Step	Procedure
5	Check rotor coils for interruption at 2 or 4 Volts and an interposed ammeter (measuring range 60 A). **NOTE** *If there are great differences between the individual ribs, the rotor must be replaced.* **NOTE** *If the rotor shows clear signs of overheating, replace it.*
6	Check ball bearing.

NOTE

When replacing the rotor, fit the ball bearing with the closed side facing towards the middle of the rotor (open side facing outward) to prevent abraded particles penetrating the ball bearing. Always use a new ball bearing 6002 Z (15/32/9).

Step	Procedure
7	Inspect gear-tooth system and radial clearance of the rotor in the rotor bearing.

BEARINGS — INSPECTION

Step	Procedure
1	Check rotor support assy. and if necessary, replace the complete starter.

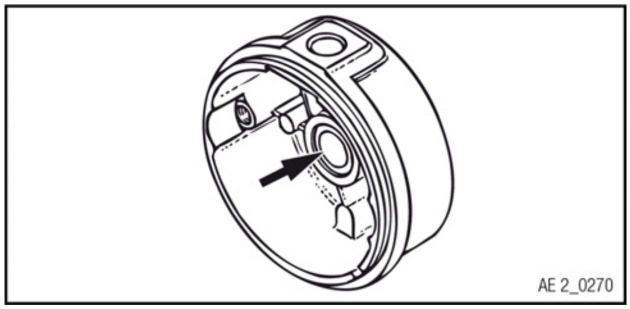


Figure 26.12

CARBON BRUSHES — INSPECTION

Step	Procedure
1	Check that the carbon brushes move freely in their guides.
2	Replace too short brushes (min. length 8 mm = 0.32 in.).
3	Check spring pressure.
4	Check connector sheaths of the positive-pole carbon brush, replace as required.

NOTE

Replace hot-run brush springs.

STARTER HOUSING — INSPECTION

Step	Procedure
1	Carry out visual inspection of the inner magnet for cracks.

STUDS — INSPECTION

Step	Procedure
1	Carry out visual inspection of both studs or Allen screws.

WEAR LIMITS

NOTE

The wear limits apply to both configurations of the electric starter, standard and HD.

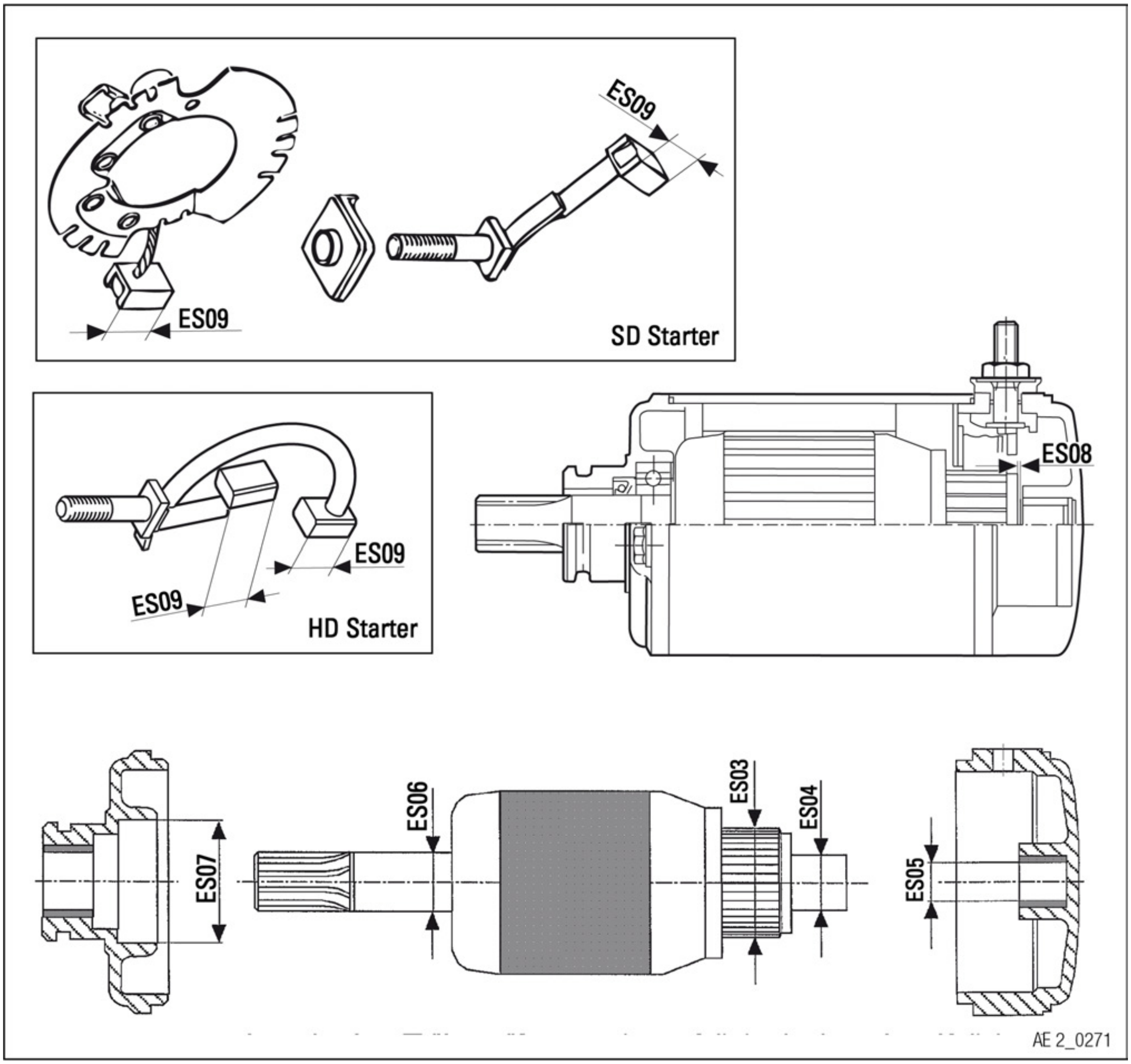


Figure 26.13

Description	Code	Reading new		Wear limit			Readings
		min	max	100 %	50 %		
Commutator	ES03	25.5 mm 1.083 in	28.0 mm 1.102 in	27.0 mm 1.063 in	27.3 mm 1.075 in	actual	
						renewed	
Armature shaft	ES04	9.77 mm 0.3846 in	9.79 mm 0.3854 in	9.75 mm 0.3839 in	9.76 mm 0.3843 in	actual	
						renewed	
Armature bushing	ES05	9.82 mm 0.3866 in	9.84 mm 0.3874 in	9.86 mm 0.3874 in	9.86 mm 0.3882 in	actual	
						renewed	
Bearing seat on shield	ES07	32.0 mm 1.2598 in	32.036 mm 1.2613 in	32.069 mm 1.2626 in	32.053 mm 1.2619 in	actual	
						renewed	
Axial clearance	ES08	0.1 mm 0.004 in	0.4 mm 0.016 in	0.4 mm 0.016 in		actual	
						renewed	
Length of plus brush	ES09	12.0 mm 0.472 in	12.5 mm 0.492 in	8.5 mm 3.347 in		actual	
						renewed	
Length of minus brush	ES09	12.0 mm 0.472 in	12.5 mm 0.492 in	8.5 mm 3.347 in		actual	
						renewed	
Radial clearance armature shaft/ armature bushing	ES05/ ES04	0.03 mm 0.0012 in	0.07 mm 0.0028 in	0.11 mm 0.0043 in	0.09 mm 0.0035 in	actual	
						renewed	
Bearing seat on shaft	ES06	14.997 mm 0.5904 in	15.005 mm 0.5907 in	14.987 mm 0.5900 in		actual	
						renewed	

ASSEMBLY

NOTE

Replace all O-rings and oil seal when repairing the electric starter.

STANDARD STARTER — ASSEMBLY

Step	Procedure
1	Determine the required number of compensating shims for the axial clearance. (ES08)
2	Grease oil seal, the ball bearing and the bearing brushing.
3	Insert the positive-pole carbon brush into the rotor support assy. Mount O-ring with connector sheath and fix with combined nut M6.
4	Fit brush holder with the carbon brushes onto the rotor support assy.
5	Put compensating shims onto the rotor shaft. **NOTE** *Support shims with grease on the rotor shaft, to prevent from falling into the rotor support housing.*
6	Insert rotor over the brush holder with the carbon brushes, into the rotor support assy.
7	Fit new O-ring 62x1.5 and put starter housing over rotor and ensure alignment with rotor support assy. **NOTE** *Hold the rotor in position while mounting the starter housing.*
8	Fit the complete rotor support assy. with new O-ring 62x1.5 onto the starter housing.

NOTE

Ensure correct positioning and engagement by the alignment marks on the housing and rotor support.

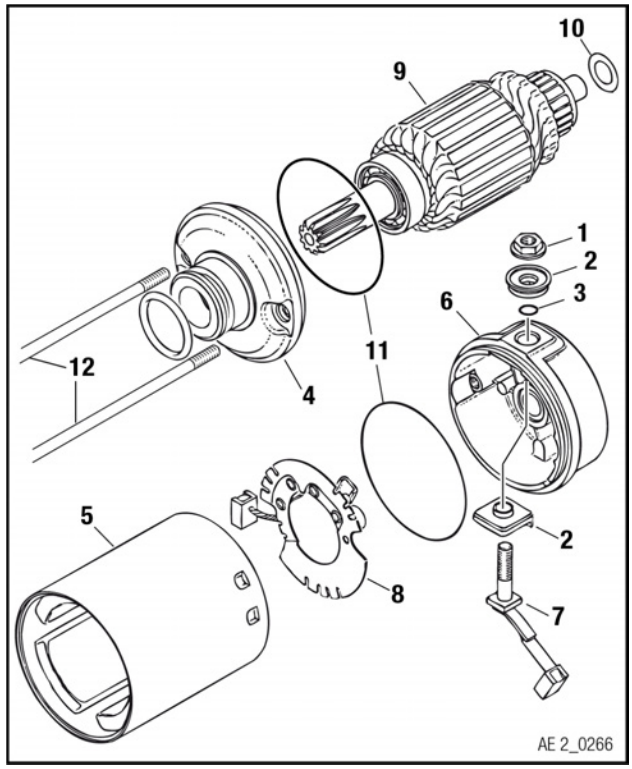


Figure 26.14

1	*Combined nut M6*	2	*Connector sheath*
3	*O-ring 6x1.7*	4	*Bearing flange*
5	*Starter housing*	6	*Rotor support assy.*
7	*Carbon brush*	8	*Brush holder*
9	*Rotor*	10	*Compensating shim*
11	*O-ring 62x1.5*	12	*Stud M5x150/16*

HD STARTER — ASSEMBLY

Step	Procedure
1	Determine the required number of compensating shims for the axial clearance. (ES08)
2	Grease oil seal, the ball bearing and the bearing brushing.
3	Insert the positive-pole carbon brush into the rotor support assy. Mount O-ring with connector sheath and fix with combined nut M6.
4	Fit brush holder with the carbon brushes onto the rotor support assy.
5	Put compensating shims onto the rotor shaft. **NOTE** *Support shims with grease on the rotor shaft, to prevent from falling into the rotor support housing.*
6	Insert rotor over the brush holder with the carbon brushes, into the rotor support assy.
7	Fit new O-ring 62x1.5 and put starter housing over rotor and ensure alignment with rotor support assy. **NOTE** *Hold the rotor in position while mounting the starter housing.*
8	Fit the complete rotor support assy. with new O-ring 62x1.5 onto the starter housing.
9	Screw the starter together with the Allen screws M5x180. Tightening torque 5 Nm (44 in.lb)

NOTE

Ensure correct positioning and engagement by the alignment marks on the housing and rotor support.

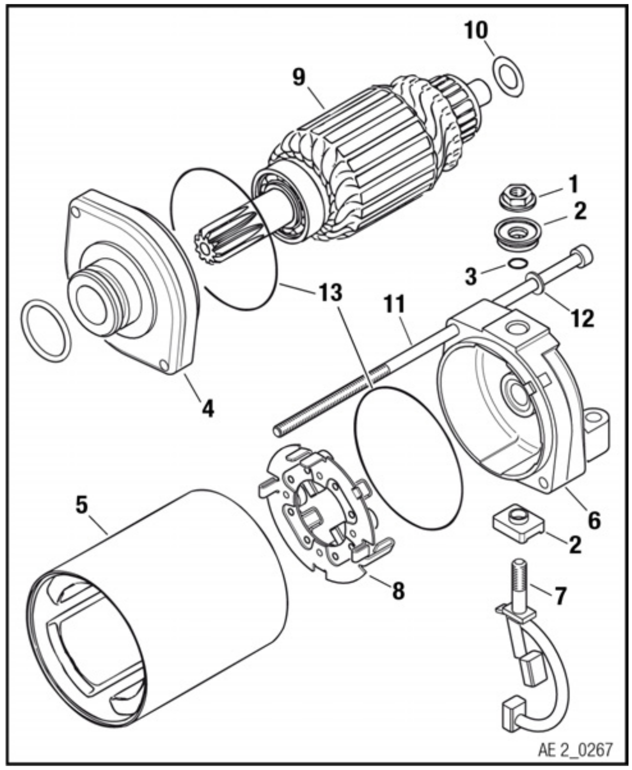


Figure 26.15

1	*Combined nut M6*	2	*Connector sheath*
3	*O-ring 6x1.7*	4	*Bearing flange*
5	*Starter housing*	6	*Rotor support assy.*
7	*Carbon brush*	8	*Brush holder*
9	*Rotor*	10	*Compensating shim*
11	*Allen screw M5x180*	12	*Washer 5.3*
12	*O-ring 62x1.5*		

INSTALLATION

Preparation

- Check that the O-rings are securely fitted on the bearing flange.
- Lightly grease the O-ring on the rotor support assy. and the centering bore in the ignition housing with LOCTITE ANTI SEIZE.

NOTICE

Ensure that the electric starter is in the correct installation position.

STANDARD STARTER — INSTALLATION

Step	Procedure
1	Push the whole electric starter with new O-rings 5x1.5 and distance sleeves into the ignition housing.

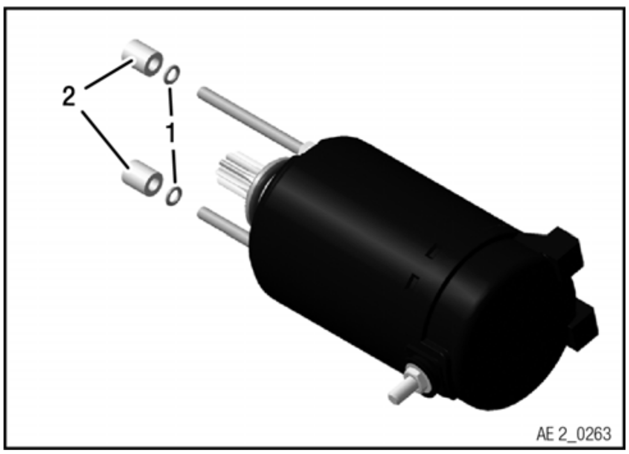


Figure 26.16

1 O-rings 5x1.5 *2 Distance sleeves*

NOTE

Take care that the electric starter is not pulled apart as you push the starter into position.

Step	Procedure
2	Attach electric starter with lock washer A5 and hex. nuts M5 or only with cap nut M5 to the crankcase. Tightening torque 6 Nm (53 in.lb).
3	Fix to ignition housing with a tension clamp.

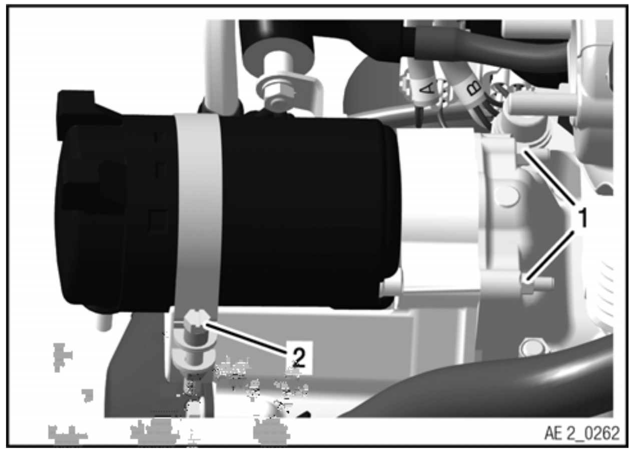


Figure 26.17

1 Cap nuts M5 *2 Tension clamp*

Step	Procedure
4	Connect the positive pole on the electric starter. Tightening torque 4 Nm (35 in. lb).

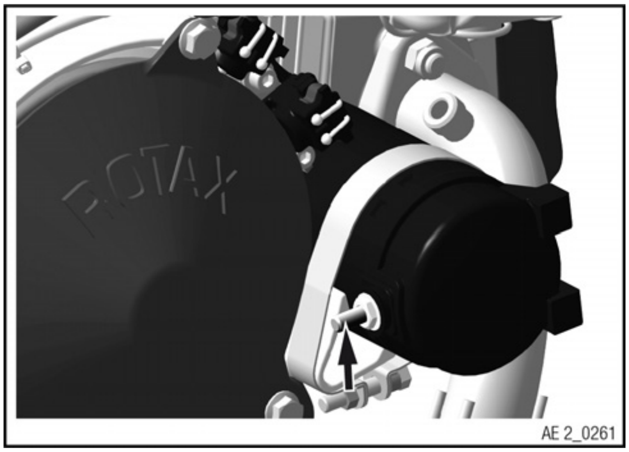


Figure 26.18

HD STARTER — INSTALLATION

Step	Procedure
1	Push the whole electric starter into the ignition housing.
2	Attach electric starter with lock washer A5 and hex. nuts M5 or only with cap nut M5 to the crankcase. Tightening torque 6 Nm (53 in. lb.).
3	Fix to ignition housing with a tension clamp.

NOTICE

The Allen screw M5x180 is only for "internal" attachment of the starter components. During assembly on the ignition housing, the Allen screw must not be turned, as the position of the rotor bearing could be changed. The marks on the rotor bearing and on the starter housing must align.

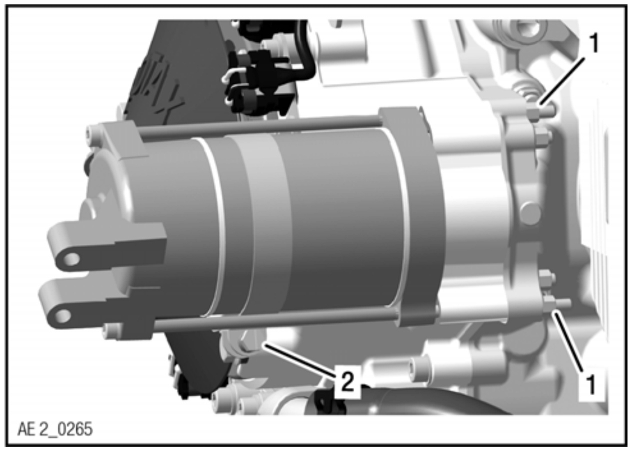


Figure 26.19

1 Cap nuts M5 *2 Tension clamp*

Step	Procedure
4	Connect the positive pole on the electric starter. Tightening torque 4 Nm (35 in.lb).

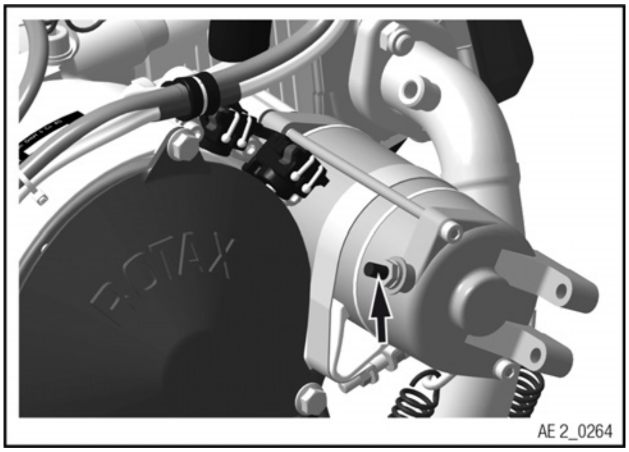


Figure 26.20

FINISHING WORK

- Connect the negative terminal of the aircraft battery.

Fill with operating fluids or check filling levels.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-10-00 section Adding operating fluids..

Carry out an engine test run.
See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00 section Planned maintenance.

INTENTIONALLY LEFT
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