Chapter: LEP
LIST OF EFFECTIVE PAGES

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

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Chapter: TOA
TABLE OF AMENDMENTS

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

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

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0	78-10-00	all	August 01 2018	DOA*			
0	78-20-00	all	August 01 2018	DOA*			
0	79-00-00	all	August 01 2018	DOA*			
0	80-00-00	all	August 01 2018	DOA*			

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1	LEP	all	June 01 2019	DOA*			
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1	78-20-00	16,18	June 01 2019	DOA*			
1	79-00–00	all	June 01 2019	DOA*			

Summary of amendments

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

Current no.	Chapter	Page	Date of change	Comment
1	00–00–00	3,4	June 01 2019	New configuration 2. New - wiring color codes
1	72–10–00	all	June 01 2019	Change of text and figures. New - Configuration 2
1	78–20–00	16,18	June 01 2019	Change of text. New - Adjustment of the wastegate

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TYPE DESCRIPTION

The type description consists of the following parts:

e. g. **ROTAX** **915** **iSc** **2** **A**

type	certification	configuration	additional designation

Designation

Designation		Description
Type	**915**	4-cylinder horizontally opposed, turbocharged engine.
Certification	**iSc**	Certified to EASA CS-E (TC No.EASA.E.121)
	iS	Approved to according ASTM F2339.
Configuration	**2**	Propeller shaft with flange for fixed pitch propeller.
	3	Propeller shaft with flange for constant speed propeller and drive for hydraulic governor for constant speed propeller.
Additional designation	**A**	Standard version

Options

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

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

NOTE

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

ABBREVIATIONS AND TERMS

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

SAE	Society of Automotive Engineers
SEP	Single Engine Piston
SB	Service Bulletin
SI	Service Instruction
SI-PAC	Service Instruction Parts and Accessories
SPST	Single pole single throw
STP	Shield twisted pair
SL	Service Letter
SMD	Surface Mounted Devices
TBO	Time Between Overhaul
TC	Type certificate
part no.	part number
TOA	Table Of Amendments
TOC	Table of content
TPS	Throttle Position Sensor
TSN	Time Since New
TSNP	Time Since New Part
TSO	Time Since Overhaul
V	Volt
VFR	Visual Flight Rules
LEP	List of Effective Pages
MM	Maintenance Manual
MEP	Multi Engine Piston
X3	Connector on Engine Management System wiring harness which serves as an interface for power supply
XXXX	shows the serial component number

WIRING COLOR CODES

Figure 1.2

INSTRUCTION

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

Safety notice

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

Accessories

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

Spare parts

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

ATTENTION

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

Standard tools / Special tools

ATTENTION

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

State of delivery

⚠ WARNING

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

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

MAINTENANCE CONCEPT

General note

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

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

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

Maintenance I (Line Maintenance)

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

NOTE

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

Maintenance II (Heavy Maintenance)

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

NOTE

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

TECHNICAL DOCUMENTATION

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

Documentation

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

Status

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

Replacement pages

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

Reference

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

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

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

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

Illustrations

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

NOTE

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

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

Installation drawings

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

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

REMOVAL

Preparation

ATTENTION

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

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

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

NOTE

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

IGNITION HOUSING – REMOVAL

NOTE

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

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

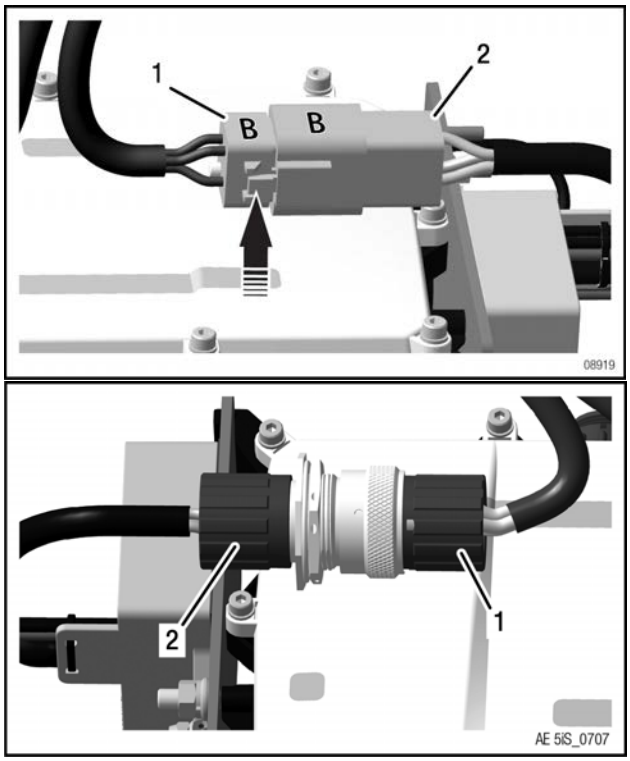


Figure 2.4

1 Controller connector 2 Connection socket

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

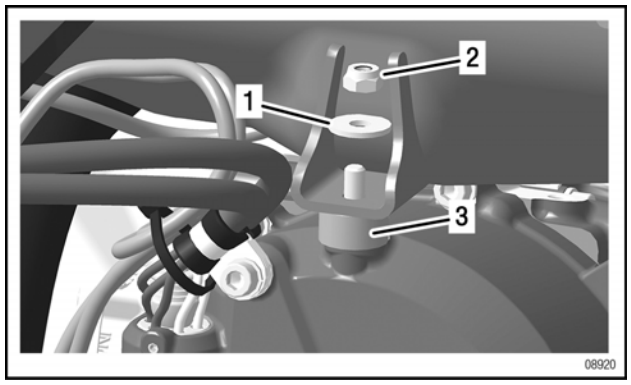


Figure 2.5

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

NOTE

Push airbox upwards and wedge in place.

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

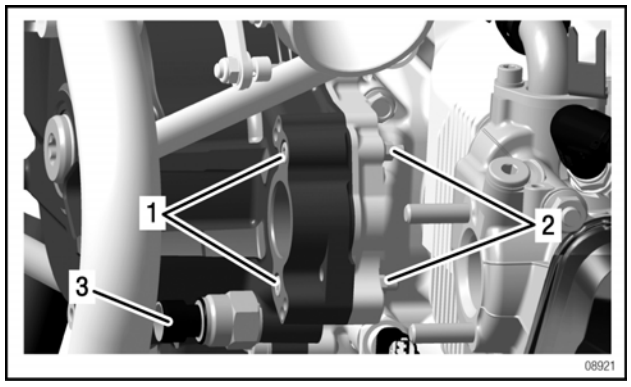


Figure 2.6

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

Step	Procedure
5	Loosen plug screw M20x1.5.

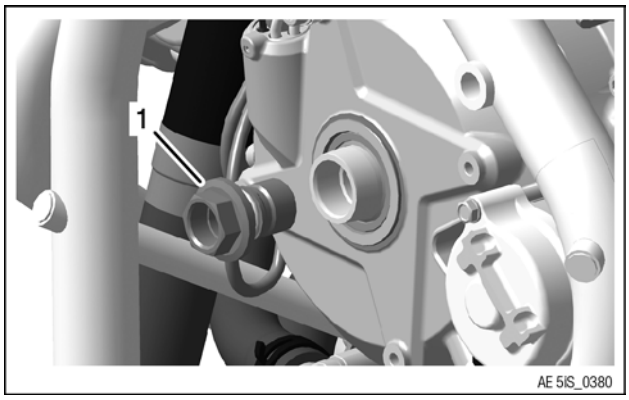


Figure 2.7

1 Plug screw M20x1.5 with O-ring

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

NOTE

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

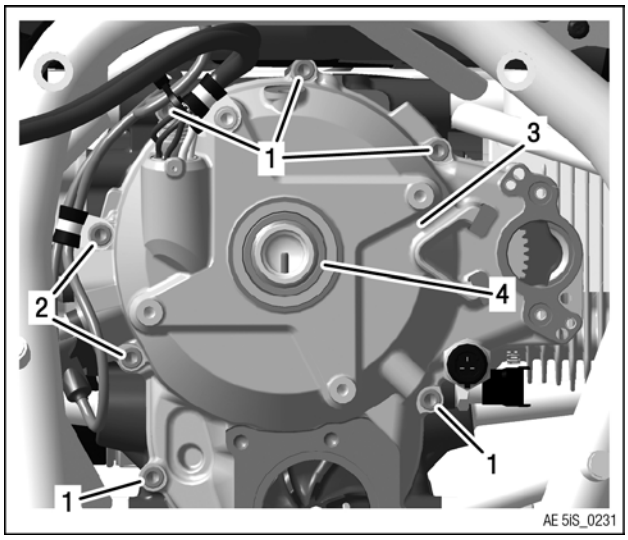


Figure 2.8

1 Allen screws M6x30 *2 Allen screws M6x50*

3 Ignition housing assy. *4 Oil seal*

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

NOTE

The ignition housing has one dowel pin.

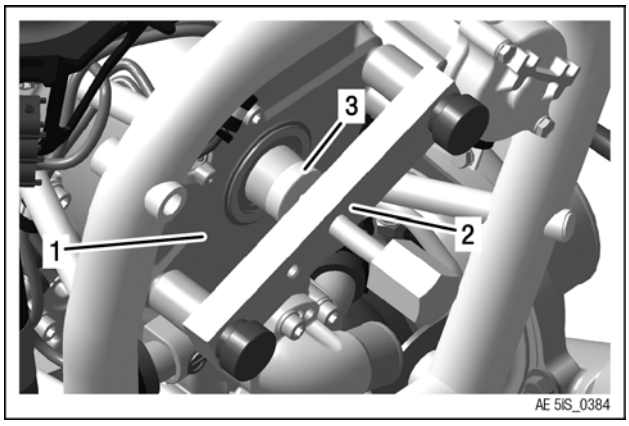


Figure 2.9

1 Ignition housing assy. *2 Puller assy. part.no. 876010*

3 Protection mushroom part no. 877419

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

NOTE

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

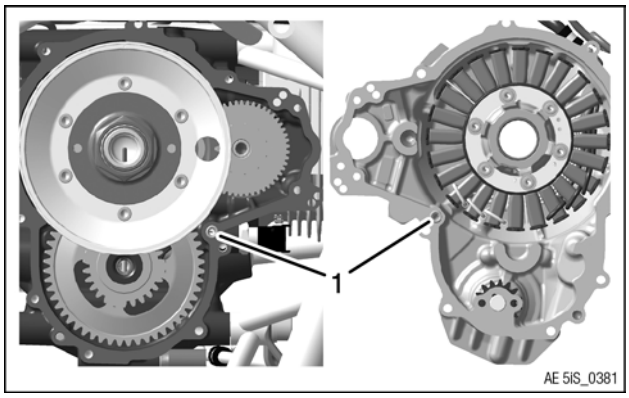


Figure 2.10

1 O-ring 5x2

FLY WHEEL ASSY. REMOVAL

Preparation

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

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

NOTE

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

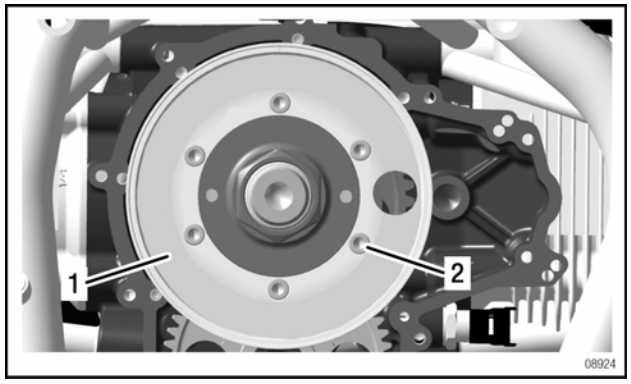


Figure 2.11: TYPICAL

1 Fly wheel
2 Allen screw M6x12

CONTROLLER CONNECTOR AMPHENOL — DISASSEMBLY

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

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

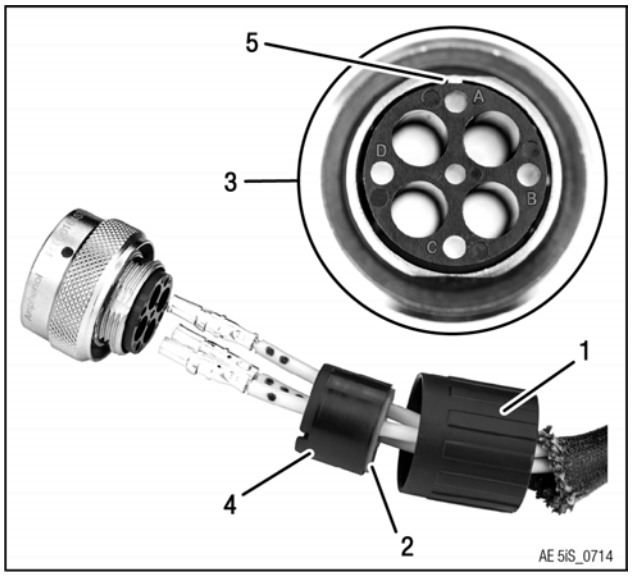


Figure 2.12

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

STATOR ASSY. — REMOVAL

ATTENTION

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

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

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

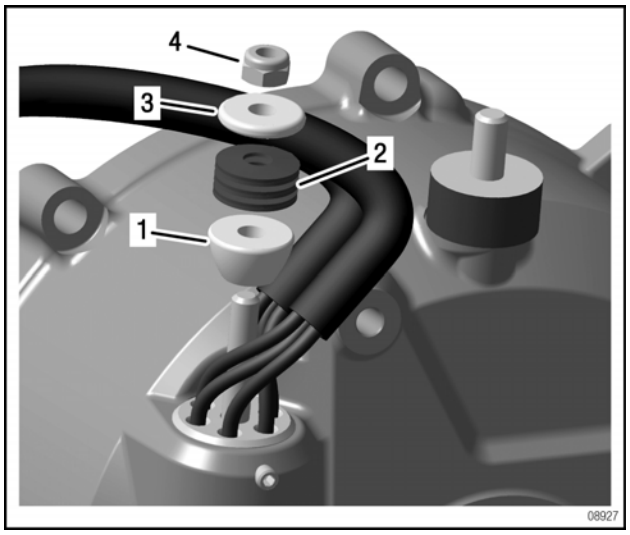


Figure 2.34: TYPICAL

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

CONTROLLER CONNECTOR — ASSEMBLY

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

NOTE

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

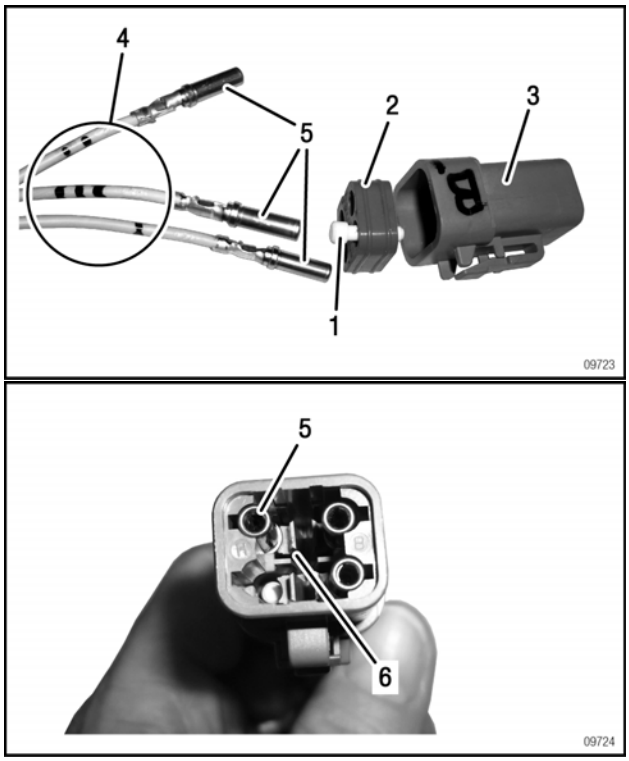


Figure 2.35

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

Step	Procedure
4	Install the orange lock.

NOTE

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

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

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

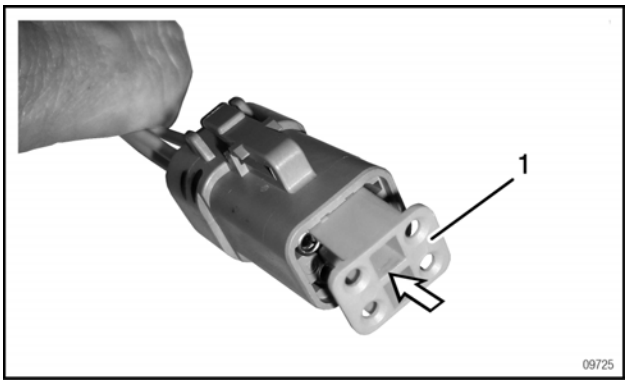


Figure 2.36

1 Lock

Step	Procedure
5	Install cable clamps 8/M6.

NOTE

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

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

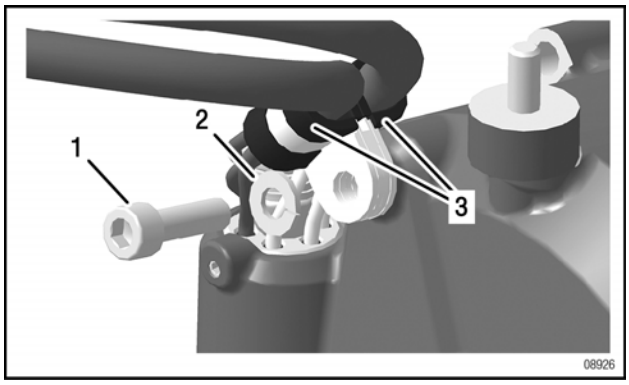


Figure 2.37

1 Allen screw M6x20 *2 Lock washer M6*

3 Cable clamps 8/M6

CONTROLLER CONNECTOR AMPHENOL — ASSEMBLY

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

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

NOTE

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

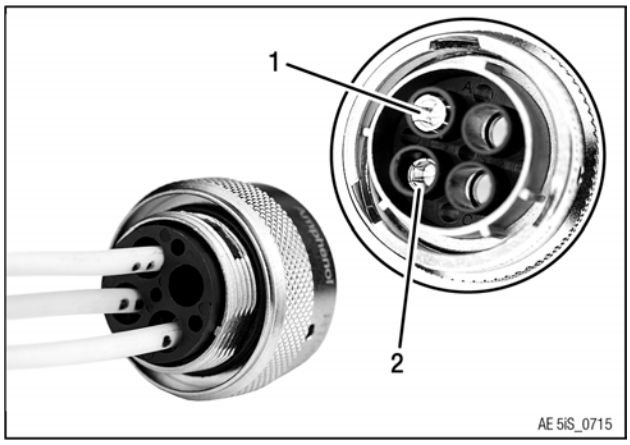


Figure 2.38

1 Secured pin *2 Un-secured pin*

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

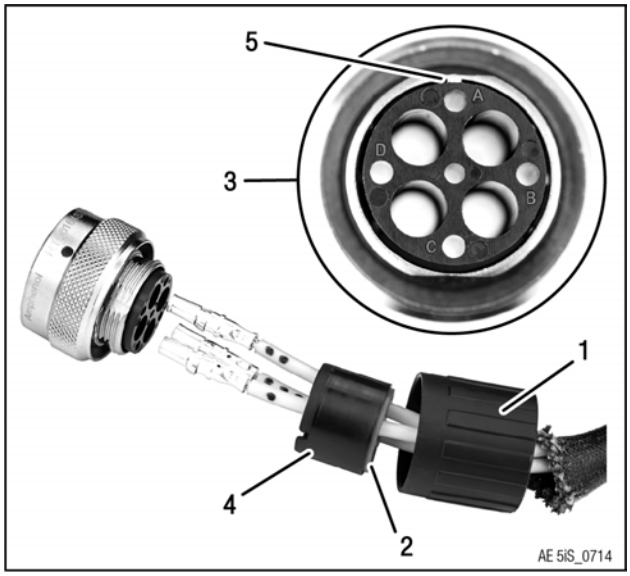


Figure 2.39

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

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

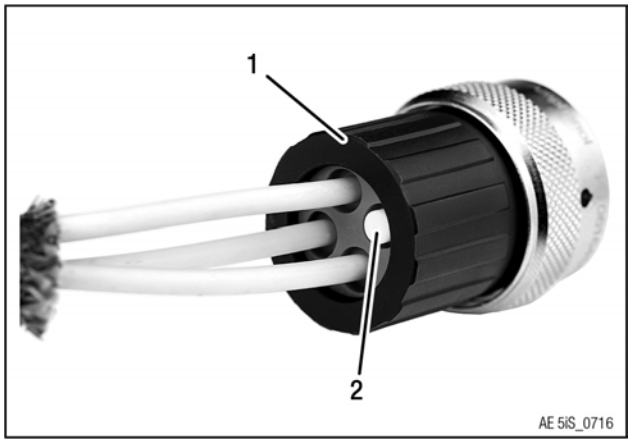


Figure 2.40

1 Connector cap *2 Plastic sealing plug*

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

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

INSTALLATION

FLY WHEEL ASSY. — INSTALLATION

Preparation

NOTE

Clean all flat surfaces

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

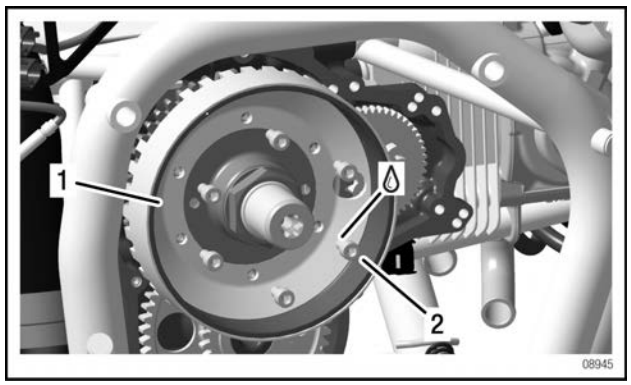


Figure 2.41: TYPICAL

1 Fly wheel *2 Allen screw M6x12*

IGNITION HOUSING ASSY. — INSTALLATION

See *Ignition housing screw diagram*

Preparation

- Check whether dowel pin has been inserted

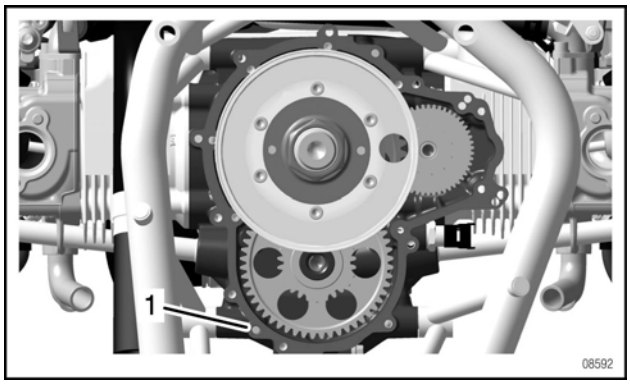


Figure 2.42: : TYPICAL

1 Dowel pin

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

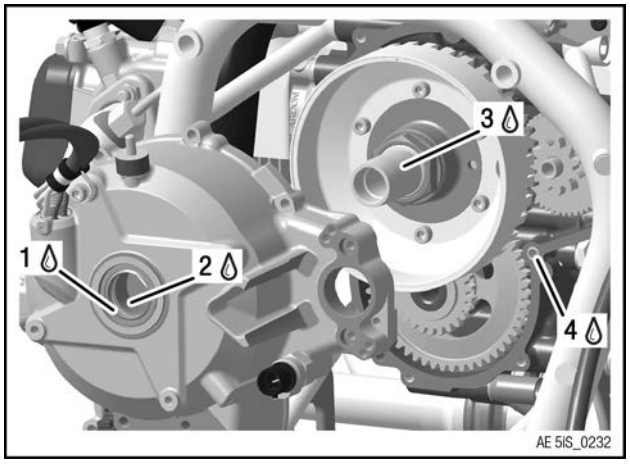


Figure 2.43

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

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

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

Location:_____**Date:** _____
Signature: _____**Print name:** _____

GENERAL NOTE

ENGINE PRESERVATION

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

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

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

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

⚠ WARNING

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

NOTE

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

If this limit is exceeded, following steps are necessary:

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

NOTE

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

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

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

ATTENTION

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

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

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

RETURN TO SERVICE

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

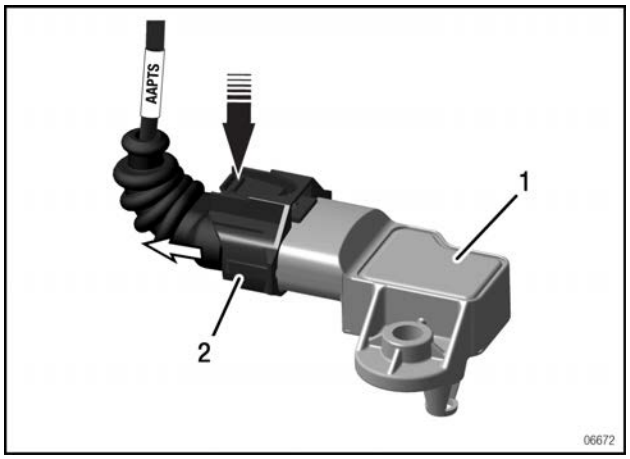


Figure 4.10

1 Tab *2 Connection socket*

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

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

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

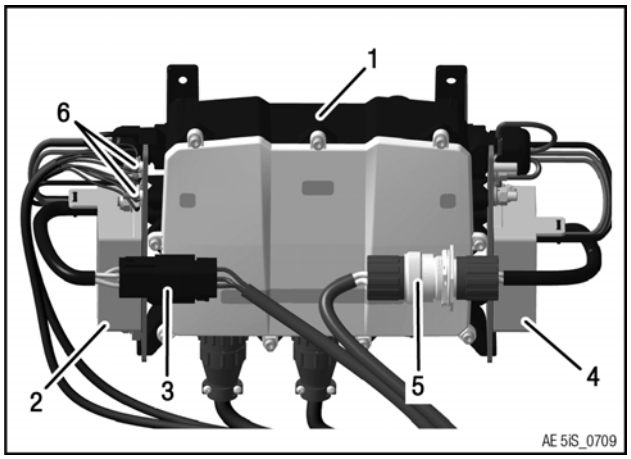


Figure 4.11

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

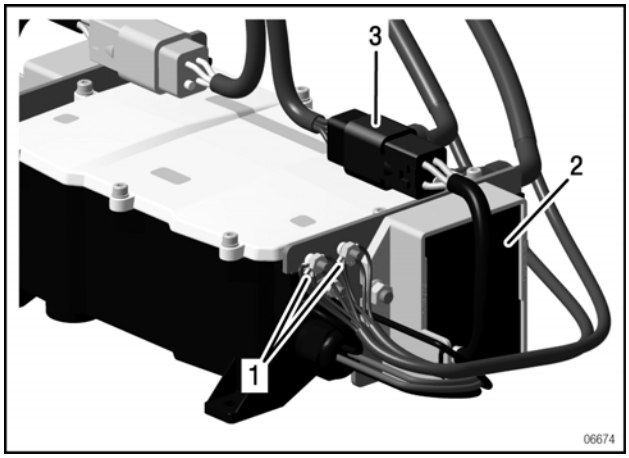


Figure 4.12: TYPICAL

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

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

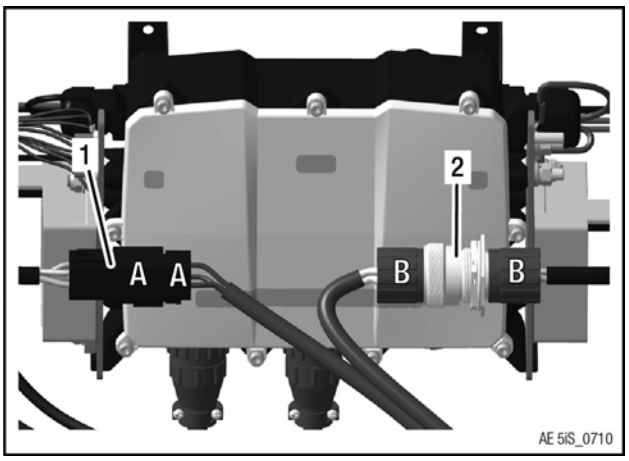


Figure 4.13

1 Connector regulator A 2 Connector regulator B

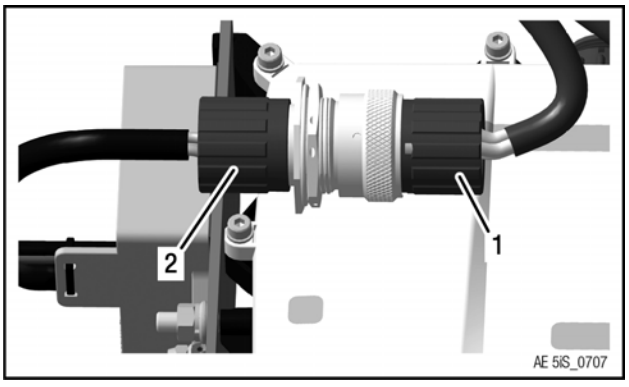


Figure 4.14

1 Amphenol connector 2 Connector socket

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

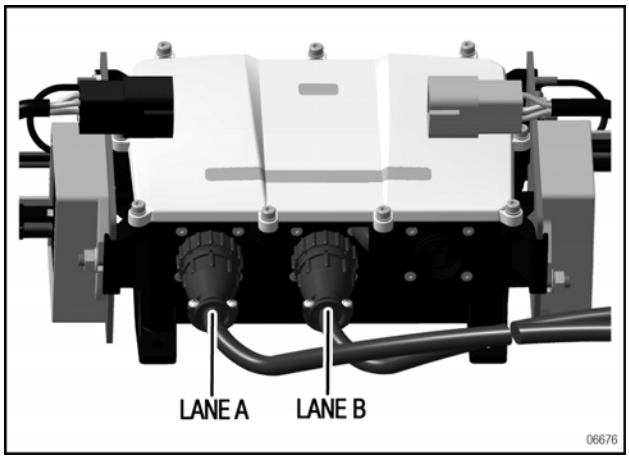


Figure 4.15: TYPICAL

NOTE

Round connectors have different grooves and cannot be mixed.

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

Control unit (ECU)

ATTENTION

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

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

Chapter: 72–10–00
PROPELLER GEARBOX

TOPICS IN THIS CHAPTER

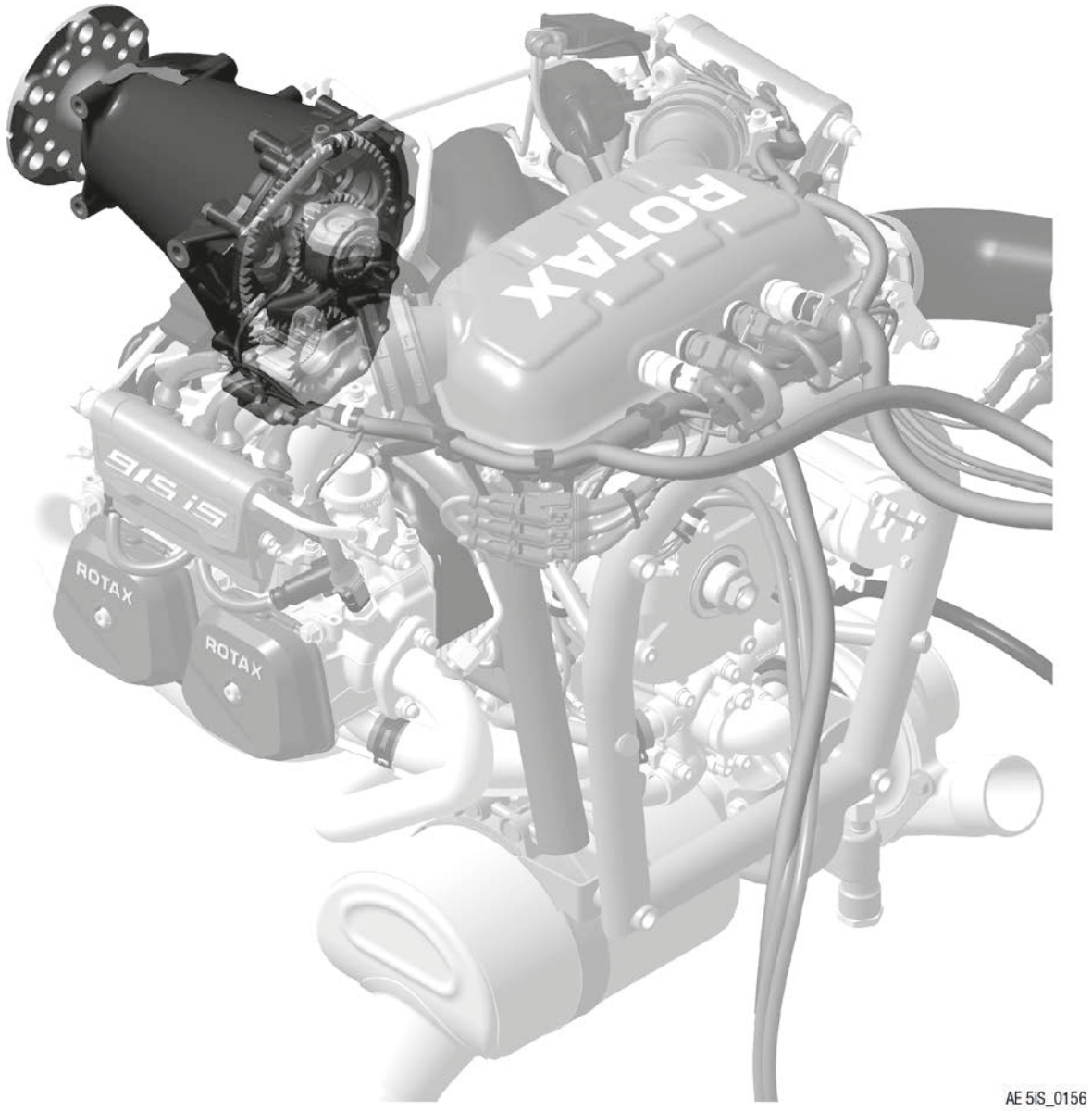


Figure 6.1: Location on the engine

SERVICE PRODUCTS

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

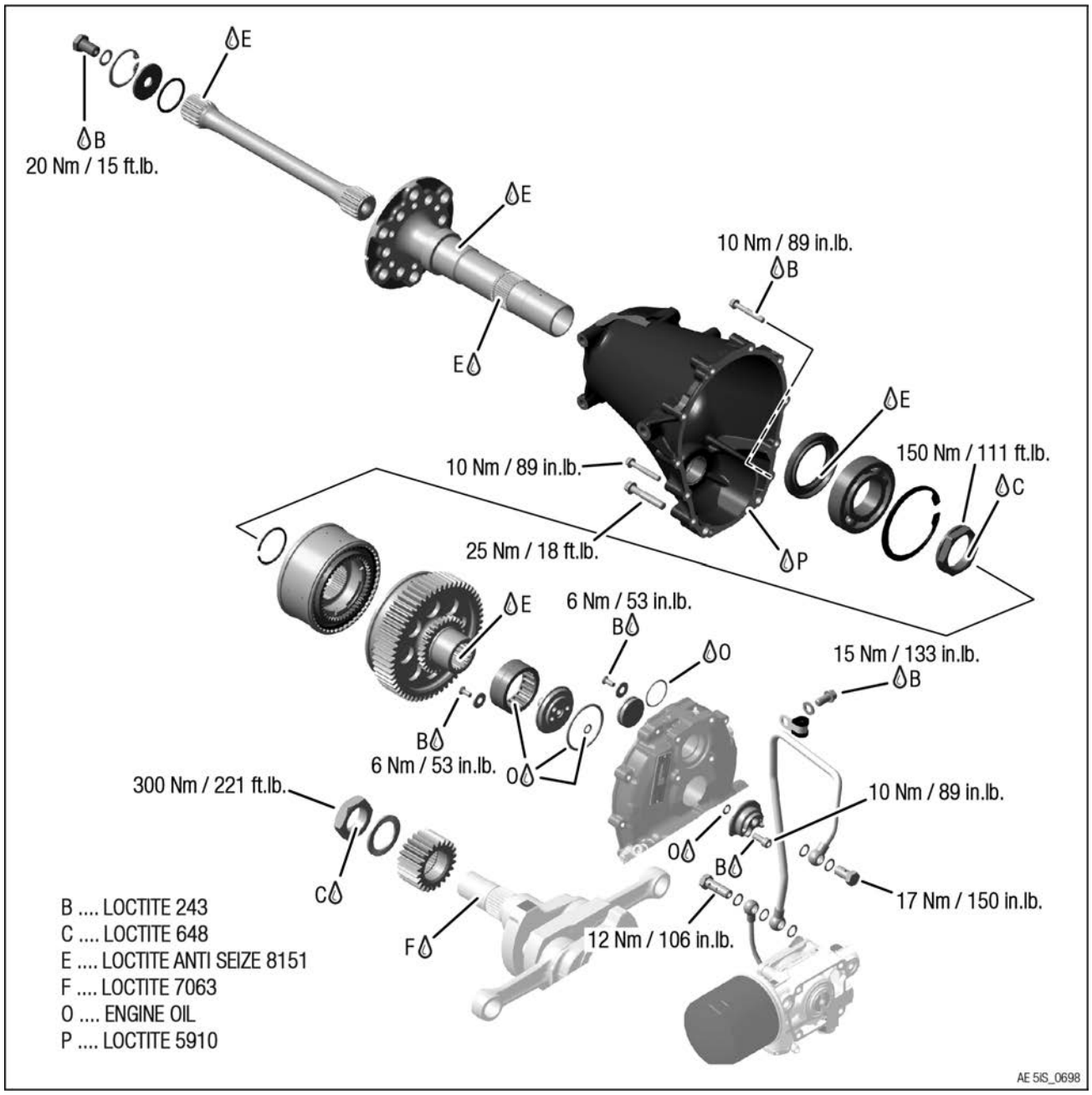

E
B
20 Nm / 15 ft.lb.
E
E
10 Nm / 89 in.lb.
B
E
150 Nm / 111 ft.lb.
C
10 Nm / 89 in.lb.
25 Nm / 18 ft.lb.
P
E
6 Nm / 53 in.lb.
B
O
15 Nm / 133 in.lb.
B
B
6 Nm / 53 in.lb.
O
300 Nm / 221 ft.lb.
10 Nm / 89 in.lb.
O
B
C
17 Nm / 150 in.lb.
F
12 Nm / 106 in.lb.
B .... LOCTITE 243
C .... LOCTITE 648
E ....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

Figure 6.3

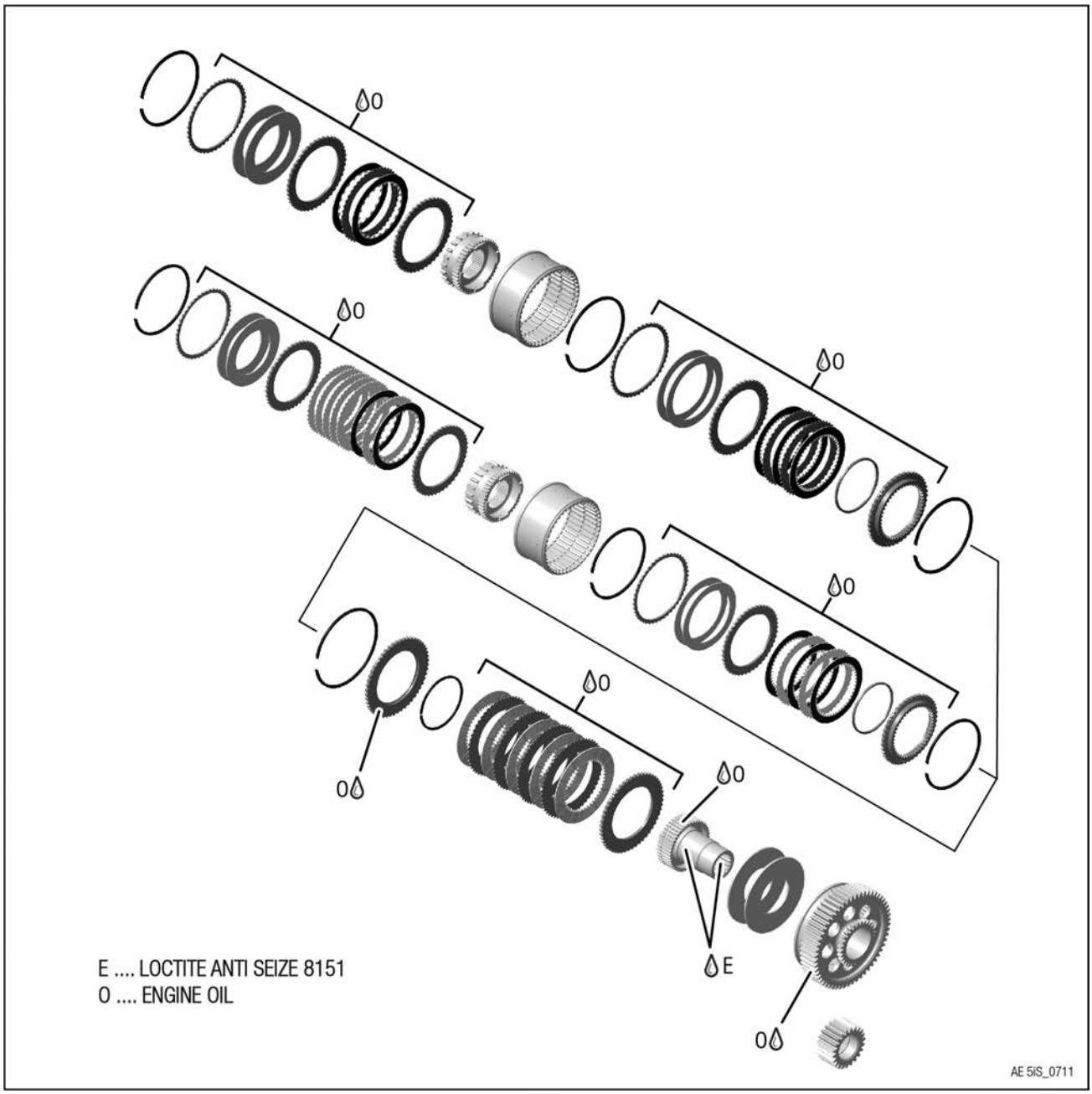


Figure 6.4

SYSTEM DESCRIPTION

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

SAFETY INSTRUCTIONS

⚠ WARNING

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

⚠ WARNING

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

CONNECTIONS FOR DISPLAY SYSTEMS

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

MAINTENANCE

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

REMOVAL

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

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

GEARBOX OIL LINE ASSY – REMOVAL

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

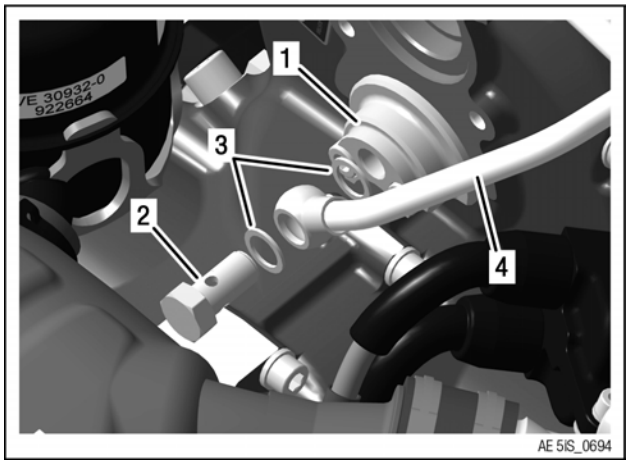


Figure 6.5

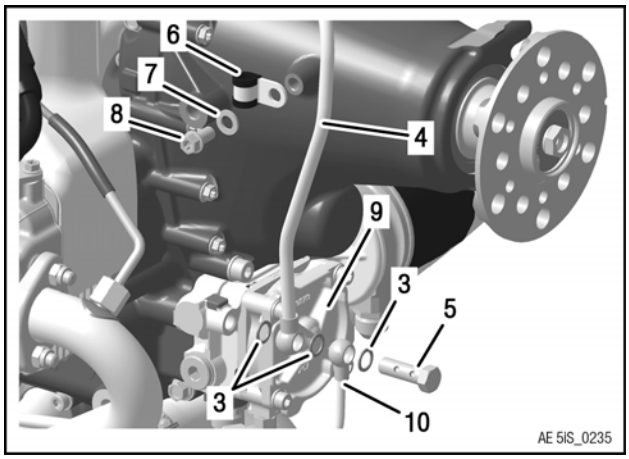


Figure 6.6

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

TORSION SHAFT— REMOVAL

NOTE

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

Step	Procedure
1	Remove the clutches.

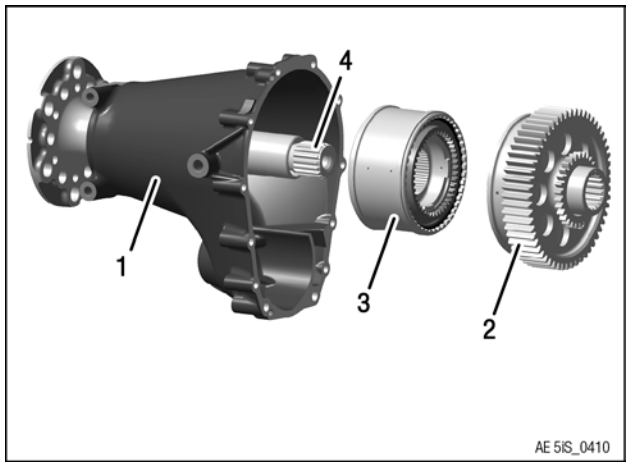


Figure 6.7

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

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

CONFIGURATION 3

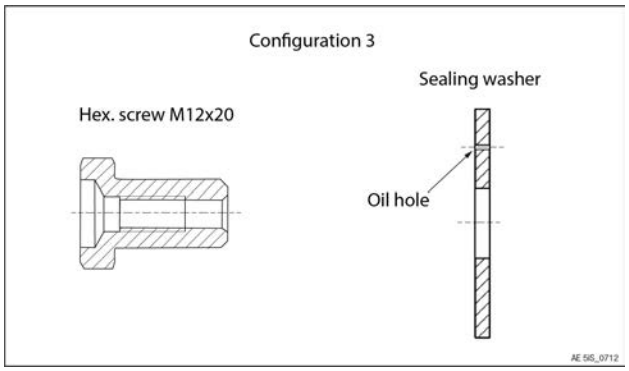


Figure 6.8

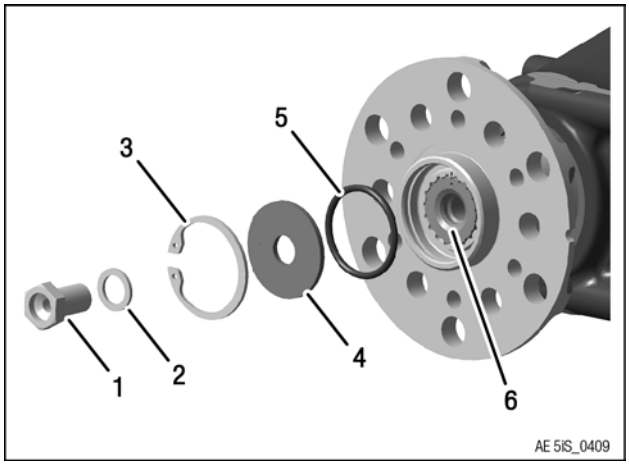


Figure 6.9

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

CONFIGURATION 2

ATTENTION

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

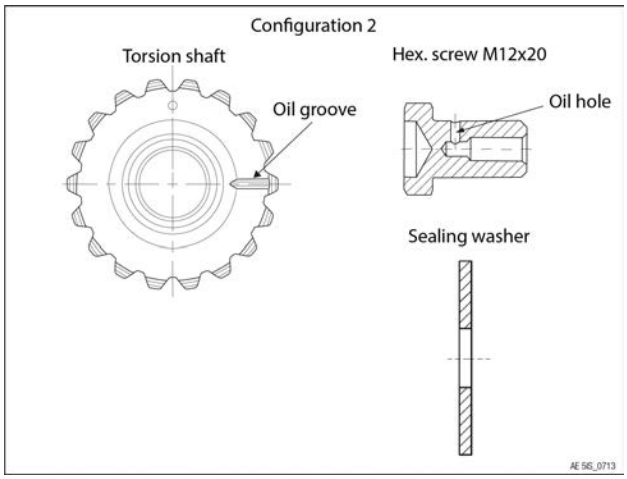


Figure 6.10

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

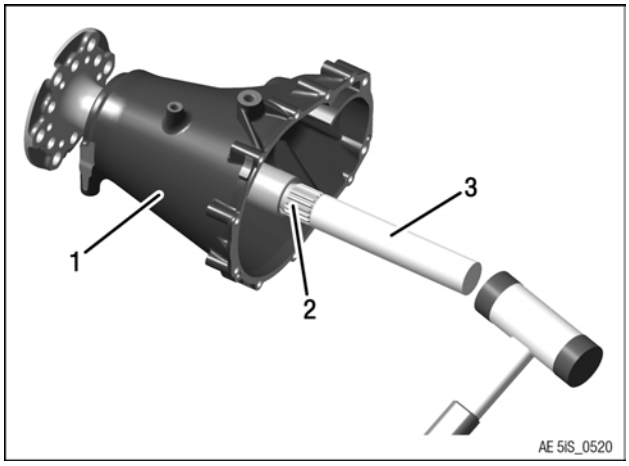


Figure 6.11

1 Propeller gearbox *2 Torsion shaft*

3 Plug tool

DISASSEMBLY

DISASSEMBLY OF THE PROPELLER GEARBOX

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

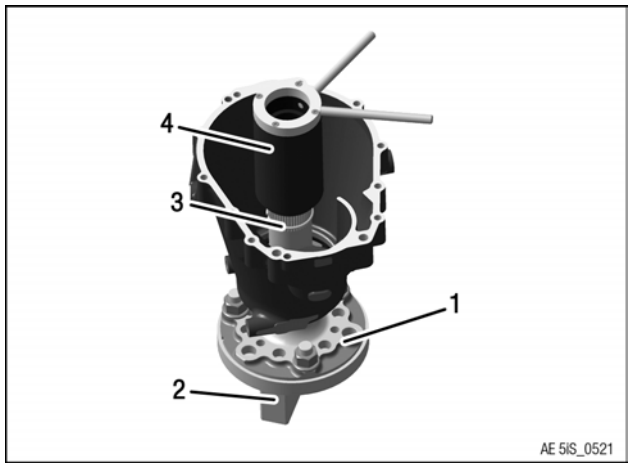


Figure 6.12

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

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

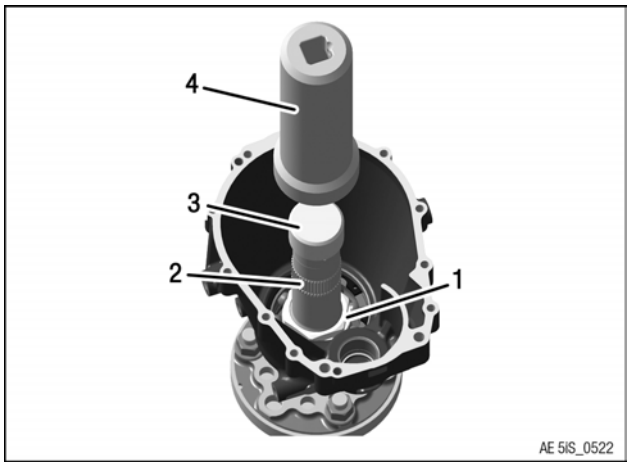


Figure 6.13

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

REMOVAL OF THE PROPELLER SHAFT

ATTENTION

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

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

ATTENTION

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

NOTE

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

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

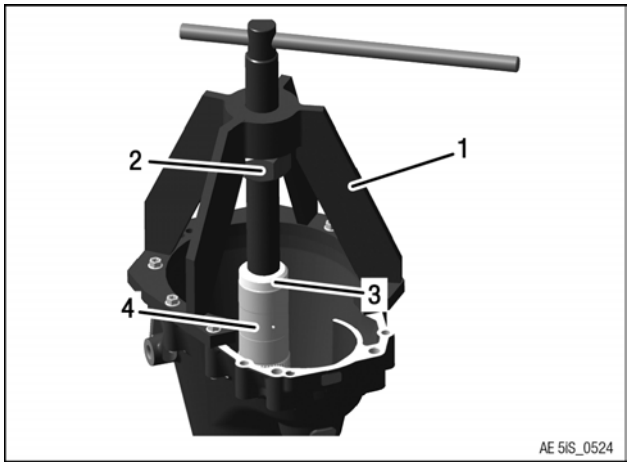


Figure 6.14

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

REMOVAL OF THE BALL BEARING AND OIL SEAL

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

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

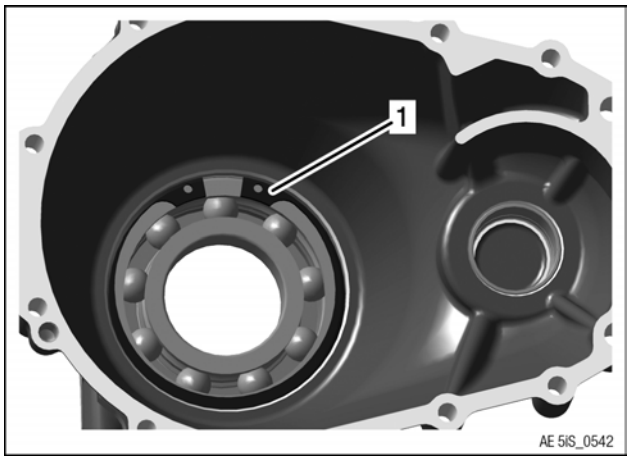


Figure 6.15

1 Retaining ring

ATTENTION

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

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

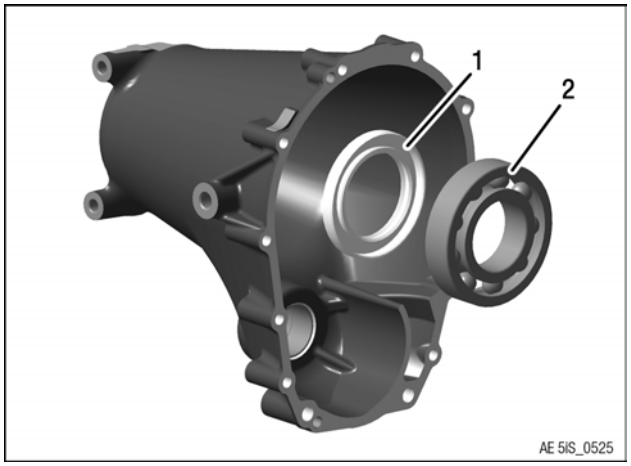


Figure 6.16

1 Oil seal *2 Ball bearing*

REMOVAL OF THE BLINDING SHIM

CONFIGURATION 2

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

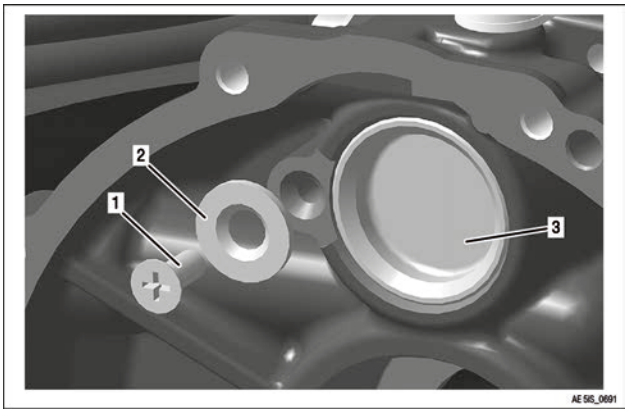


Figure 6.17

1 Countersunk screw M5x12 *2 Thrust washer*

3 Blinding shim

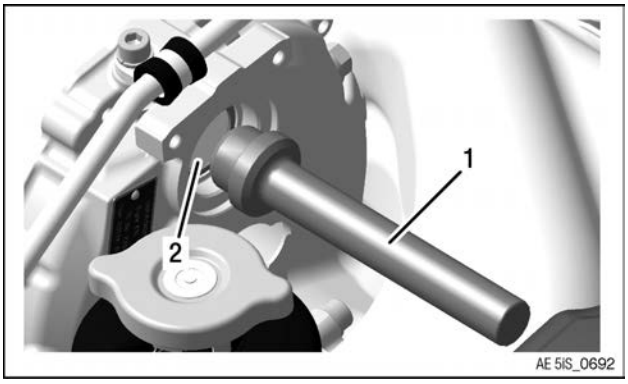


Figure 6.18

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

REMOVAL OF THE OIL INLET FLANGE

CONFIGURATION 2

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

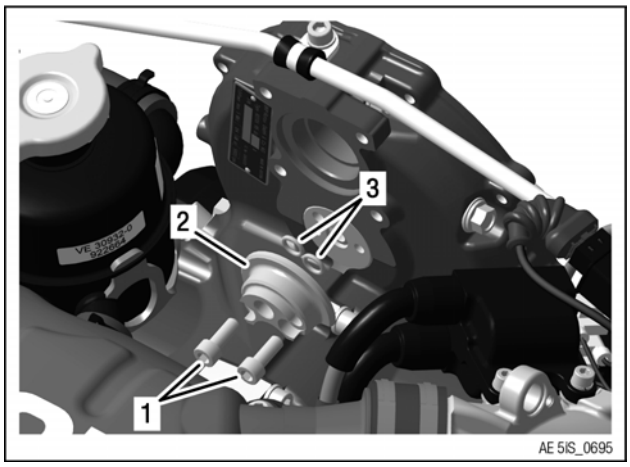


Figure 6.19

1 Allen screws M6x16 *2 O-rings*

3 Oil inlet flange

REMOVAL OF THE NEEDLE BEARING

Preparation – CONFIGURATION 2 AND 3

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

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

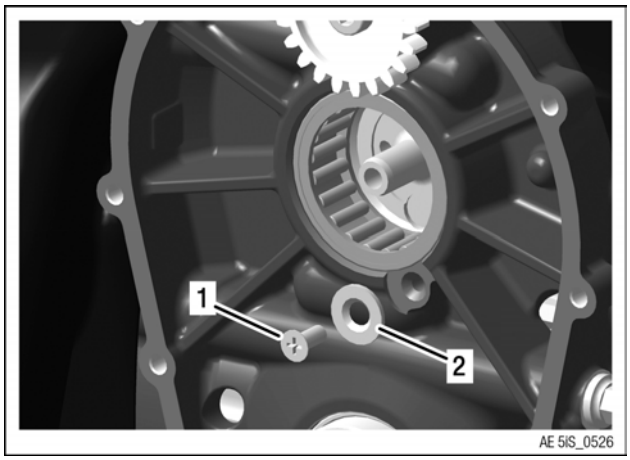


Figure 6.20: TYPICAL

1 M5x12 *2 Thrust washer*

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

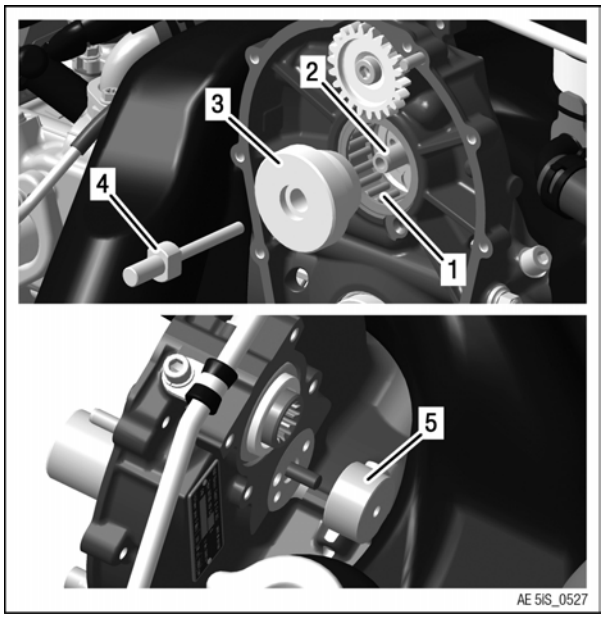


Figure 6.21: TYPICAL

1 Needle bearing *2 Oil inlet flange*

3 Press-in jig part no. 276000 *4 Threaded pin of tool 276004*

5 Knurled nut of tool 276004

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

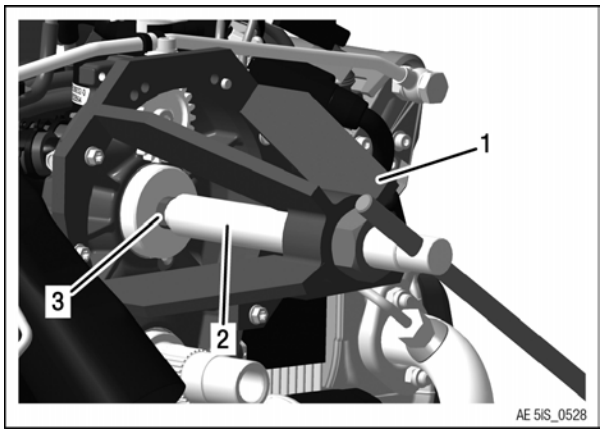


Figure 6.22: TYPICAL

1 Extractor part no. 877615 *2 Extractor spindle*

3 Threaded pin of tool 276004

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

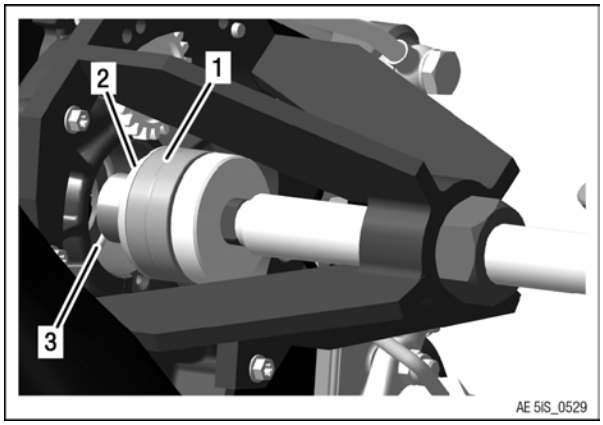


Figure 6.23: TYPICAL

1 Needle bearing *2 Oil inlet flange*

3 O-ring

DISASSEMBLY OF THE OVERLOAD CLUTCH ASSY.

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

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

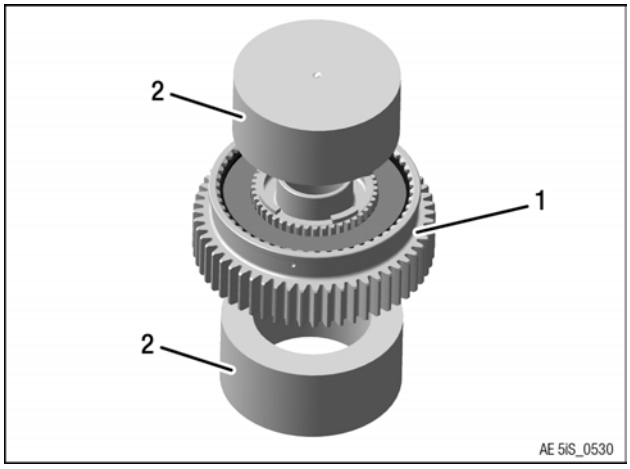


Figure 6.24

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

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

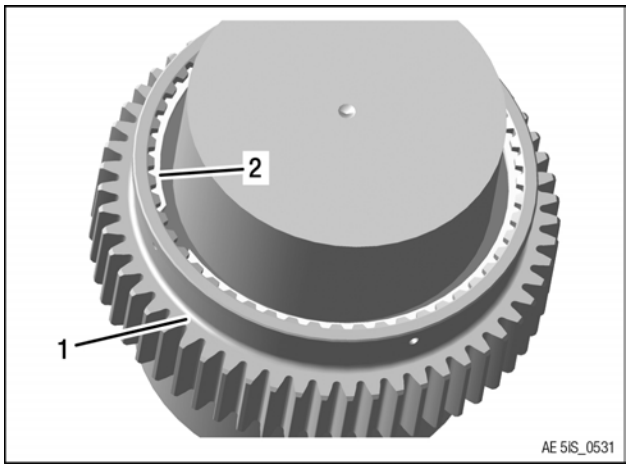


Figure 6.25

1	*Clutch assy.*	*2*	*Circlip*

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

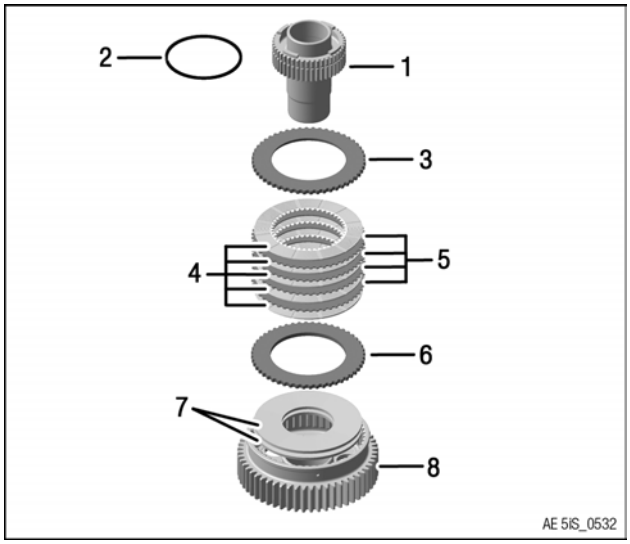


Figure 6.26

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

NOTE

Remove circlip only if necessary.

DISASSEMBLY OF THE DAMPER CLUTCH ASSY.

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

ENGINE SIDE / OVERLOAD CLUTCH SIDE

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

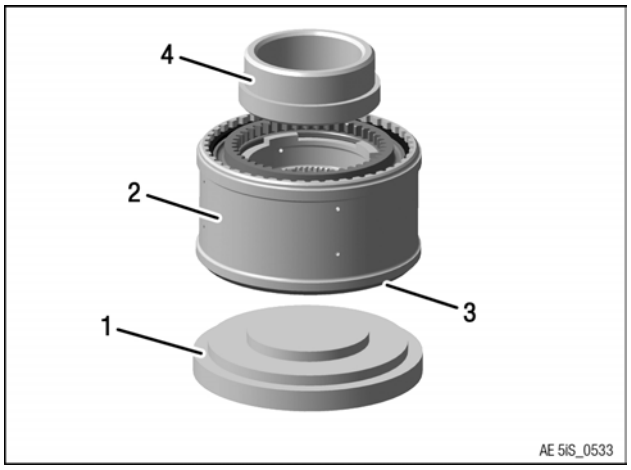


Figure 6.27: TYPICAL

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

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

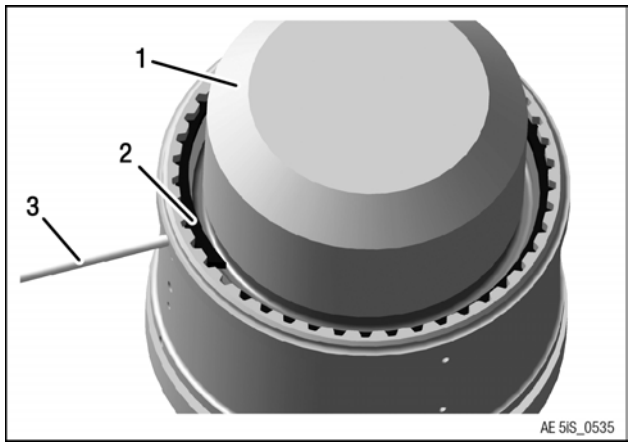


Figure 6.28: TYPICAL

1 Insertion jig 276952 *2 Retaining ring*

3 Pin

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

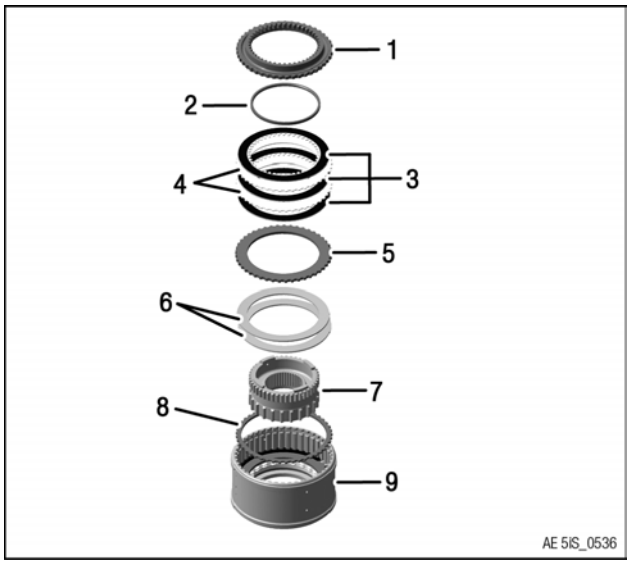


Figure 6.29: TYPICAL

1 Driving collar *2 Spacer ring*

3 Friction plate 1.54 mm *4 Steel friction plate 1 mm*

5 Steel friction plate 3 mm *6 Disk spring*

7 Clutch hub *8 Support ring*

9 Clutch drum

PROPELLER SIDE

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

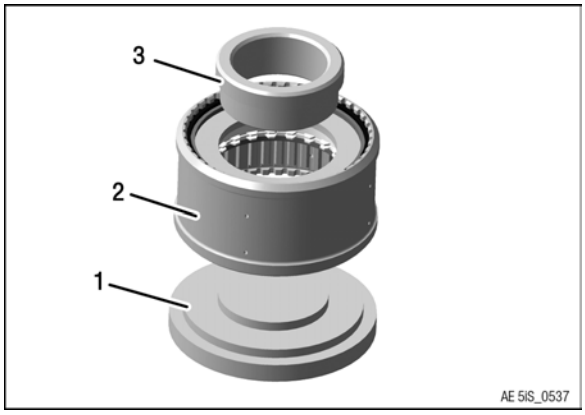


Figure 6.30: TYPICAL

1 Centering plate 276954
2 Damper clutch
3 Centering ring 276950

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

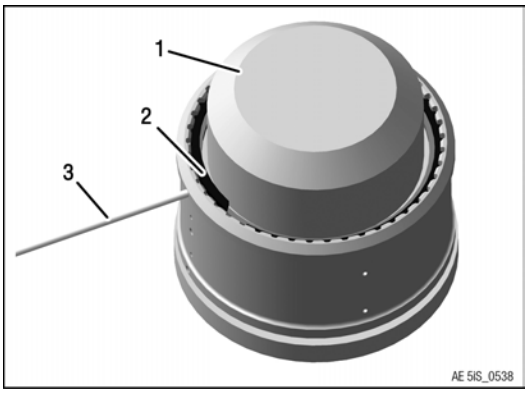


Figure 6.31: TYPICAL

1 Insertion jig
2 Circlip ring
3 Pin

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

NOTE

Remove circlip only if necessary.

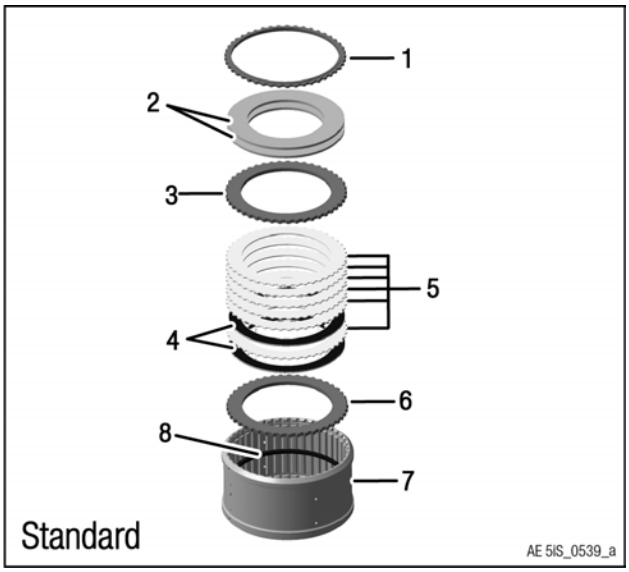


Figure 6.32: TYPICAL

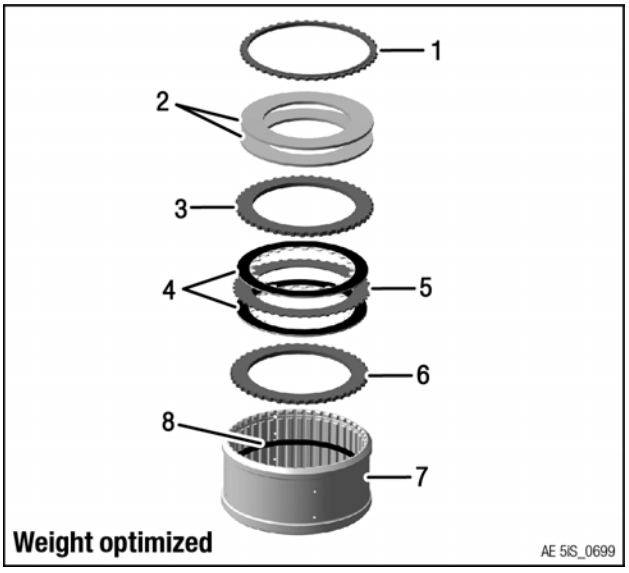


Figure 6.33

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

INSPECTION

PROPELLER GEARBOX SINGLE PARTS CHECK

Preparation

- Clean all parts carefully.

GEAR COVER ASSY. CHECK

Step	Procedure
1	Inspect the gear cover for cracks.

NOTE

Only carry out in the case of prop strike!

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

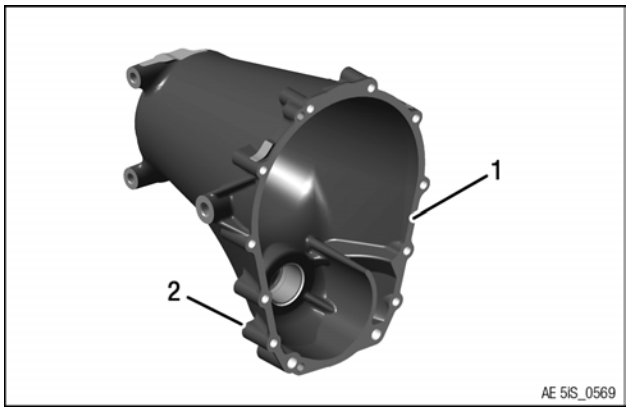


Figure 6.34

1 Flat sealing surface *2 Contact surface*

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

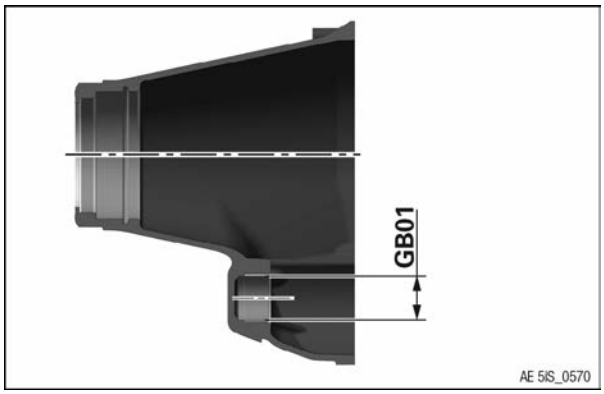


Figure 6.35: Bearing bushing

PROPELLER SHAFT — CHECK

ATTENTION

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

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

NOTE

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

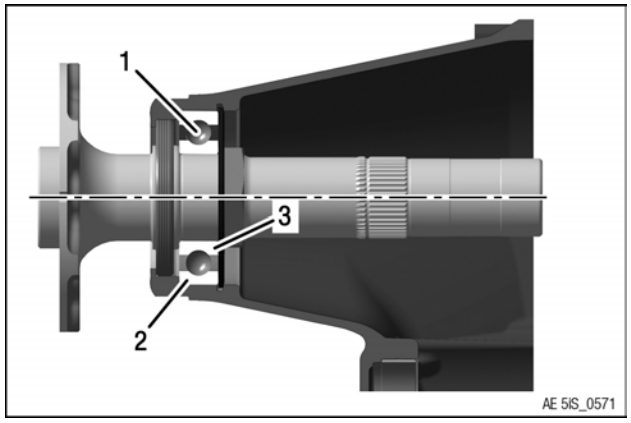


Figure 6.36

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

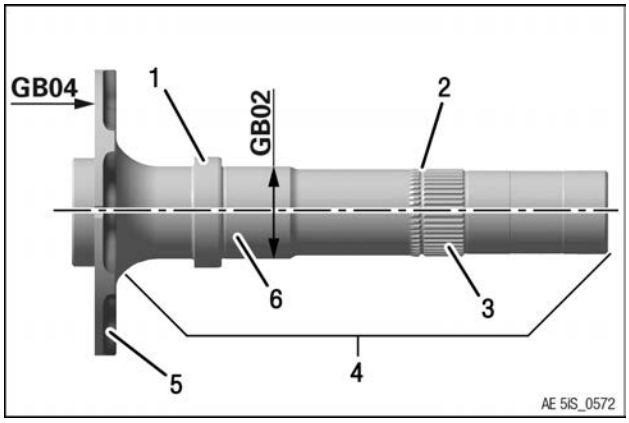


Figure 6.37

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

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

ATTENTION

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

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

OVERLOAD CLUTCH — CHECK

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

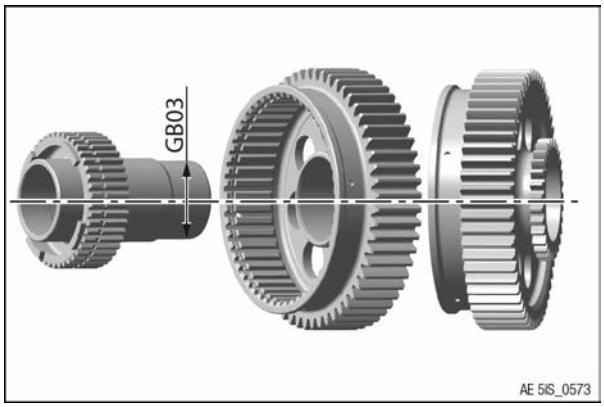


Figure 6.38

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

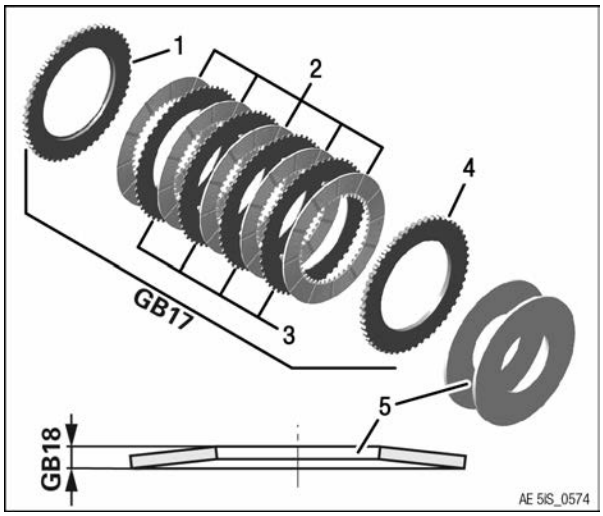


Figure 6.39

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

DAMPER CLUTCH — CHECK

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

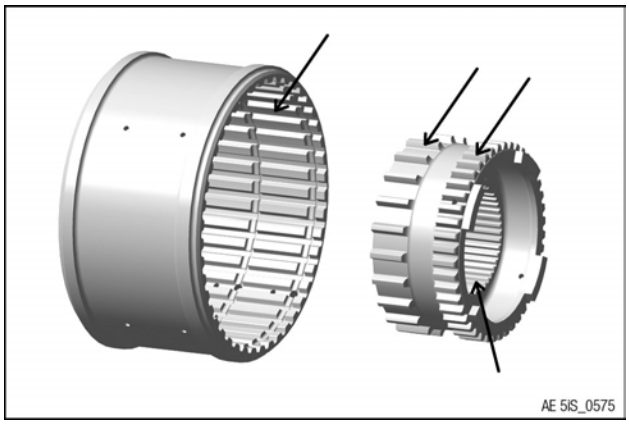


Figure 6.40

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

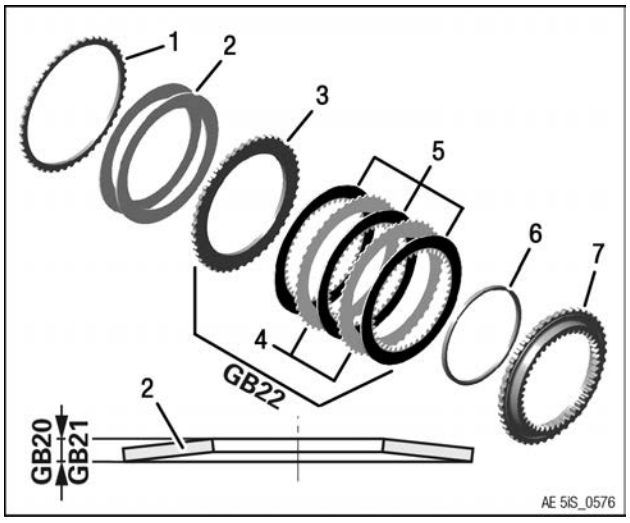


Figure 6.41

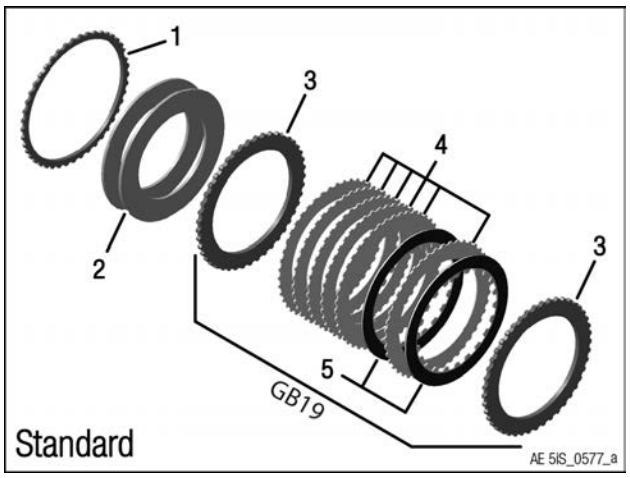


Figure 6.42

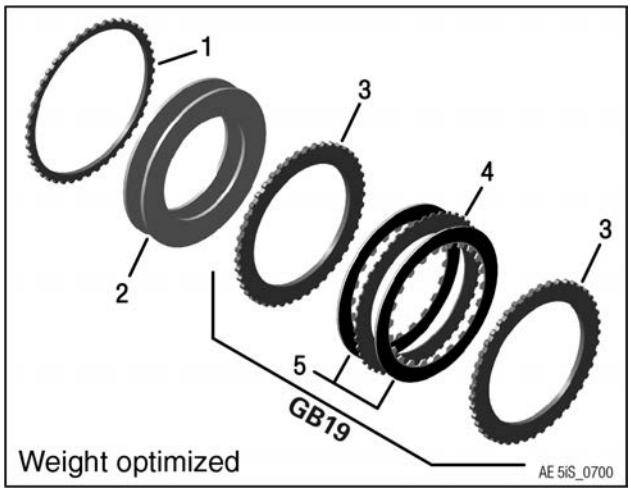


Figure 6.43

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

TORSION BAR - CHECK

ATTENTION

Torsion bar must not be reworked.

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

CHECKING THE SPLINES

There are 4 essential splined shaft connections in the gearbox.

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

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

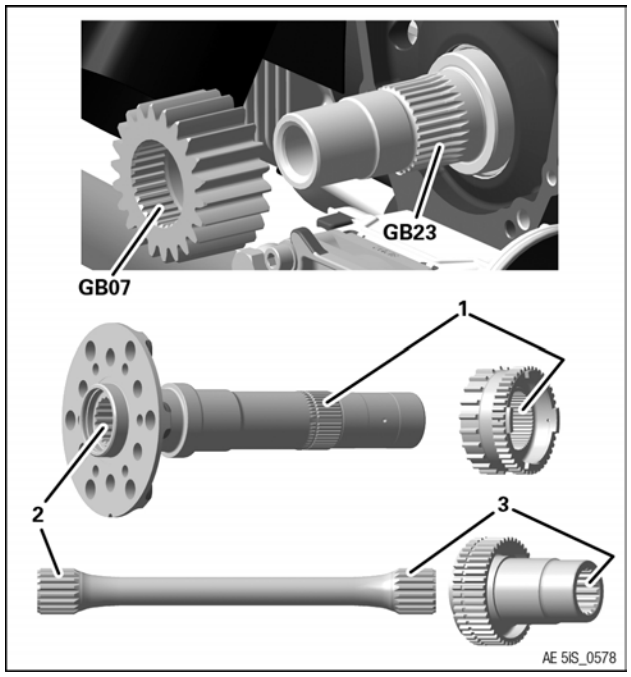


Figure 6.44

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

NOTE

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

GEAR SET CHECK (GEARS)

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

ATTENTION

Check all the tooth flanks for any damage or pitting.

NOTE

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

Pitting

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

NOTE

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

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

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

NOTE

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

PITTING, GENERAL INFORMATION

NOTE

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

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

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

NOTE

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

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

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

SLIGHT PITTING

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

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

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

NOTE

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

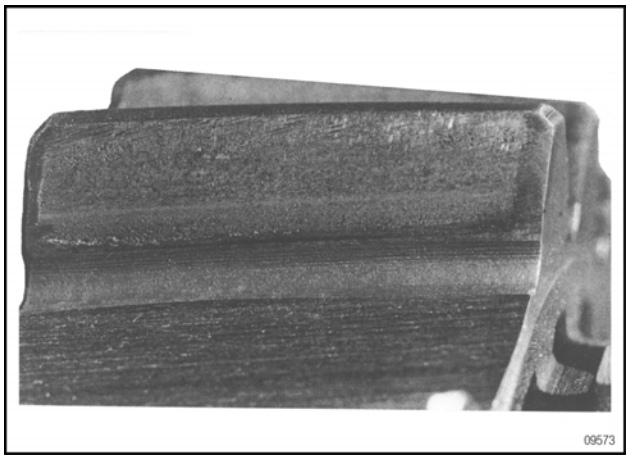


Figure 6.45: Magnification: approx. 2x

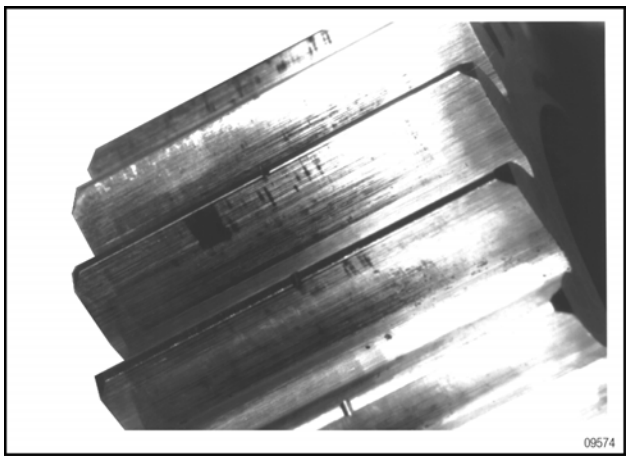


Figure 6.46: Magnification: approx. 1.5x

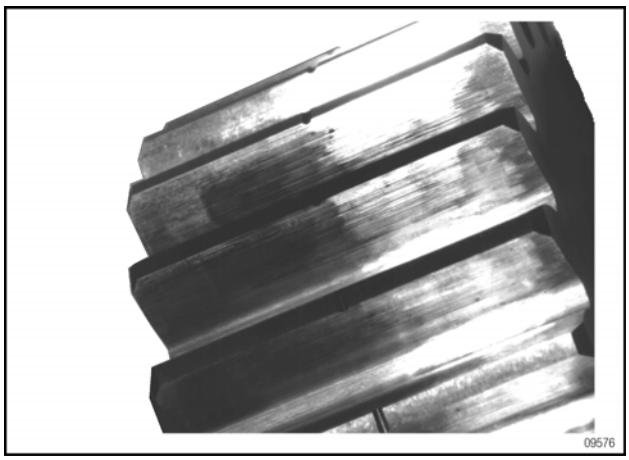


Figure 6.47: Magnification: approx. 1.5x

DESTRUCTIVE PITTING

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

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

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

ATTENTION

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

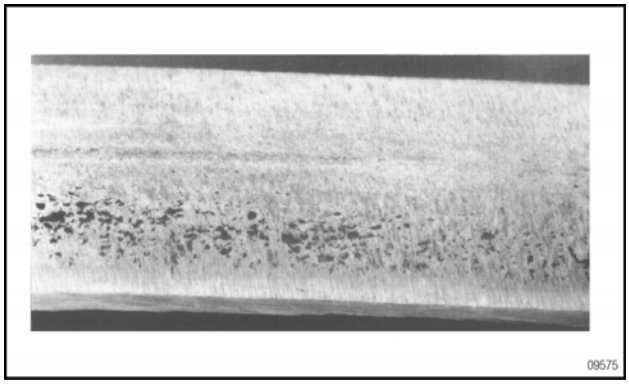


Figure 6.48: Magnification approx. 5x.

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

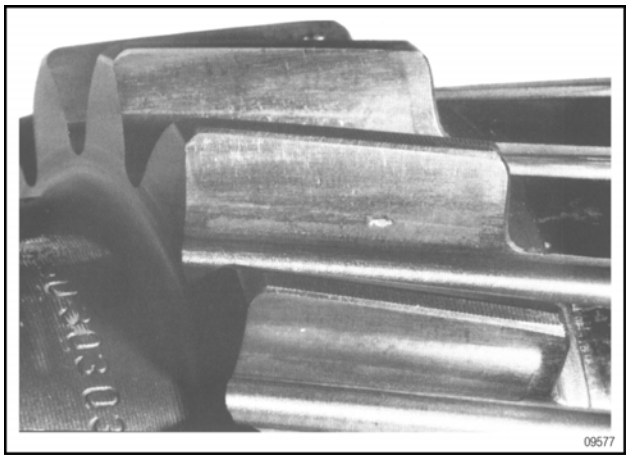


Figure 6.49: Magnification approx. 1.5x.

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

FLAKE PITTING (LARGE-AREA FLANK FRACTURES)

See the following figures.

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

ATTENTION

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

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

ATTENTION

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

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

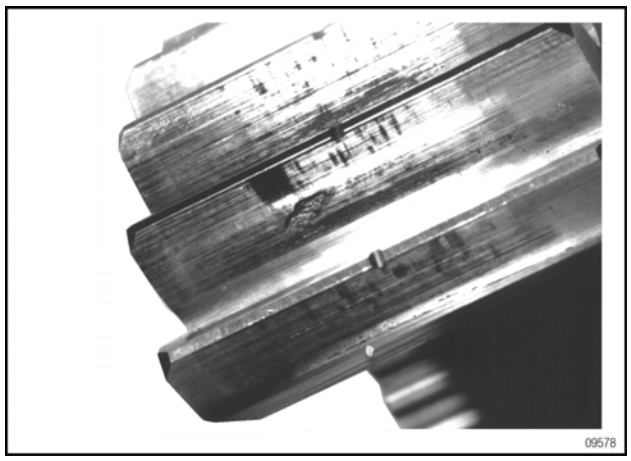


Figure 6.50: Magnification approx. 2x.

Triangular flake pitting

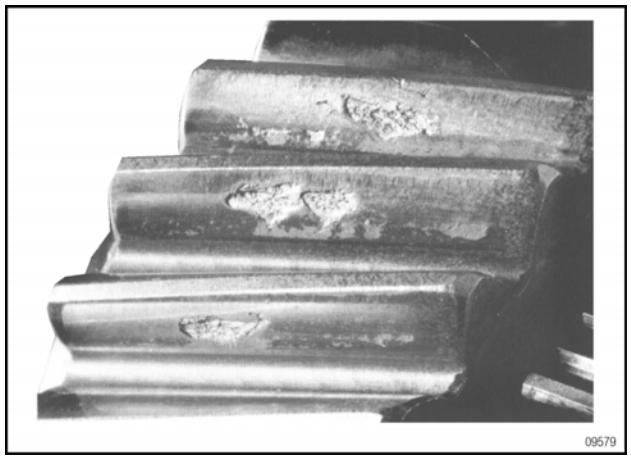


Figure 6.51: Magnification approx. 2x.

Triangular flake pitting

WEAR LIMITS

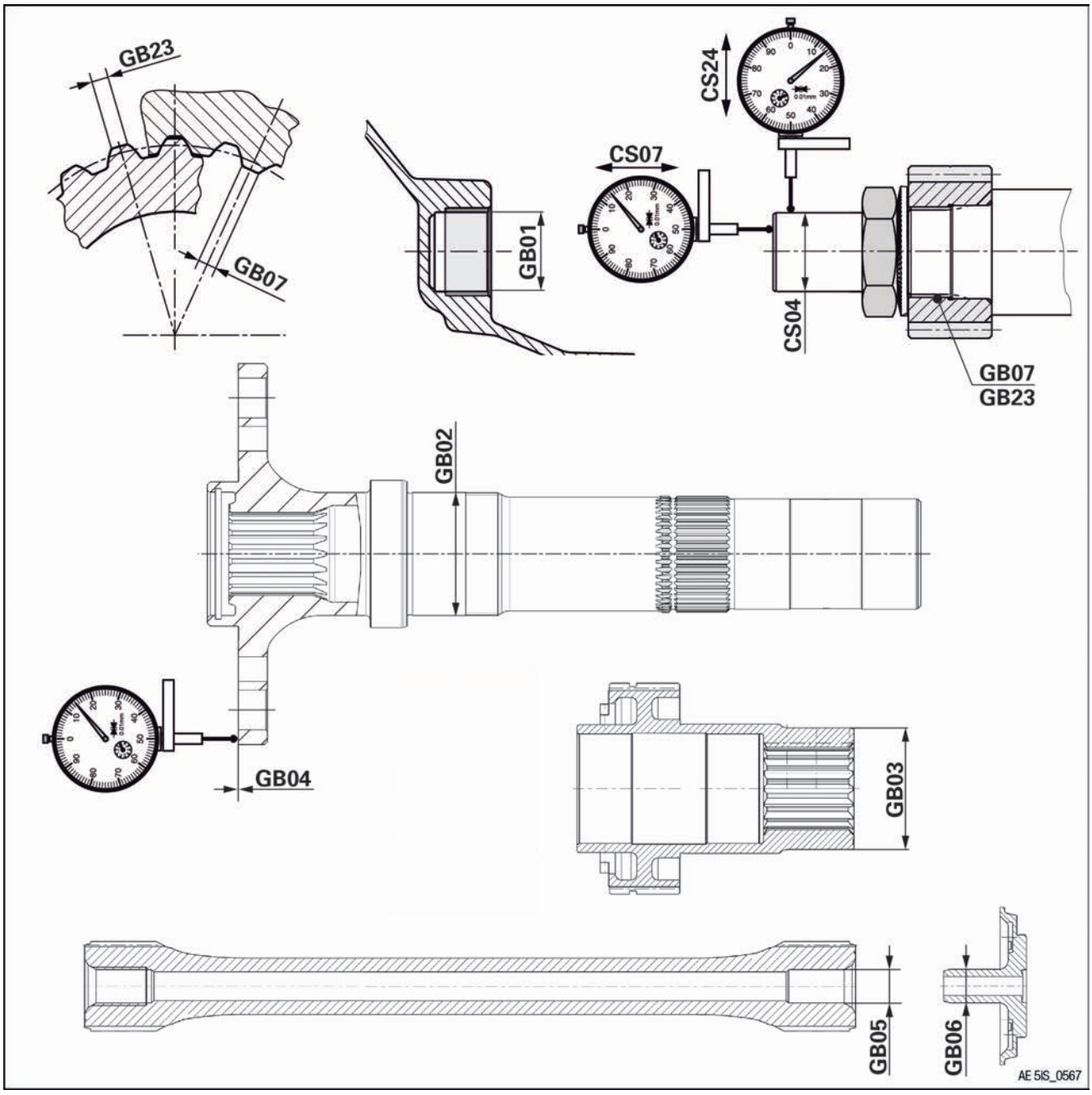


Figure 6.52

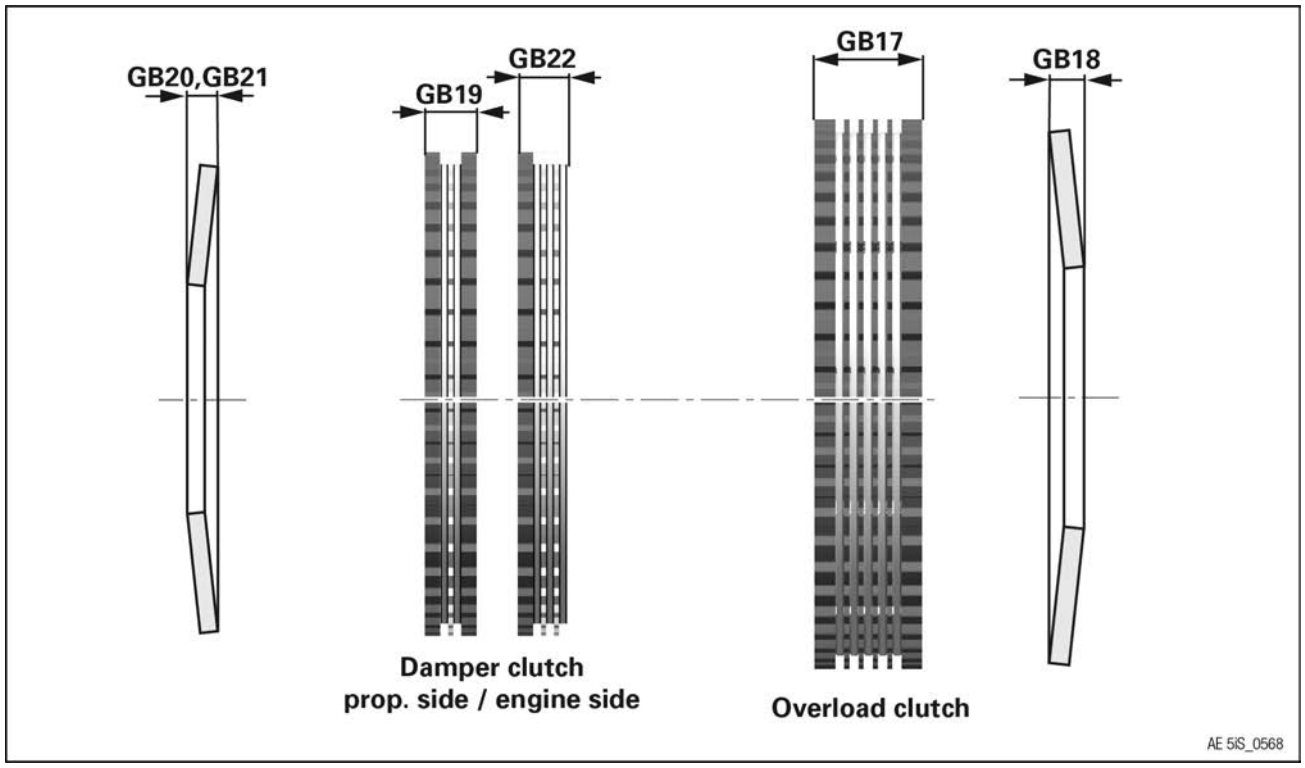


Figure 6.53

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

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

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Drive gear	GB07	0.95 mm 0.037 in.	1.00 mm 0.037 in.	0.80 mm 0.031 in.	0.88 mm 0.034 in.	current replaced	
7. Gear set							
Drive gear pitting up to 5% of flank area	GB14	0.0 %	0.0 %	5.0 %	2.5 %	current replaced	
Dog gear pitting up to 5% of flank area	GB15	0.0 %	0.0 %’	5.0 %	2.5 %	current replaced	
8. Overload clutch							
Height of clutch plates (4 frict., 5 steel 1mm, 2 steel thrust wash-er plates 4mm)	GB17	20.49 mm 0.807 in.	21.51 mm 0.847 in.	18.50 mm 0.728 in.	19.50 mm 0.768 in.	current replaced	
Free height of disc springs	GB18	6.50 mm 0.256 in.	6.80 mm 0.268 in.	6.00 mm 0.236 in.	6.25 mm 0.246 in.	current replaced	
9. Damper clutch							
Height of clutch plates prop-side 1 (3 frict, 2 steel, 1mm, 1 steel 3mm)	GB22	9.30 mm 0.575 in.	9.94 mm 0.613 in.	8.90 mm 0.350 in.	9.10 mm 0.358 in.	current replaced	
Free height of disc springs prop-side	GB20	3.34 mm 0.131 in.	3.55 mm 0.140 in.	3.10 mm 0.122 in.	3.22 mm 0.127 in.	current replaced	

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

ASSEMBLY

Preparation

⚠ WARNING

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

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

INSTALLATION OF THE BALL BEARING

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

NOTE

Lubricate sealing lips with engine oil.

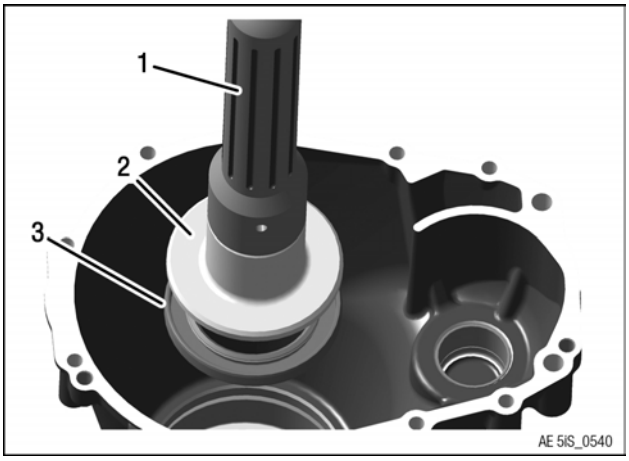


Figure 6.54

1 Insertion jig 877650
2 Press-in mushroom 276964
3 Oil seal

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

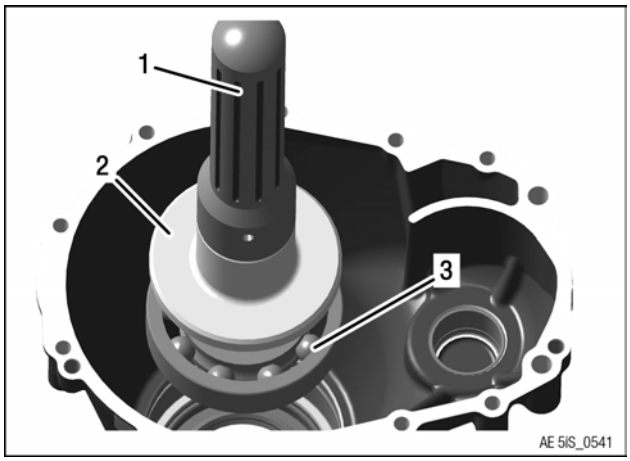


Figure 6.55

1 Insertion jig 877650
2 Press-in mushroom 276966
3 Ball bearing

Step	Procedure
3	Install the retaining ring with circlip pliers.

NOTE

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

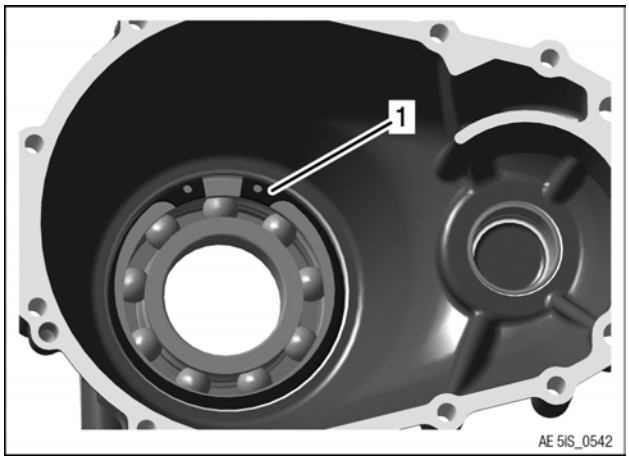


Figure 6.56

1 Retaining ring

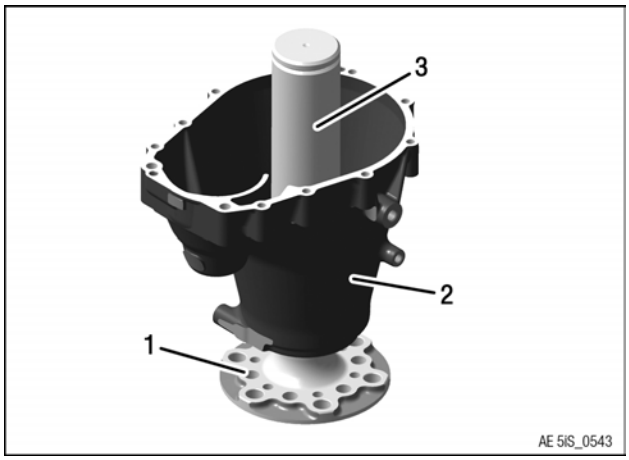


Figure 6.57

1 Propeller shaft *2 Propeller gearbox*

3 Special tool 276972

PROPELLER SHAFT — INSTALLATION

Preparation

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

Step	Procedure
1	Press propeller shaft into gearbox housing using the special tool part no. 276972. **NOTE** *Do not use high forces for propeller shaft installation, only press-in with the special tool part no. 276972.*
2	Install gearbox on support plate part. no. 276958, fix both in the bench vice.
3	Secure M40x1.5 collar nut with LOCTITE 648 and tighten it. with a special tool part no. 276006. Tightening torque 150 Nm (111 ft.lb.).

NOTE

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

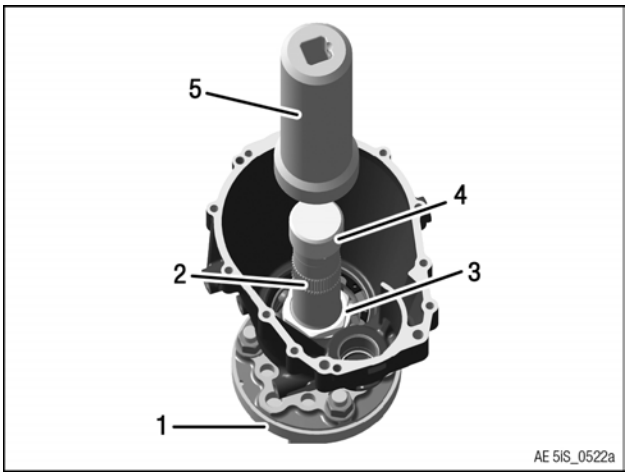


Figure 6.58

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

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

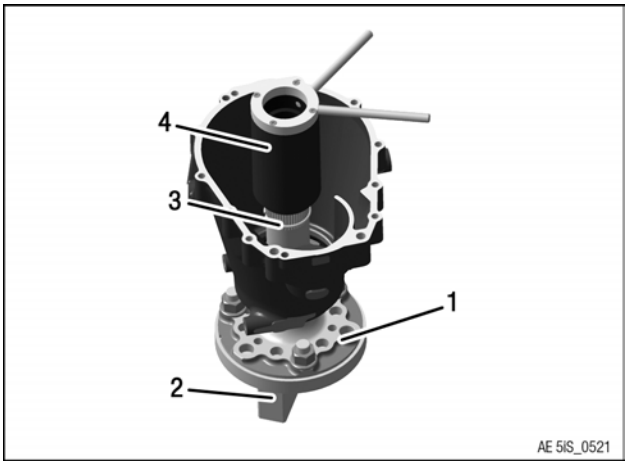


Figure 6.59

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

TORSION SHAFT — INSTALLATION

ATTENTION

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

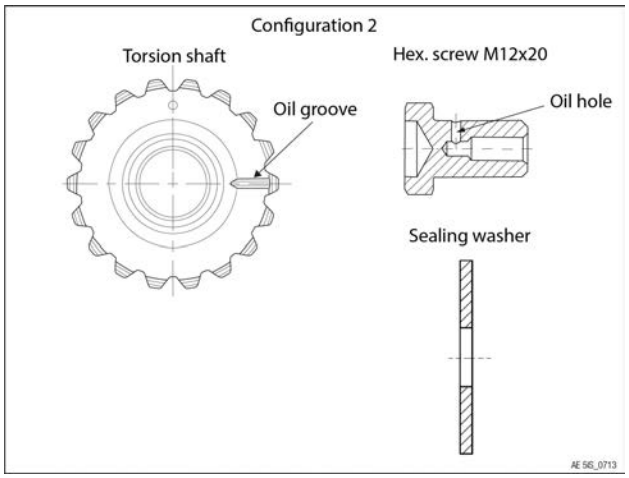


Figure 6.60

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

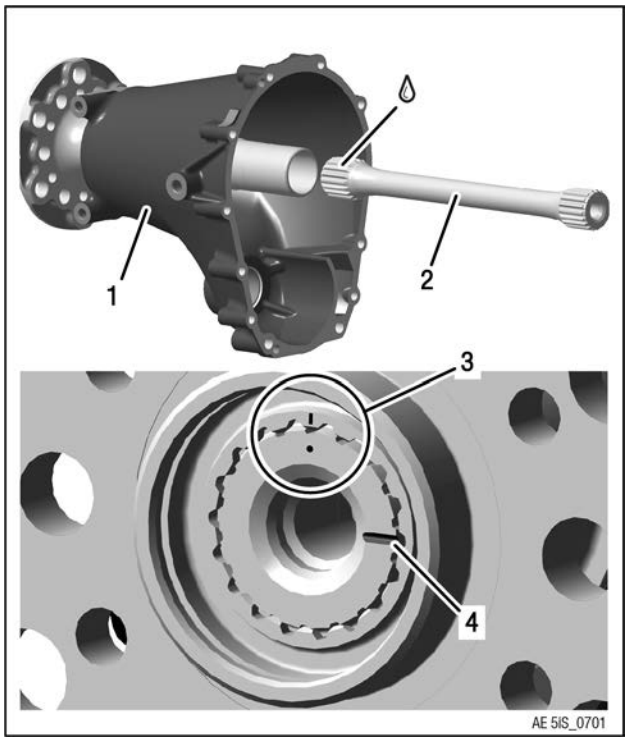


Figure 6.61

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

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

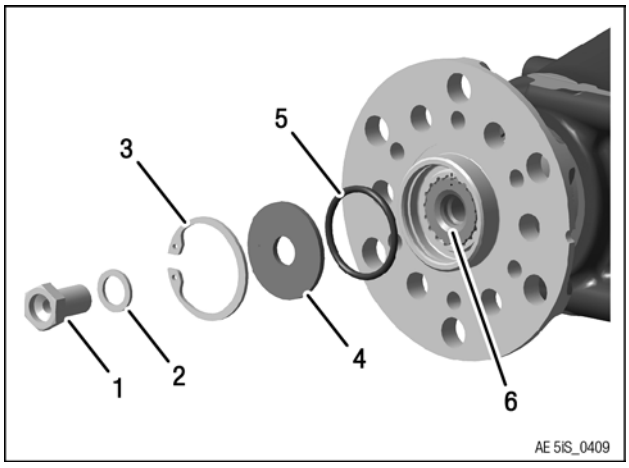


Figure 6.62: TYPICAL

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

ATTENTION

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

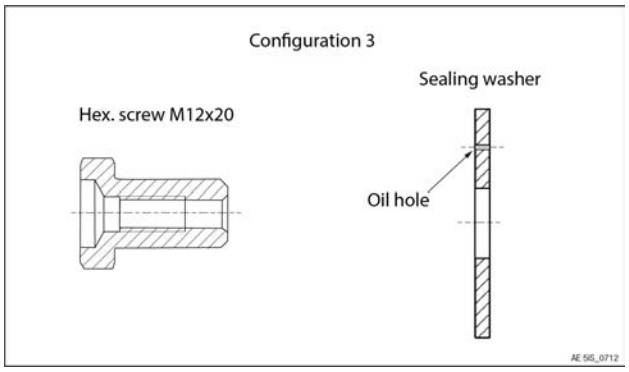


Figure 6.63

ASSEMBLY OF THE OVERLOAD CLUTCH ASSY.

NOTE

Use a hand operated hydraulic press or similar.

NOTE

Lubricate all components with engine oil before assembly.

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

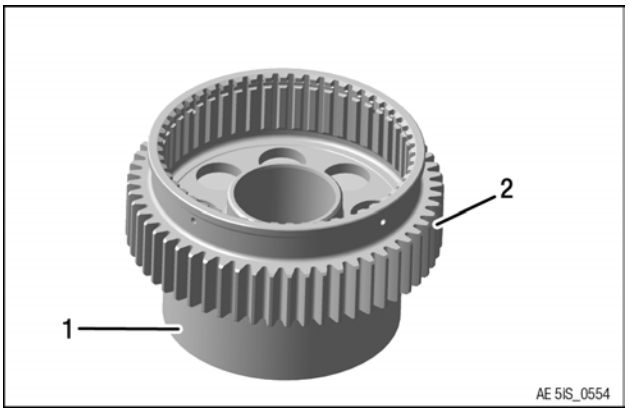


Figure 6.64

1 Insertion jig *2 Overload clutch assy.*

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

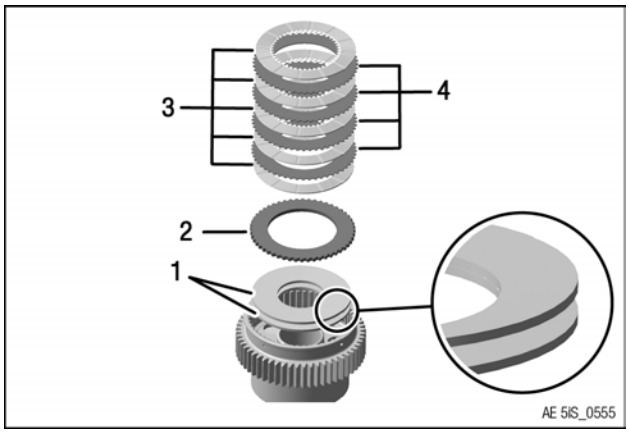


Figure 6.65

1 Disc springs (contrary) *2 Steel friction plate 3mm*

3 Sintered friction plates (5 pcs.) *4 Steel friction plates 1mm(4 pcs.)*

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

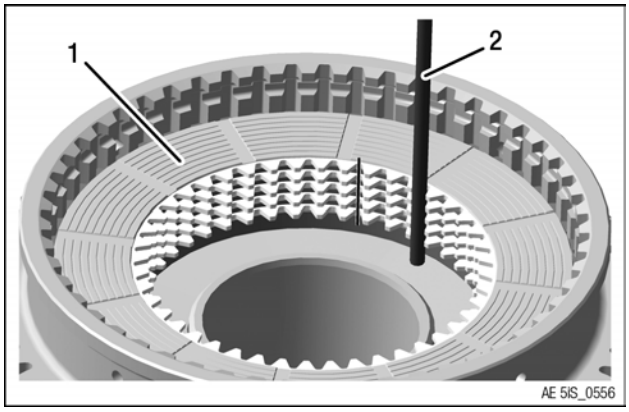


Figure 6.66

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

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

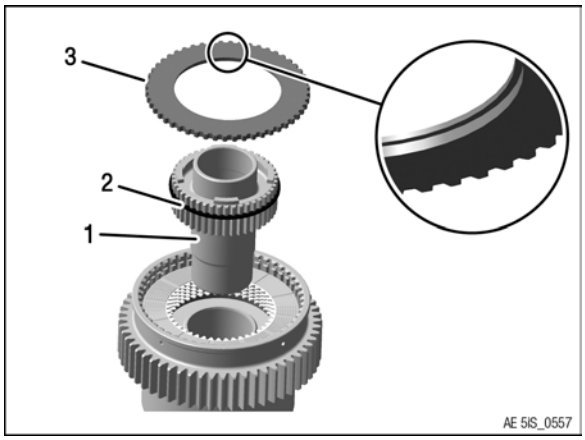


Figure 6.67

1 Clutch hub *2 Support ring*

3 Steel friction plate 4 mm

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

NOTE

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

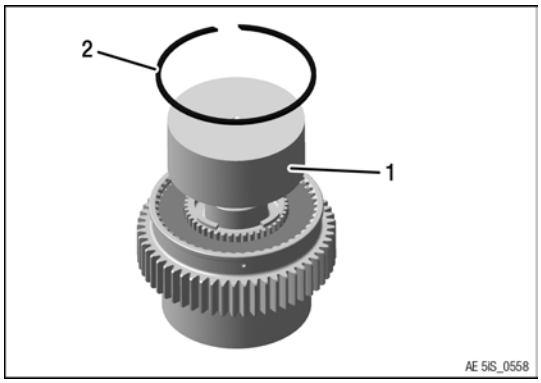


Figure 6.68

1 Insertion jig *2 Support ring*

ASSEMBLY OF THE DAMPER CLUTCH ASSY.

NOTE

Use a hand operated hydraulic press or similar.

NOTE

Before assembly, lubricate all components with engine oil.

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

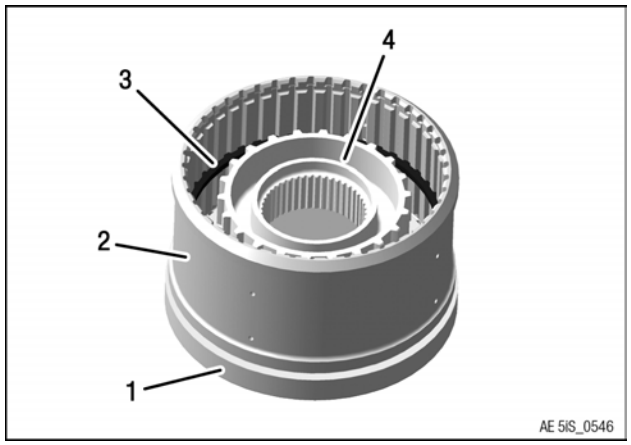


Figure 6.69

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

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

STANDARD VERSION

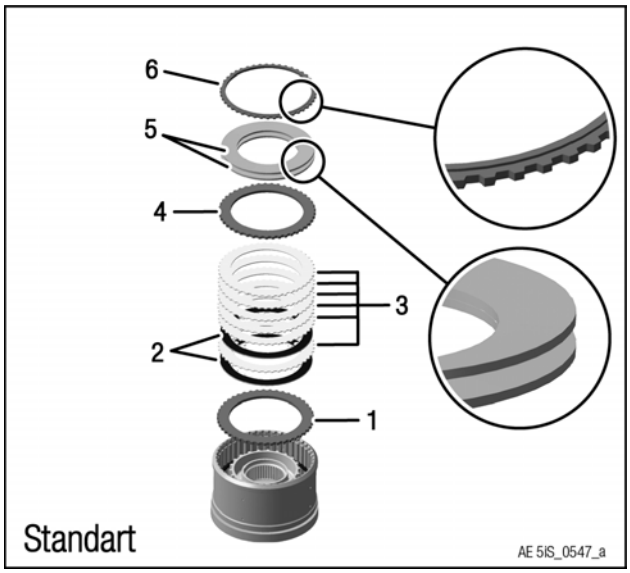


Figure 6.70

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

WEIGHT OPTIMIZED VERSION

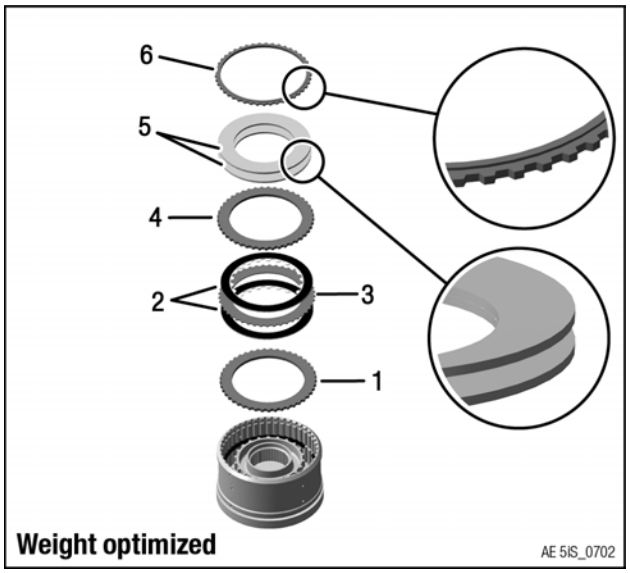


Figure 6.71

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

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

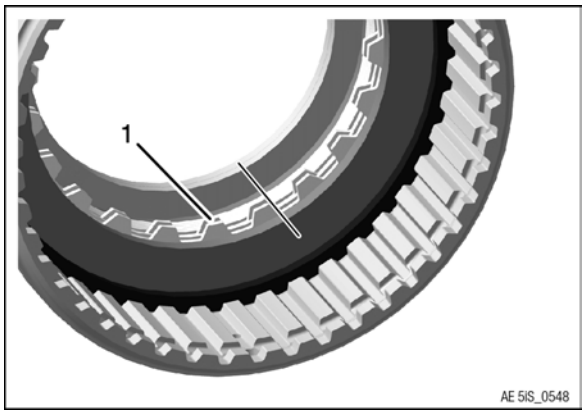


Figure 6.72: TYPICAL

1 Friction plates

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

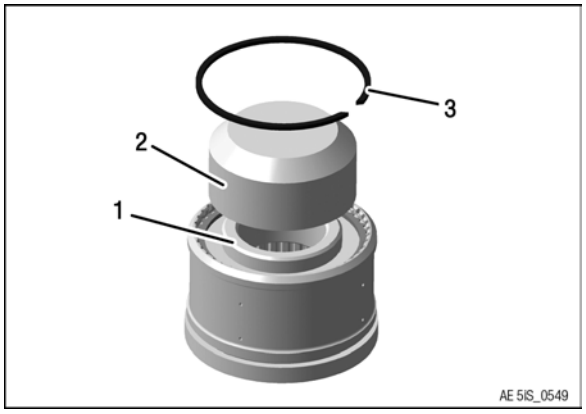


Figure 6.73: TYPICAL

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

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

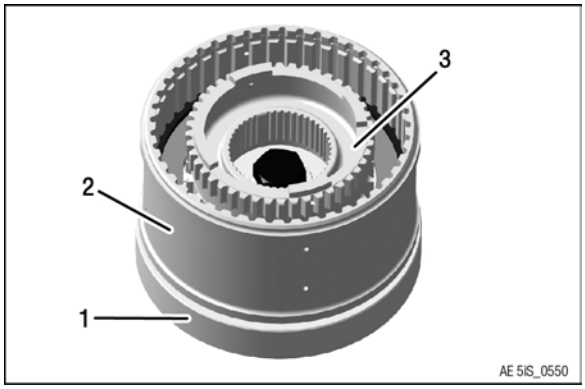


Figure 6.74: TYPICAL

1 Centering plate *2 Clutch drum*

3 Clutch hub

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

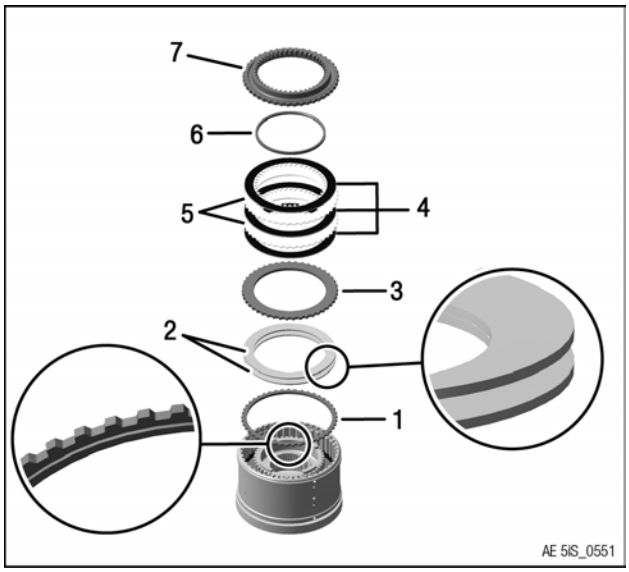


Figure 6.75: TYPICAL

1 Support ring *2 Disc springs (contrary)*

3 Steel friction plate 3 mm *4 Sintered friction plates (3 pcs.)*

5 Steel friction plates 1 mm (2 pcs.) *6 Spacer ring*

7 Driving collar

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

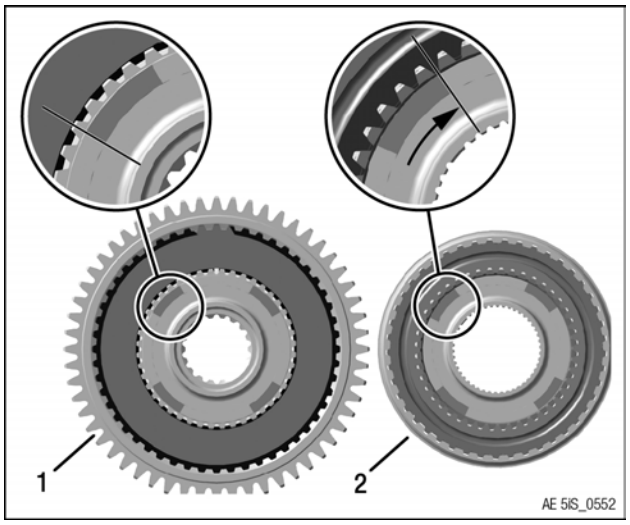


Figure 6.76

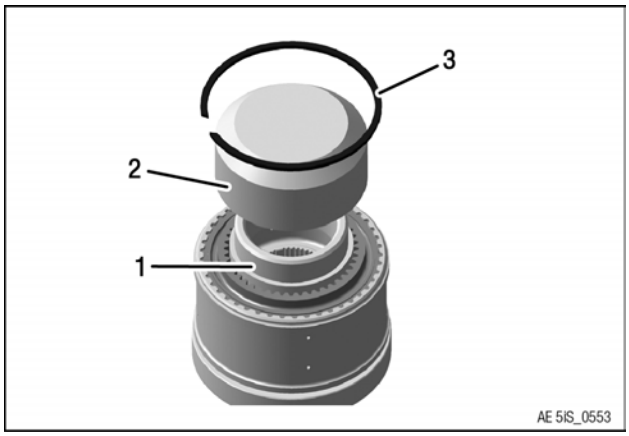
1 Overload clutch *2 Damper clutch assy.*

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

ATTENTION

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

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



1 Clutch hub *2 Insertion jig*
3 Circlip

Figure 6.77: TYPICAL

ASSEMBLY OF THE PROPELLER GEARBOX ASSY.

Damper clutch— installation

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

NOTE

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

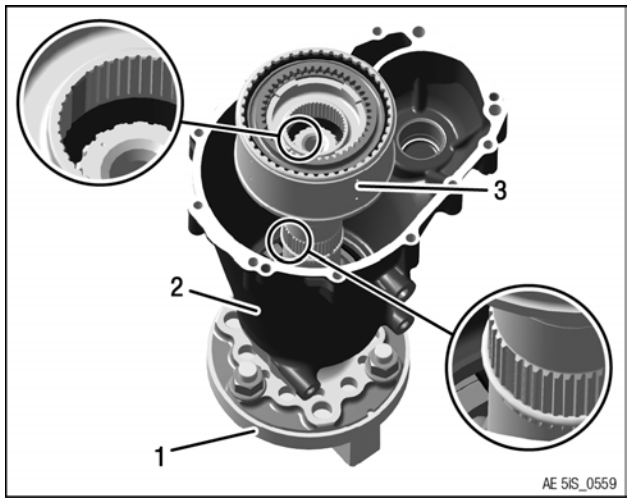


Figure 6.78

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

Overload clutch — installation

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

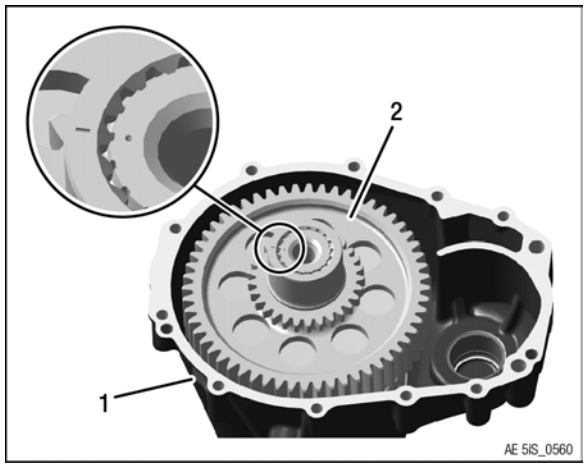


Figure 6.79

1 Gearbox
2 Overload clutch

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

NOTE

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

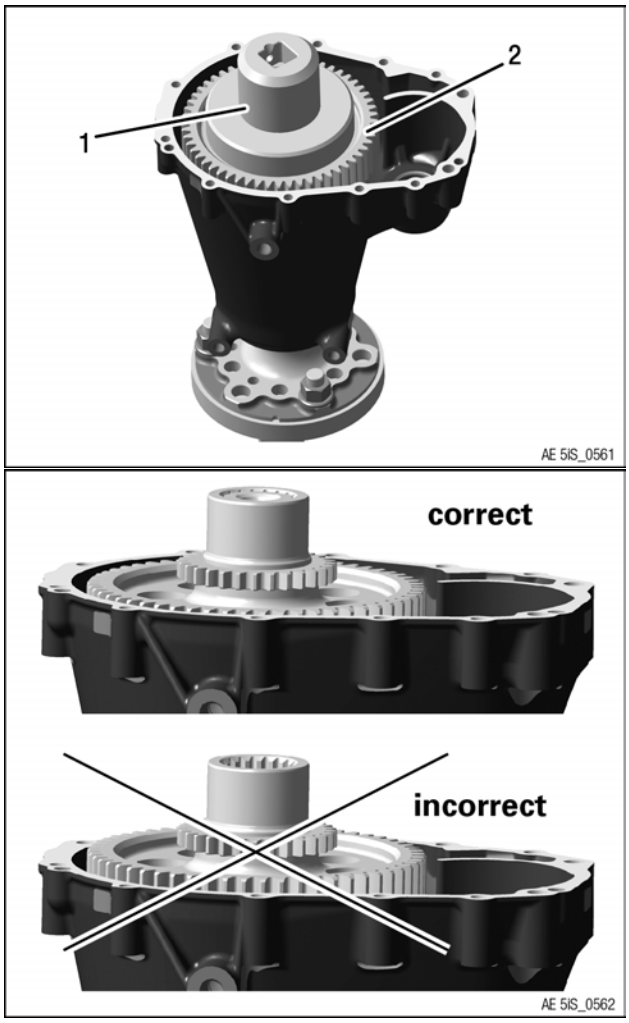


Figure 6.80

1 Special tool 276962 *2 Overload clutch*

INSTALLATION

BLINDING SHIM – INSTALLATION

CONFIGURATION 2

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

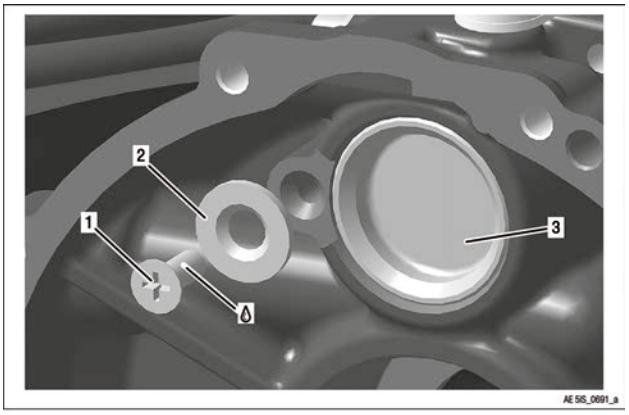


Figure 6.81

1 Countersunk screw M5x12 *2 Thrust washer*

3 Blinding shim

OIL INLET FLANGE— INSTALLATION

CONFIGURATION 3

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

NOTE

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

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

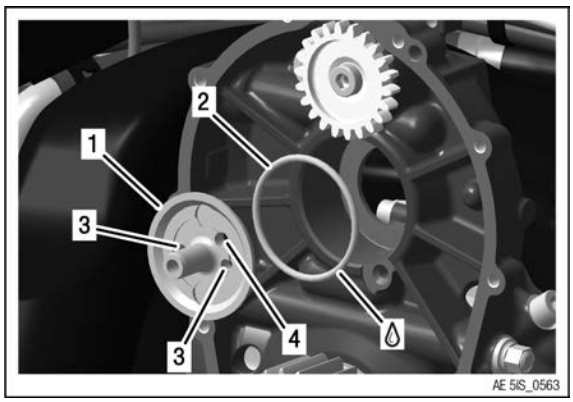


Figure 6.82

1 Oil inlet flange *2 O-ring*

3 M6 threaded bores *4 Scavenge oil hole*

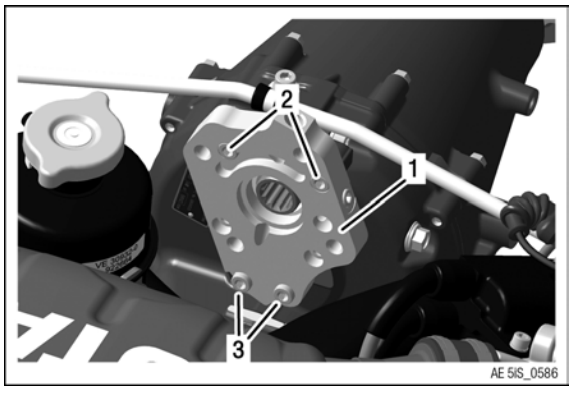


Figure 6.83

1 Governor flange *2 M6x20 Allen screws*

3 M6x16 Allen screws

CONFIGURATION 2

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

NOTE

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

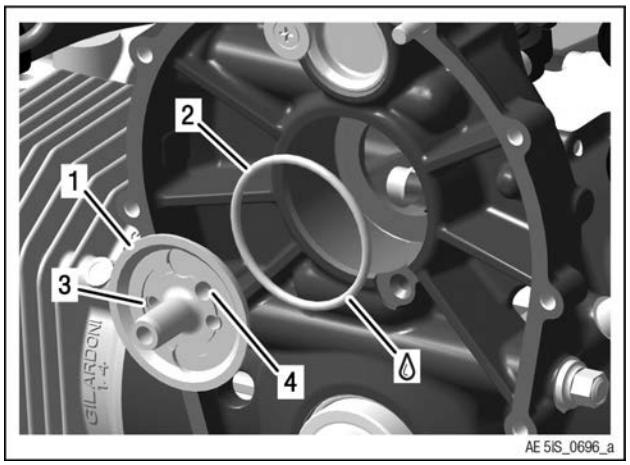


Figure 6.84

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

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

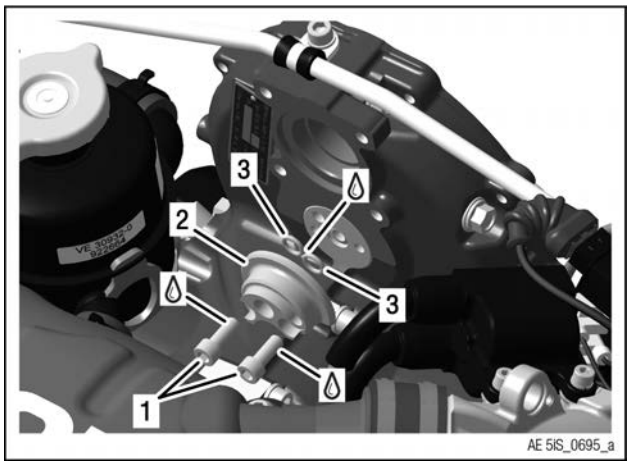


Figure 6.85

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

NEEDLE BEARING – INSTALLATION

CONFIGURATION 3 AND 2

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

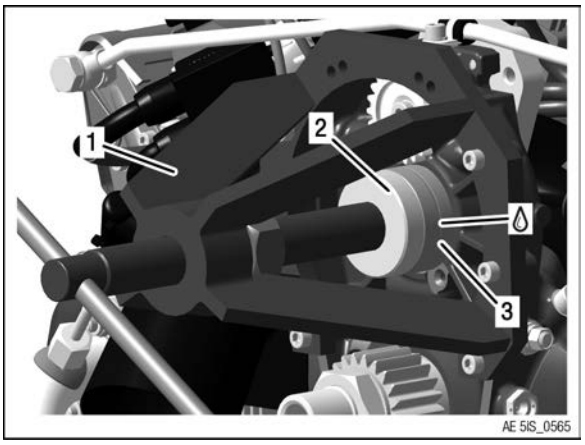


Figure 6.86: TYPICAL

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

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

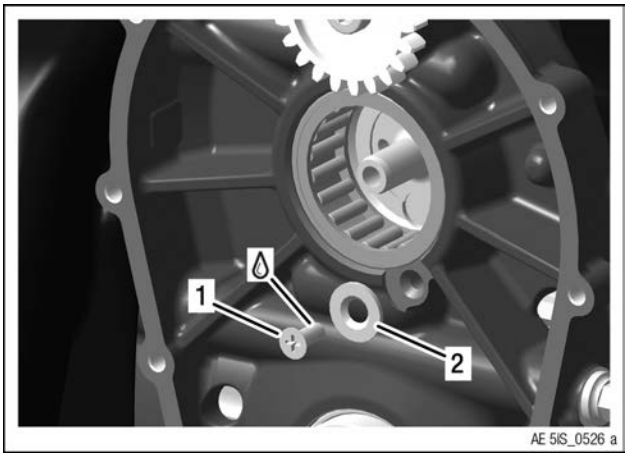


Figure 6.87: TYPICAL

1 M5x12 countersunk screw
2 Washer

CONFIGURATION 2

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

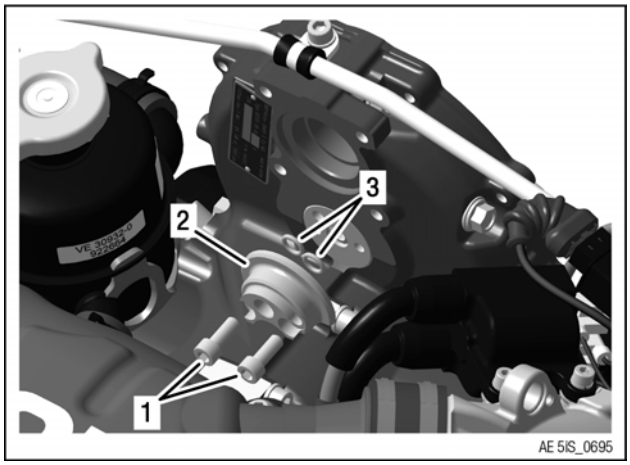


Figure 6.88

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

GEARBOX OIL LINE ASSY – INSTALLATION

CONFIGURATION 2

For configuration 3 see Chapter 61-20-00.

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

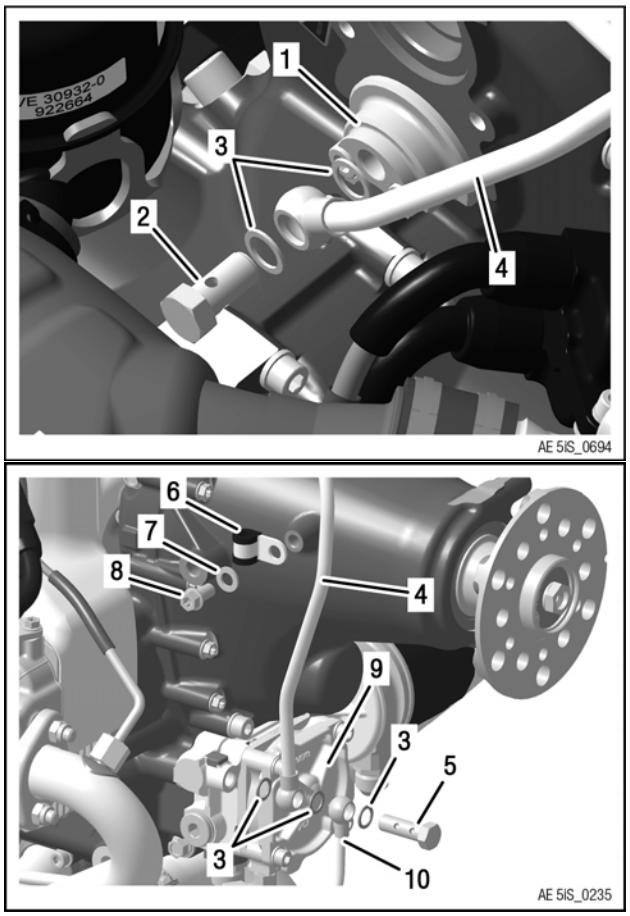


Figure 6.89

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

FINISHING WORK

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

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

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

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

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

INTENTIONALLY LEFT
BLANK

SYSTEM DESCRIPTION

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

SAFETY INSTRUCTION

⚠ WARNING

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

MAINTENANCE

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

REMOVAL

Preparation

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

CYLINDER AND PISTON — REMOVAL

NOTE

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

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

NOTE

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

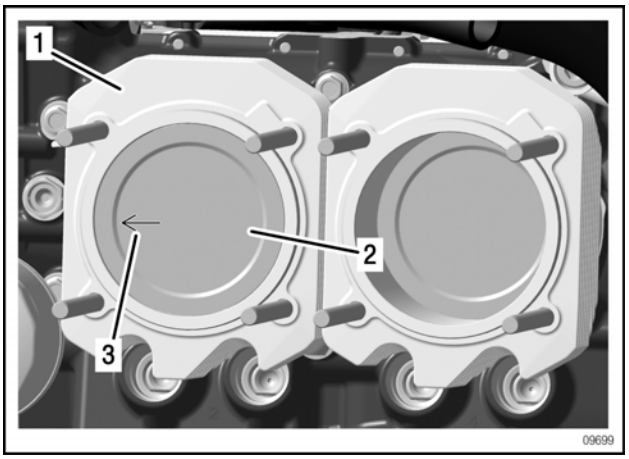


Figure 9.3

1 Cylinders *2 Pistons*

3 Marking arrow

ATTENTION

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

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

ATTENTION

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

⚠ WARNING

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

ATTENTION

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

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

POP OFF VALVE — INSTALLATION

Reduction sleeve - installation (if necessary)

- Install air intake hose and the hose to intercooler and fix with clamps.
- Install low pressure hose and fix with hose clamp.

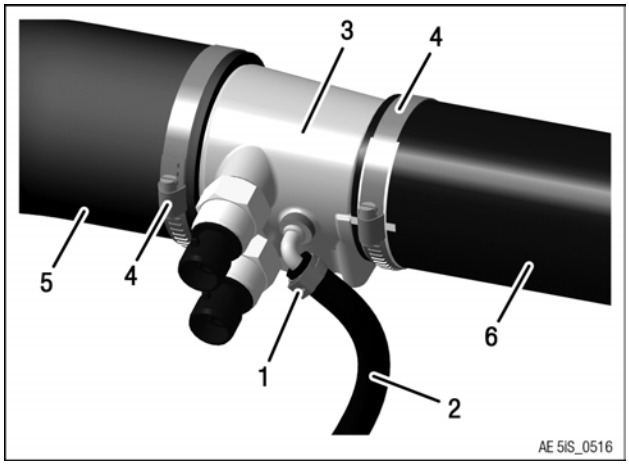
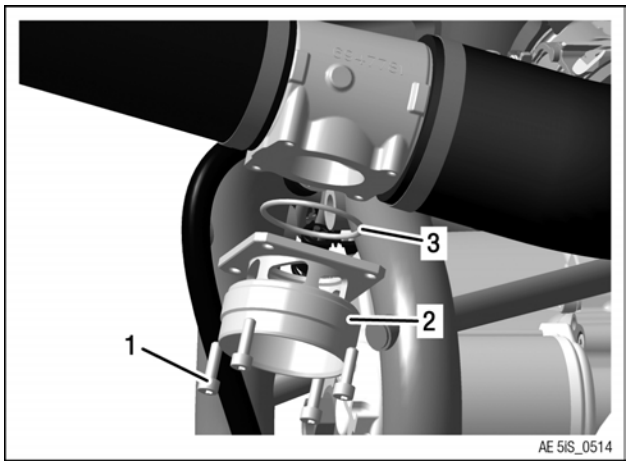


Figure 11.85

1	*Hose clamp (low pressure hose)*	*2*	*Low pressure hose*
3	*Reduction sleeve*	*4*	*Clamps (intercooler / air intake)*
5	*Air intake hose*	*6*	*Intercooler hose*

Step	Procedure
1	Install valve housing with new O-ring on reduction sleeve using 4 M5x16 Allen screws. Tightening torque 5 Nm (44 in. lb).



1	*M5x16 Allen screw*	*2*	*Valve housing*
3	*O-ring*		

Figure 11.86

Step	Procedure
2	Insert new O-ring 38x2.4 into the O-ring groove of the valve cover.

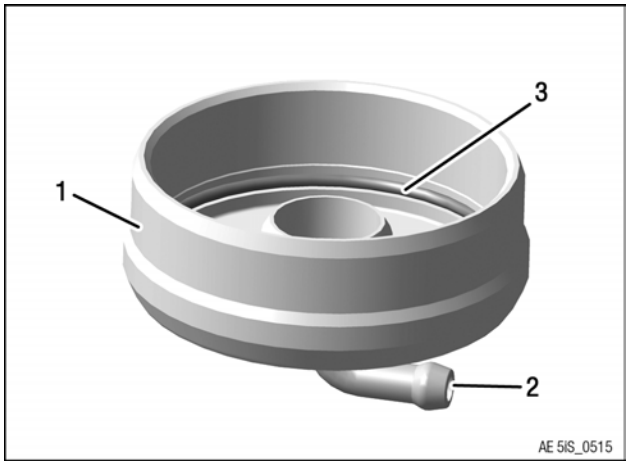


Figure 11.87

1	*Valve cover*	*2*	*Hose nipple*
3	*O-ring*		

Step	Procedure
3	Insert valve piston and valve spring. Install the valve cover.

NOTE

If the hose nipple of the valve cover points to the wrong direction, the valve housing can be unscrewed and displaced by 90°.

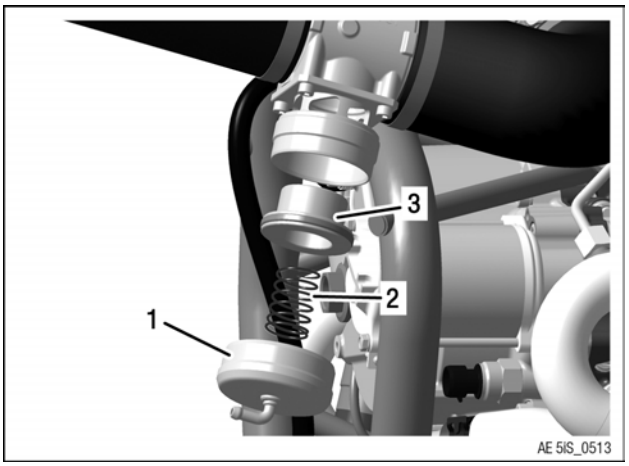
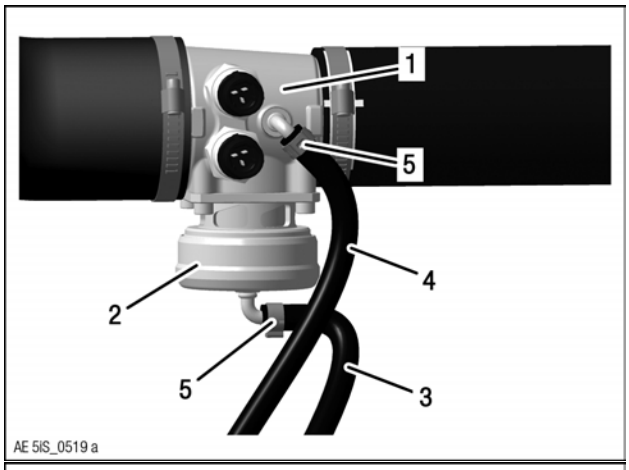


Figure 11.88

1 Valve cover
2 Valve spring
3 Valve piston

Step	Procedure
4	Install low pressure hoses and fix with hose clamps.



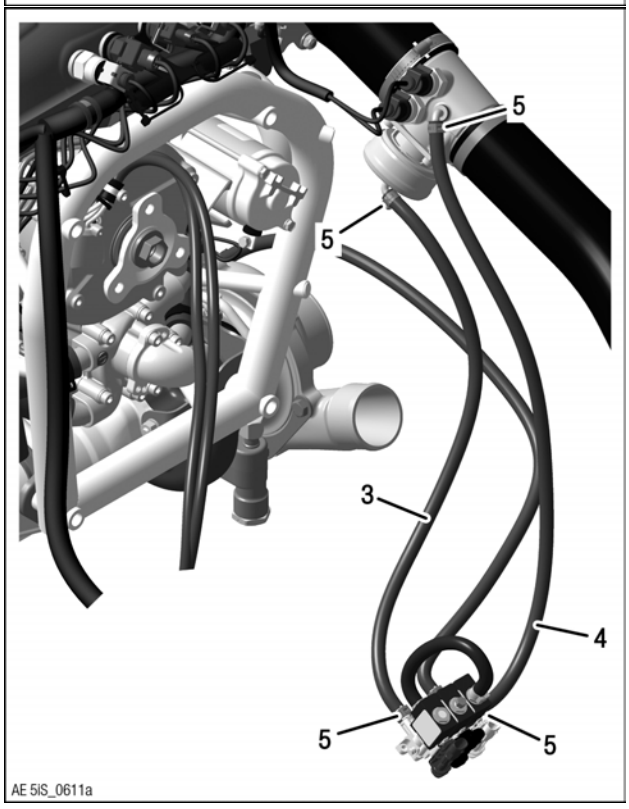


Figure 11.89

1 Reduction sleeve
2 Valve cover
3 Low pressure hose (valve cover)
4 Low pressure hose (reduction sleeve)
5 Hose clamp

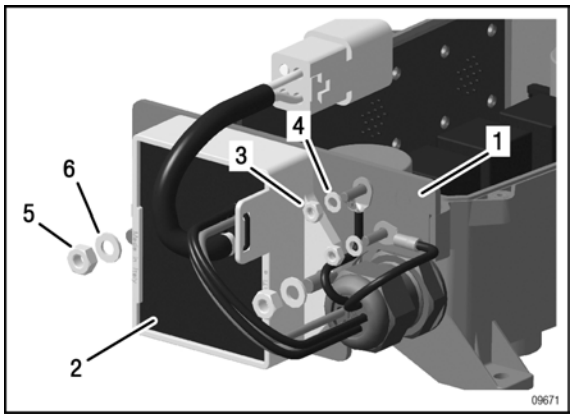


Figure 16.7: TYPICAL

1	*Regulator plate*	*2*	*Regulator B*
3	*Lock nut M4*	*4*	*Washer 4.3*
5	*Lock nut M6*	*6*	*Washer 6.4*

Step	Procedure
8	Pull the 2 RED-WHITE and the 4 BLACK cables with grommet out of the fuse box. To pull out the cables easily, avoid bending the ring terminals.

NOTE

The connecting thread of sealing union must not be dismantled, if you replace the regulator. An exchange of this plastic insert is only necessary if it is damaged.

Step	Procedure
9	Remove the regulator.

NOTE

Be careful when handling the dismantled regulator. On the back side of the regulator and the regulator plate thermal paste can adhere.

REGULATOR A — REMOVAL

- The regulator A is removed analogously to regulator B.

ATTENTION

The pin assignment of the ground cable is different for regulator A and B.

NOTE

Wrench size of the gasket screw connection: A/F 25.

INSTALLATION

- The regulator is installed and removed in the same way. The following should be noted.

NOTE

If the wire is broken or the connector is defective, the damage can be repaired. The wire must be long enough if the connector is cut off. Repair with the tools described here must comply with the aircraft standard of the respective country.

Part no. from the Connector Set	Associated Tool
866420 (black)	DEUTSCH HDT-48 - 00
866422 (gray)	
481510 (Amphenol)	DMC® AF8 / DMC® UH2-5 / DMC® QXRT08 or equivalent

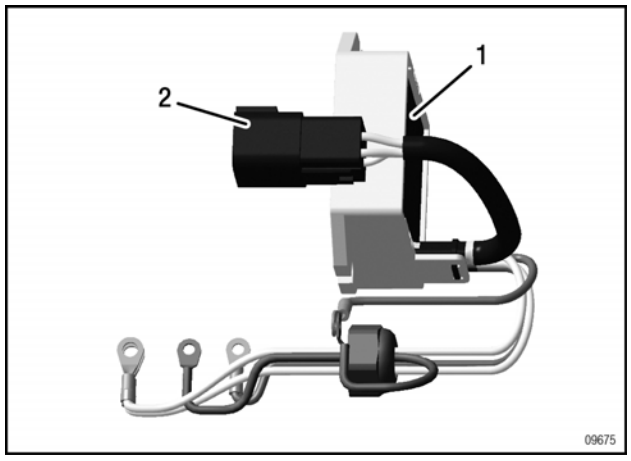


Figure 16.8

1 Regulator A
2 DEUTSCH connector (black)

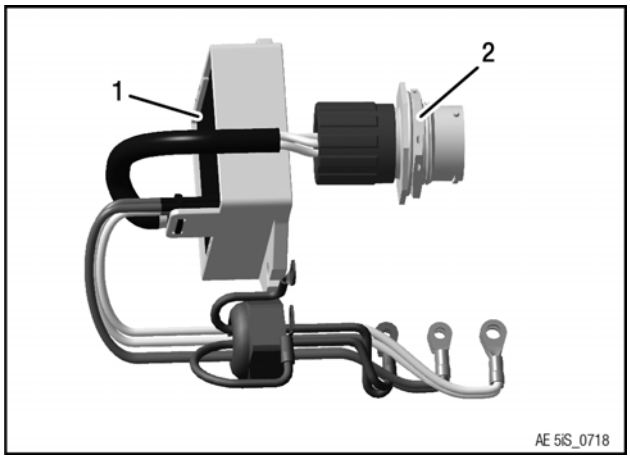


Figure 16.9

1 Regulator B
2 Amphenol connector

ATTENTION

All hex nuts (self-locking) must be replaced after each removal (e.g. replacement of a regulator).

REGULATOR B — INSTALLATION

ATTENTION

The adhesive surface on the back of the regulator must be cleaned before applying the heat transfer pads. Remove the protective film with caution, because rapid stripping can damage the heat transfer pad.

Step	Procedure
1	Clean the regulator plate: Remove residues of the thermal paste or the heat transfer pads.
2	Bonding the heat transfer pad to the rectifier regulator: Remove the protective film from heat transfer pad and stick the heat transfer pad with the adhesive surface onto the rectifier regulator (avoid any folds or bubbles).

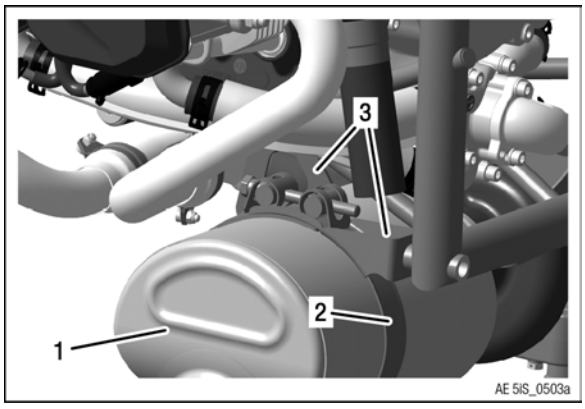


Figure 21.24

1 Muffler assy. *2 Tension clamp*

3 Exhaust bracket

Step	Procedure
4	Install exhaust manifold using Allen screws M8x30 with hex. nuts M8 and washers. Apply LOCTITE ANTI SEIZE to the screws. Tightening torque 25 Nm (18 ft. lb).

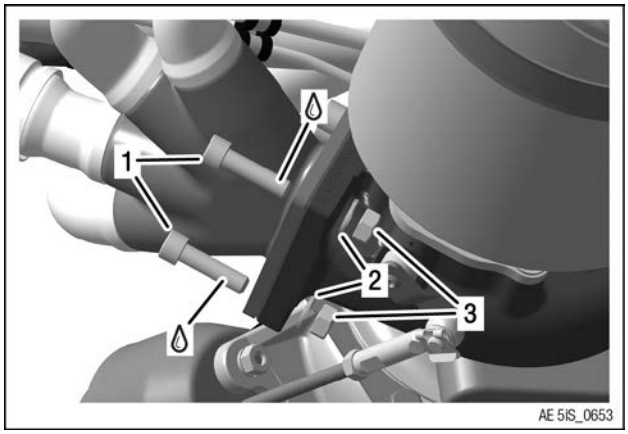


Figure 21.25

1 Screws stainless steel M8x30 *2 Washer stainless*

3 M8 hex. nut stainless

Step	Procedure
5	Re-establish attachment (turbocharger bracket engine suspension frame (not supplied with engine). Tightening torque as specified by the aircraft manufacturer.
6	Install spring and ball of pressure oil line, see Chapter 79-00-00 Oil line (steel line) installation.
7	Re-connect the two oil lines for turbo-charger on the oil pump, see Chapter 79-00-00 Oil line (steel line) installation.
8	Install turbo suction oil line with clamp, M5x20 screw and new M5 lock nut on turbocharger bracket, see Chapter 79-00-00 Oil line (steel line) installation.
9	Install hose on wastegate regulator assy.

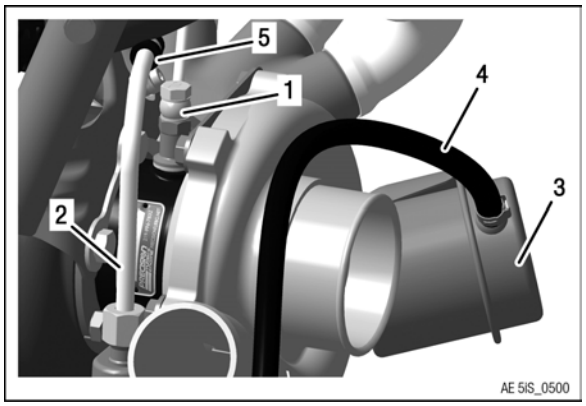


Figure 21.26

1 Turbo pressure line *2 Suction oil line*

3 Wastegate regulator *4 Hose (wastegate regulator)*

5 Cable clamp

NOTE

If the location of the oil line connection does not correspond with oil pump housing, correction can be achieved by slightly turning the turbocharger center section.

After completion of installation as described, all the screw connections on the turbocharger bracket, exhaust manifold, exhaust bends and the tension clamp must be tightened to the specified torques.

Description	Application	Tightening torque
Allen screw M8x30	Turbo flange	25 Nm / 18 ft. lb
Allen screw M10x50	Turbocharger bracket	60 Nm / 44 ft . lb
Allen screw M10x50	Exhaust bracket	60 Nm / 44 ft . lb
Hex. screw M10	Tension clamp	20 Nm / 15 ft . lb

ATTENTION

In the high temperature zone of the turbocharger and exhaust system, use exclusively high grade, stainless steel screws.

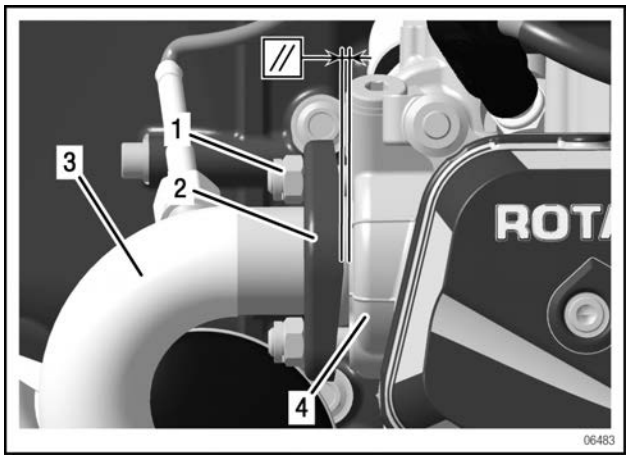


Figure 21.27

1 Hex. nut M8
2 Exhaust flange
3 Exhaust pipe
4 Cylinder head

WASTEGATE REGULATOR ASSY.—INSTALLATION

ATTENTION

Check for leakage of the wastegate regulator assy. before installation.

Step	Procedure
1	Install wastegate regulator assy. and heat shield with two collar nuts with washers onto the turbocharger housing. **NOTE** *The heat shield must be positioned to provide maximum shielding of radiant heat from the exhaust system. The heat shield must point towards the exhaust manifold.*

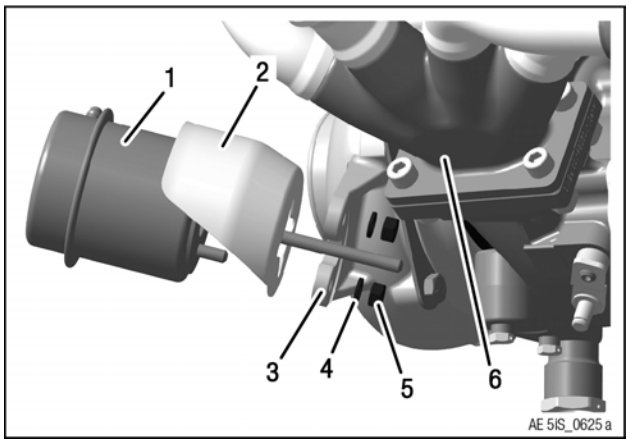


Figure 21.28

1	*Wastegate regulator assy.*	*2*	*Heat shield*
3	*Turbocharger housing*	*4*	*Washer*
5	*Collar nut*	*6*	*Exhaust manifold*

Step	Procedure
2	Mount locking nut and rod end.

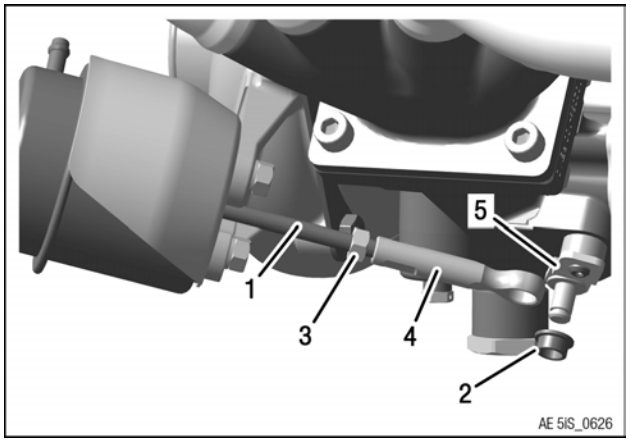


Figure 21.29

1	*Rod*	*2*	*Bushing*
3	*Locking nut*	*4*	*Rod end*
5	*Wastegate lever*		

Step	Procedure
3	Lubricate the bushing with LOCTITE ANTI SEIZE 8151 or equivalent.
4	Place the bushing onto the wastegate lever shaft with the bushing collar facing towards the wastegate lever.
5	Press wastegate lever to closed position and hold it.
6	Adjust the rod end so, that the wastegate is in closed position.
7	Fix this position with the locking nut.

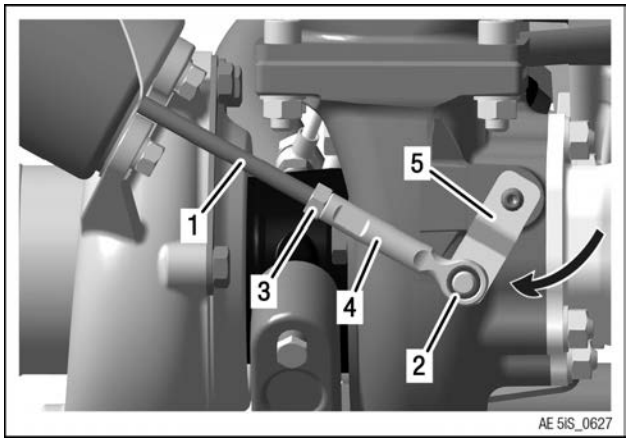


Figure 21.30

1	*Rod*	*2*	*Bushing*
3	*Locking nut*	*4*	*Rod end*
5	*Wastegate lever*		

Step	Procedure
8	Place the washer over the wastegate shaft and hold in place.
9	Place the open end of the locking clip into the groove of the wastegate shaft and the beveled portion of the clip over the end of the shaft.

Step	Procedure
10	Push the locking clip into place until the beveled end retains the clip over the shaft.
11	Mount low pressure hose and fix with hose clamp.

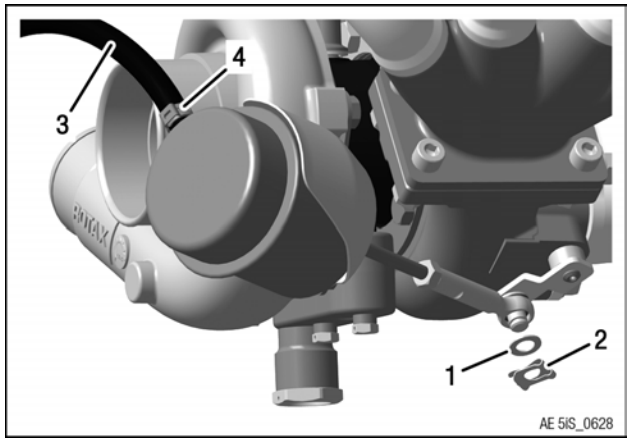


Figure 21.31

1 Washer *2 Locking clip*
3 Low pressure hose *4 Hose clamp*

ADJUSTMENT OF THE WASTEGATE

Step	Procedure
1	Check the wastegate for proper adjustment. Pressurize the wastegate and observe the following calibration table and figure. Around 150-160 mbar the wastegate must be closed, if not adjust by turning the hex. nut on wastegate lever. **NOTE** *Proper adjustment allowed only while installed / connected to wastegate lever. Wastegate shaft movement has to be without friction.*

Control pressure (mbar / psi)	A = Rod travel mm [inches]	Notes / tolerance mm [inches]
150 - 160 / 2.18 - 2.32	0	closed
185 / 2.60	2 [0.079]	1 [+/- 0.04]

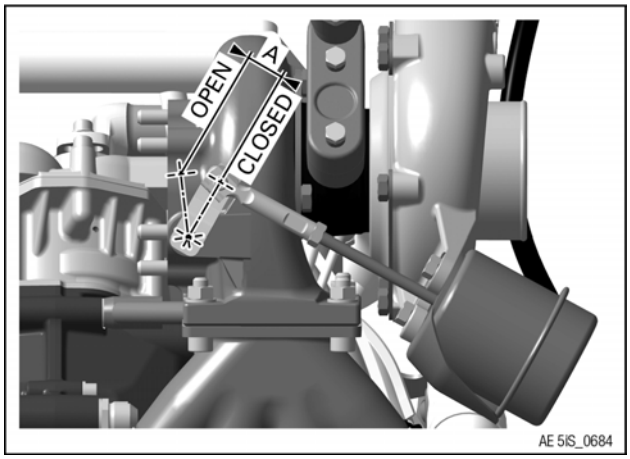


Figure 21.32

FINISHING WORK

- Install coolant hoses, see Chapter 75-00-00 section Expansion tank and coolant hose — installation.
- Install air filter.
- Install hose from intercooler to turbocharger, see documentation of aircraft manufacturer.

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

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

- Carry out an engine test run and leakage check.

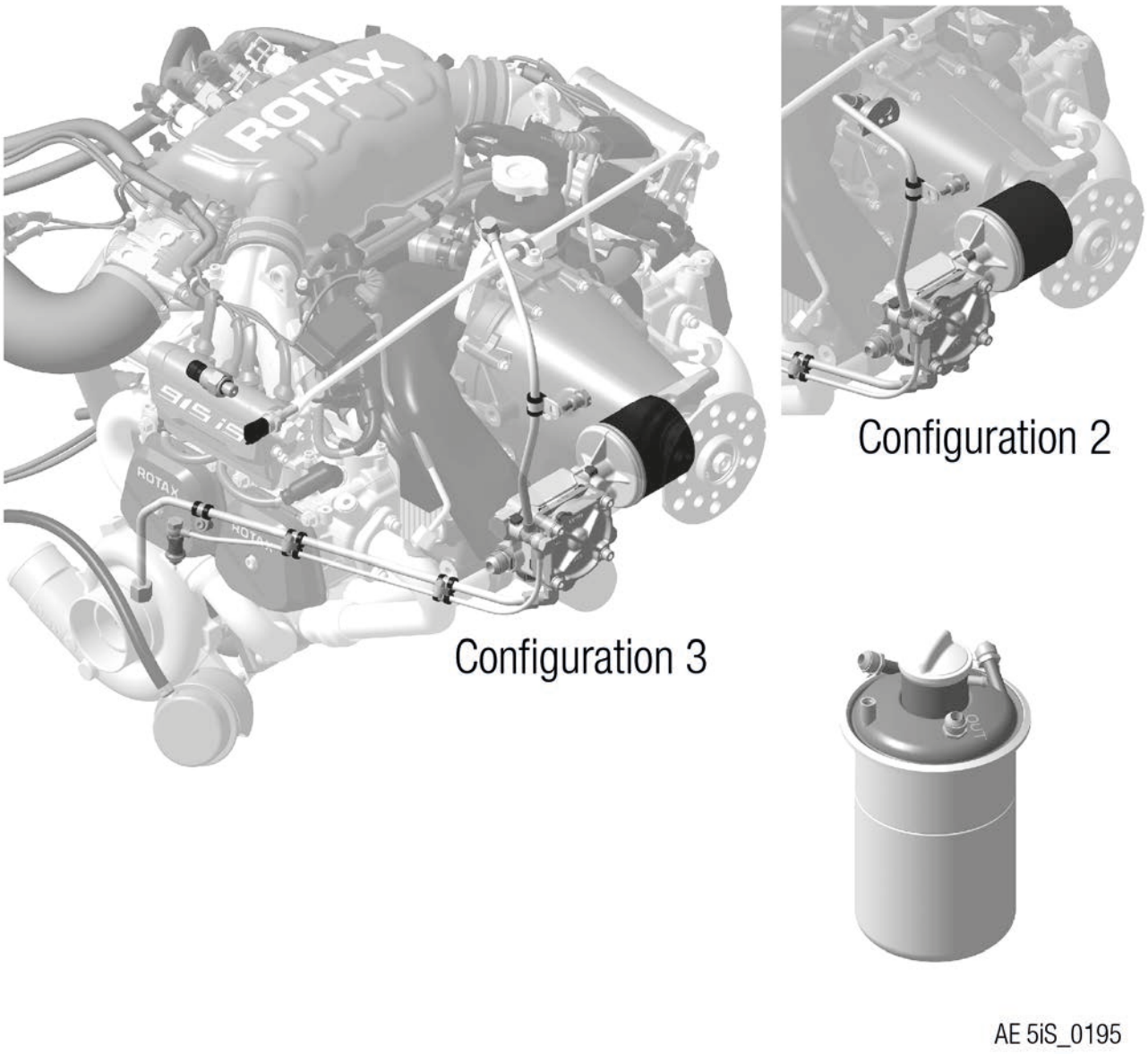


Figure 22.1

SPECIAL TOOLS

Description	Part number	
Oil filter wrench	877620	Non certified part
Socket wrench	876075	Non certified part
Socket wrench	876130	Non certified part

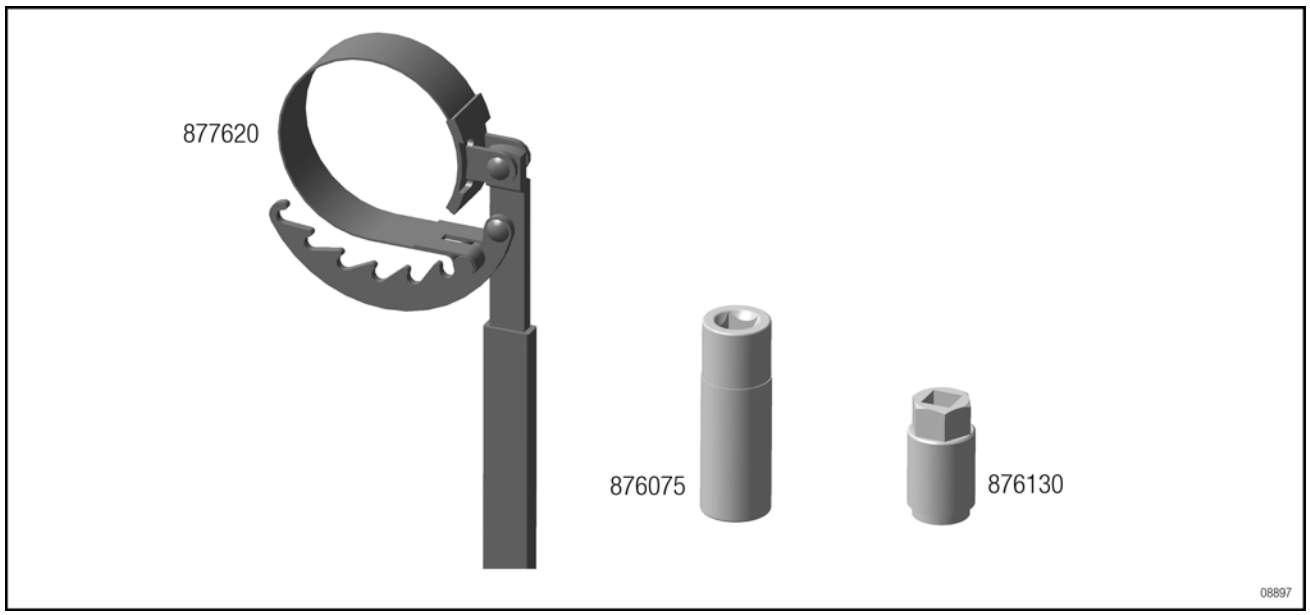


Figure 22.2

SERVICE PRODUCTS

Description	Part number
LOCTITE ANTI SEIZE 8151	898351
LOCTITE 5910	899791
LOCTITE 243	897651
LOCTITE 648	899788
Engine oil	n.a.
Insulating tape	n.a.

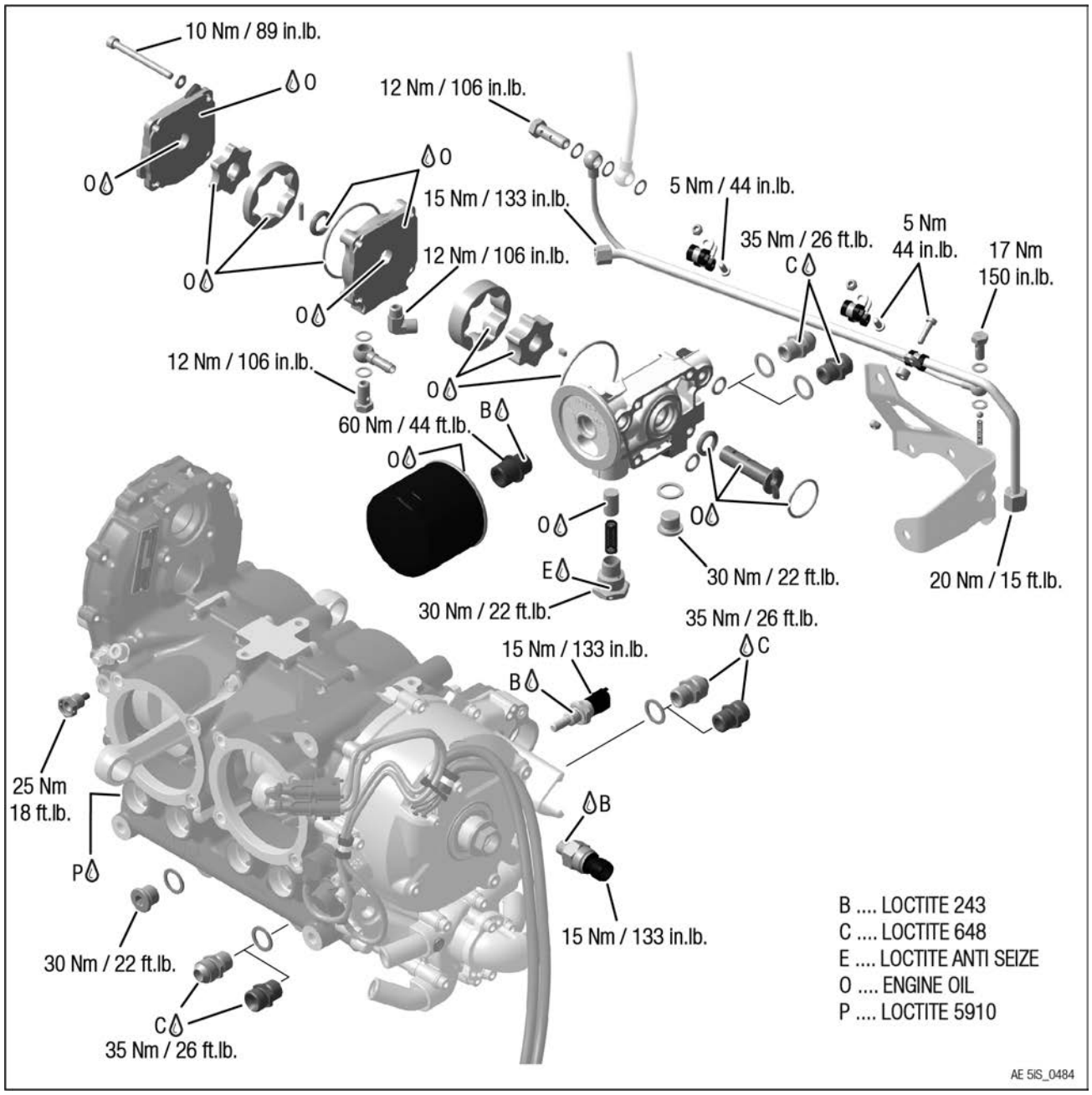


Figure 22.3: Lubrication system

ATTENTION

The rotary piston and rotor are marked.

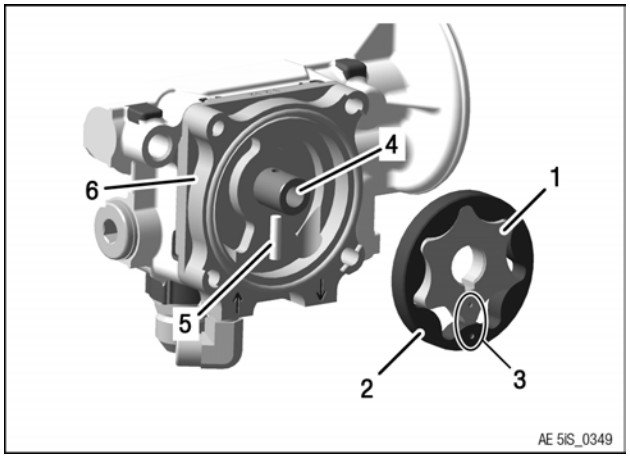


Figure 22.9

1	*Rotor (inner rotor)*	*2*	*Rotary piston (outer rotor)*
3	*Mark (dot)*	*4*	*Oil pump shaft*
5	*Needle pin 4x15.8*	*6*	*Oil pump housing*

Step	Procedure
3	Pull out the rotor and rotary piston.
4	Remove the pin
5	Remove oil pump housing.
6	Remove the feather key.

ATTENTION

The sealing lip of the oil seal is damaged when the oil pump shaft is pulled out and must be replaced.

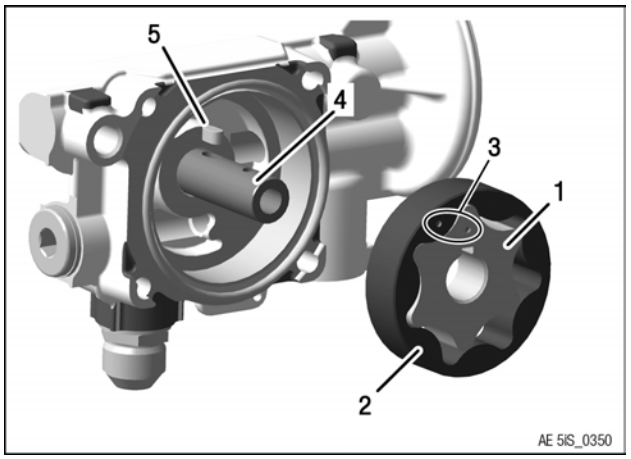


Figure 22.10

1	*Rotor (inner rotor)*	*2*	*Rotary piston (outer rotor)*
3	*Mark (dot)*	*4*	*Oil pump shaft*
5	*Feather key*		

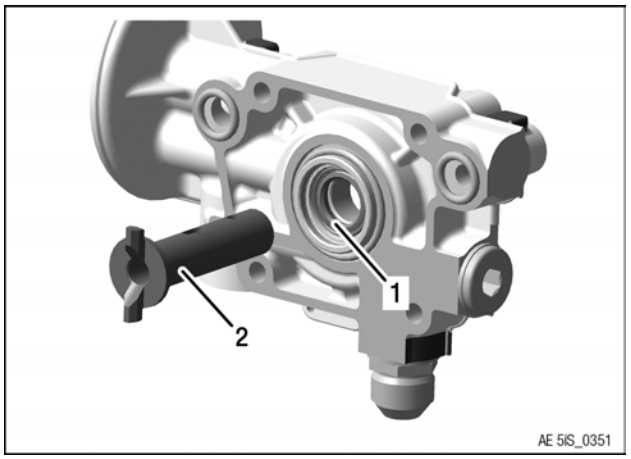


Figure 22.11

1	*Oil seal*	*2*	*Oil pump shaft*

Step	Procedure
7	Carefully lever the oil seal out of the oil pump housing and cover with a screwdriver.

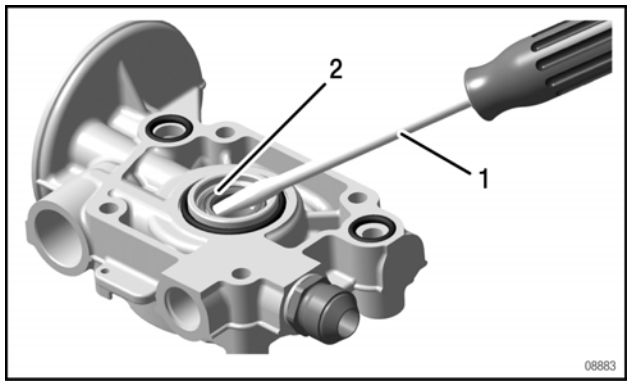


Figure 22.12

1 Screwdriver *2 Oil seal*

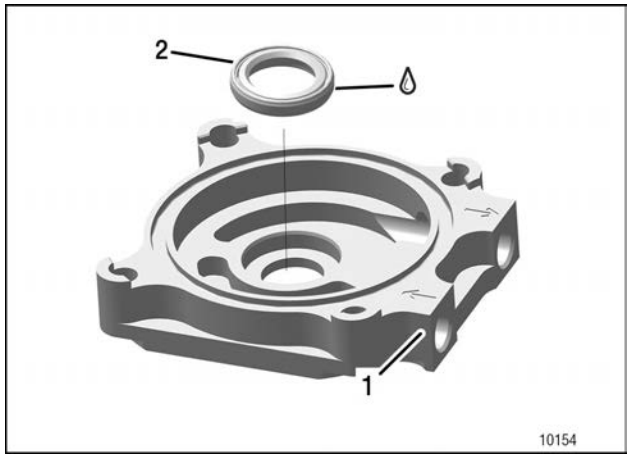


Figure 22.13

1 Oil pump cover *2 Oil seal*

OIL PUMP SINGLE PARTS — CHECK

Preparatory work

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

OIL PUMP HOUSING — INSPECTION

Step	Procedure
1	Visually inspect all the components of the oil pump.
2	All the O-rings must be replaced.
3	Check the oil pump cover for wear on the inside using a straight-edge.

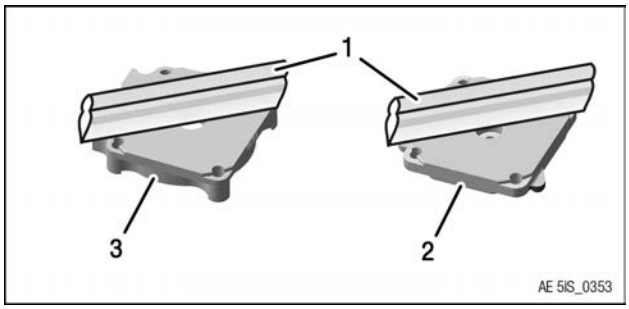


Figure 22.14

1 Straight-edge *2 Oil pump cover*

3 Oil pump housing

Step	Procedure
4	Check the sealing surface of the oil pump housing and pump cover for scoring. Dress of them out on a surface plate if necessary.

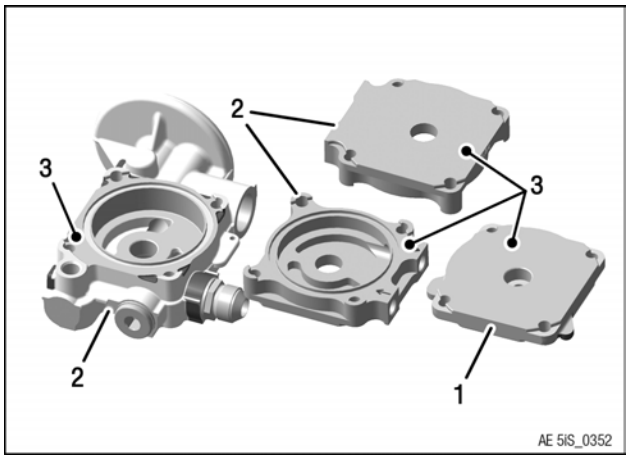


Figure 22.15

1 Oil pump cover *2 Oil pump housing*

3 Sealing surface

ROTARY PISTON/ROTOR — INSPECTION

Step	Procedure
1	Check the rotary piston and rotor for grooves.

NOTE

If there are noticeable grooves on the outer side of the rotor or inner side of the rotary piston, they must both be replaced.

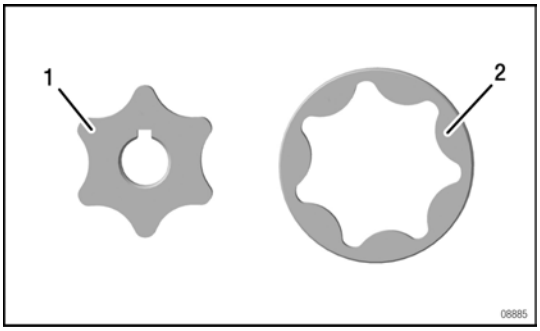


Figure 22.16

1 Rotor *2 Rotary piston*

OIL PUMP SHAFT — INSPECTION

Step	Procedure
1	Check the oil pump shaft at the bearing points.
2	Check the feather key groove and feather key for wear.
3	Check the needle pin.

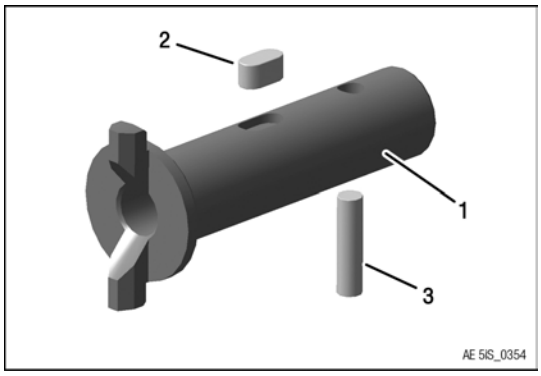


Figure 22.17

1 Oil pump shaft *2 Feather key*

3 Needle pin 4x15.8

OIL PUMP — ASSEMBLY

NOTE

New acid-free greased O-rings and other sealing elements must always be used correctly!

Step	Procedure
1	Apply LOCTITE ANTI SEIZE to the plug screw.
2	Screw the plug screw with the pressure spring and the regulator piston finger-tight into the oil pump housing.

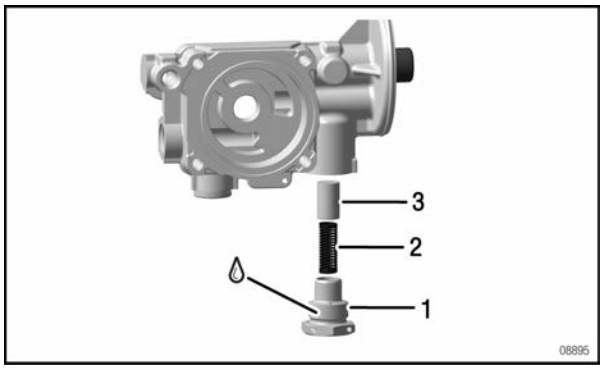


Figure 22.18

1 Plug screw
2 Pressure spring DM9.1 D1.0 L65.6
3 Regulator piston

Step	Procedure
3	Wrap tape over the feather key groove and bore.

ATTENTION

Press in the oil seal so that the closed side points towards the oil pump housing.

Step	Procedure
4	Apply Engine oil to the oil pump shaft and push oil seal A 14x22x4 onto the oil pump shaft while turning slightly.

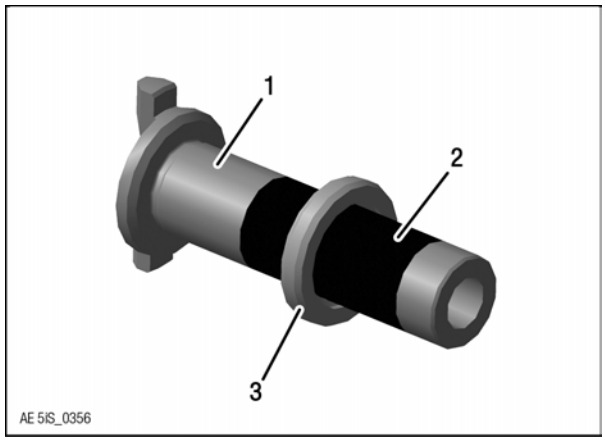


Figure 22.19

1 Oil pump shaft
2 Insulating tape
3 Oil seal A 14x22x4

Step	Procedure
5	Place the oil pump housing on a firm surface.
6	Remove the insulating tape from the oil pump shaft.
7	Insert the oil pump shaft with the oil seal and press it in as far as it will go with a soft-faced hammer.

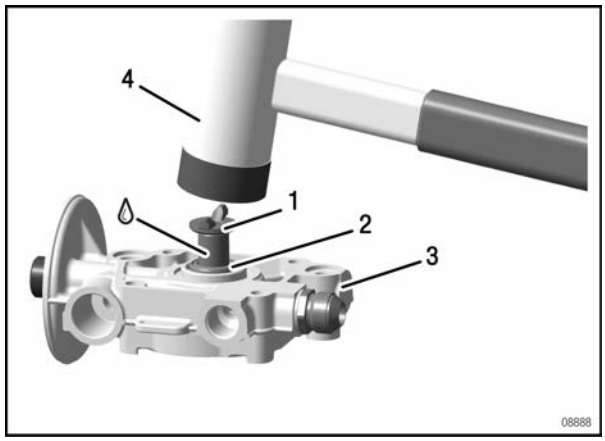


Figure 22.20: TYPICAL

1 Oil pump shaft
2 Oil seal
3 Oil pump housing
4 Soft-faced hammer

ATTENTION

If the oil pump shaft is pulled out again, replace the oil seal (unusable).

NOTE

Apply engine oil to the oil seal at replacement.

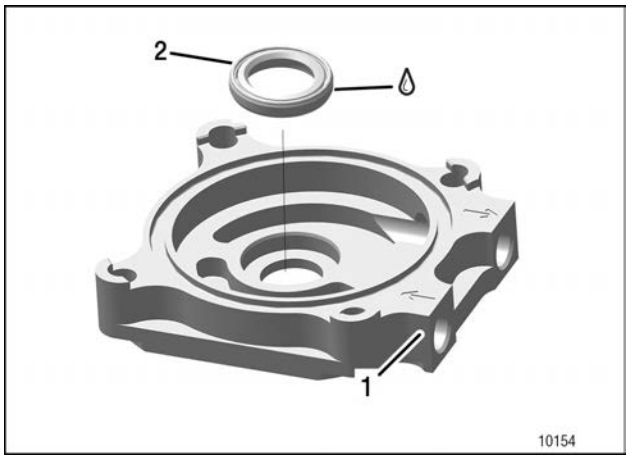


Figure 22.21

1 Oil pump center housing
2 Oil seal

Step	Procedure
8	Insert the feather key in the oil pump

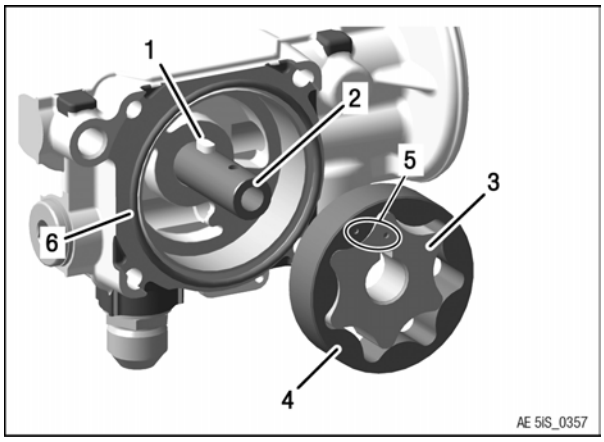


Figure 22.22: TYPICAL

1 Feather key
2 Shaft
3 Rotor (inner rotor)
4 Outer rotor
5 Mark
6 O-ring

ATTENTION

The rotor and rotary piston have a mark. The mark must be visible after inserting both rotors.

Step	Procedure
9	Push on the rotor (inner rotor).
10	Insert the rotary piston (outer rotor).
11	Install O-ring.
12	Install oil pump center housing with new oil seal.
13	Insert needle pin.

NOTE

Apply Engine oil to the rotor and rotary piston.

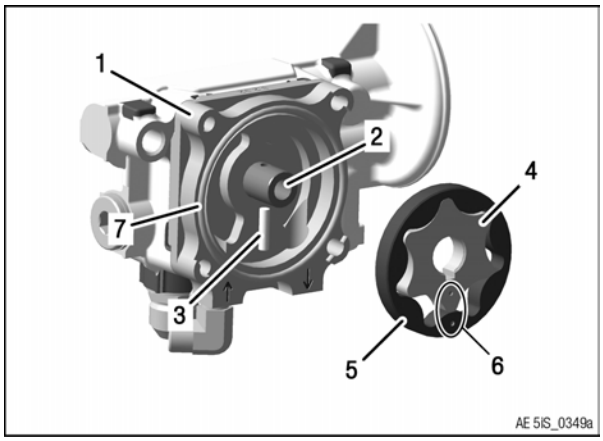


Figure 22.23: TYPICAL

1	*Oil pump center housing*	*2*	*Oil pump shaft*
3	*Needle pin 4x15.8*	*4*	*Rotor (inner rotor)*
5	*Outer rotor*	*6*	*Mark*
7	*O-ring 63–2.5*		

OIL PUMP HOUSING O-RINGS

ATTENTION

All the O-rings must be replaced!

Step	Procedure
1	Insert new O-rings in the oil pump housing.

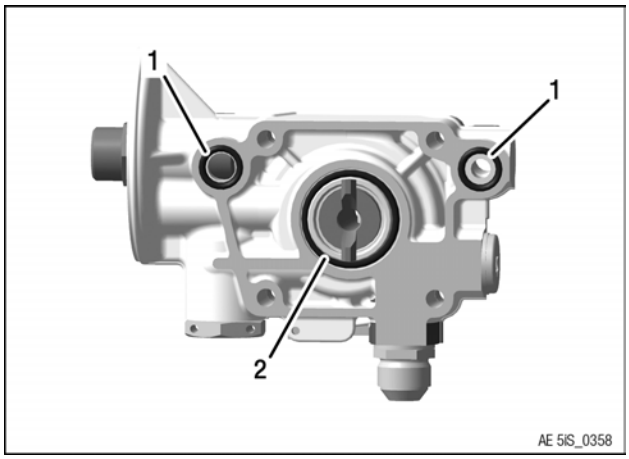


Figure 22.24: TYPICAL

1	*11x2.7 O-ring*	*2*	*30x2.5 O-ring*

OIL PUMP COVER

Preparation

- Apply Engine oil to the bearing point and contact surface.

ATTENTION

Hold the oil pump shaft when putting the oil pump cover on it. Otherwise the oil pump shaft is pushed out by the air cushion.

ATTENTION

Make sure the oil pump cover is in the correct position when putting it on.

Step	Procedure
1	Place the oil pump cover on the oil pump center housing.

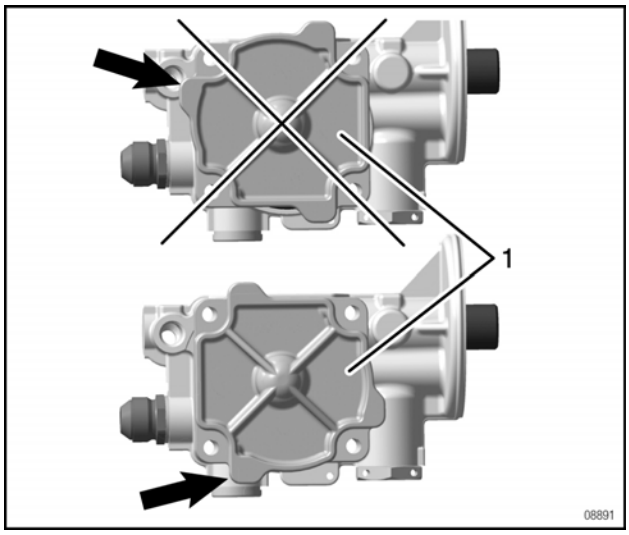


Figure 22.25: TYPICAL

1 Oil pump cover

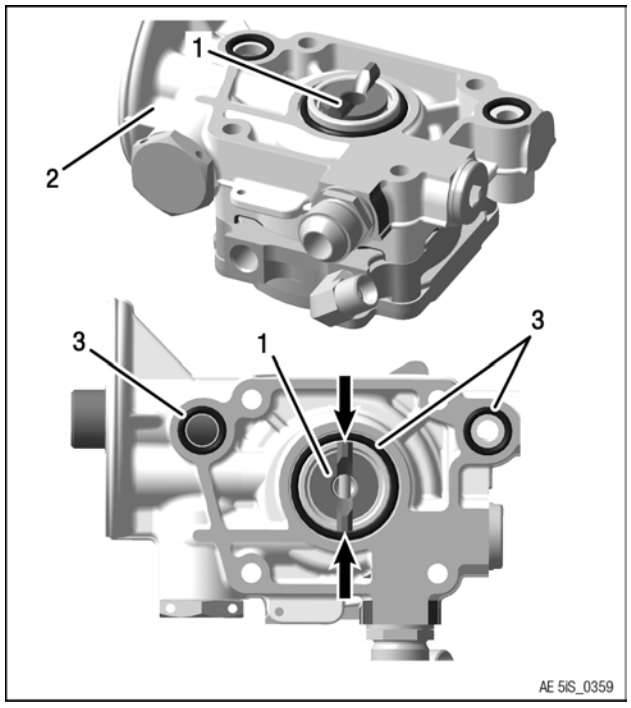
OIL PUMP — INSTALLATION

Preparation

- Check the fit of the O-rings on the oil pump housing.

ATTENTION

Ensure that the oil pump shaft is in the correct installation position.



1 Oil pump shaft *2 Oil pump housing*

3 O-rings

Figure 22.26: TYPICAL

Step	Procedure
1	Apply LOCTITE 5910 to the contact area on the crankcase.

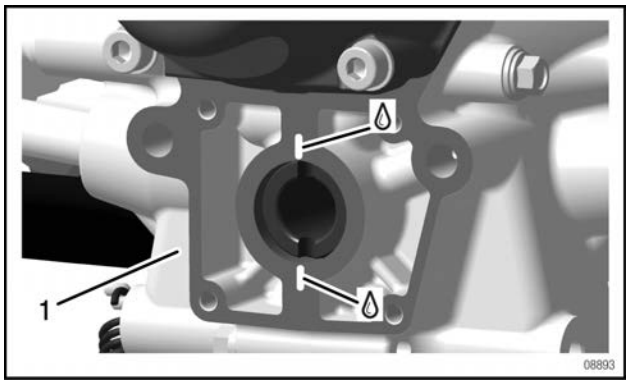


Figure 22.27

1 Crankcase

Step	Procedure
2	Install the oil pump housing with Allen screws M6x50 and washers 6.4 cross-wise and by hand. Then tighten the Allen screws crosswise. Tightening torque 10 Nm (89 in. lb.).
3	Tighten plug screw. Tightening torque 30 Nm (22 ft. lb.).
4	Attach the safety wire.

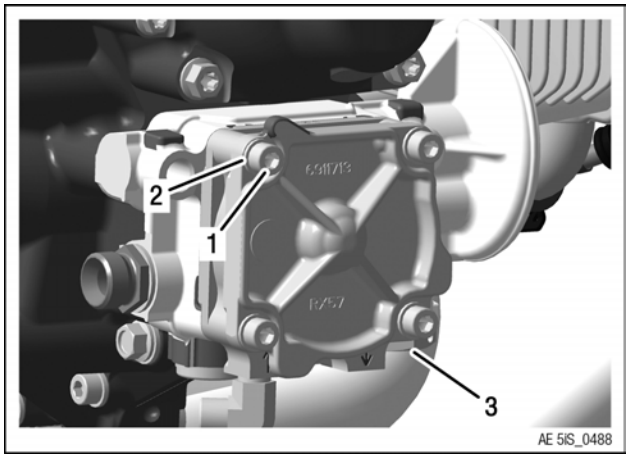


Figure 22.28: TYPICAL

1 Allen screws M6x50 *2 Washers 6.4*

3 Plug screw M22x1.5

OIL FILTER - INSTALLATION

Step	Procedure
1	Install the oil filter.

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

NOTE

Oil the gasket of the oil filter.

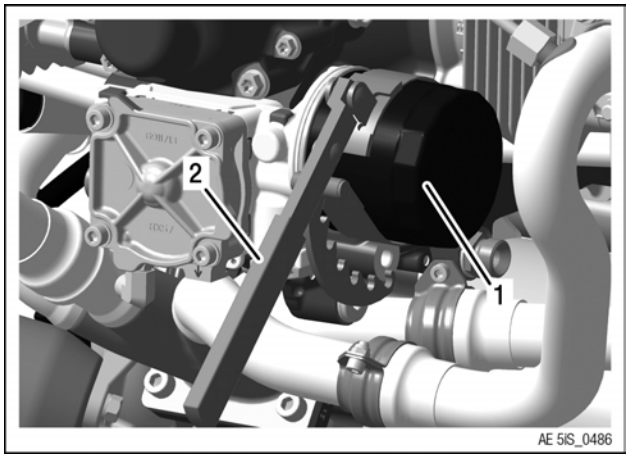


Figure 22.29

1 Oil filter *2 Oil filter wrench*

Step	Procedure
2	Install the oil lines/hoses.

FINISHING WORK

- Fill with fresh oil.

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

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

- Carry out an engine test run and leakage check.

NOTE

Then check that the oil filter is securely fitted after the test run.

WEAR LIMITS

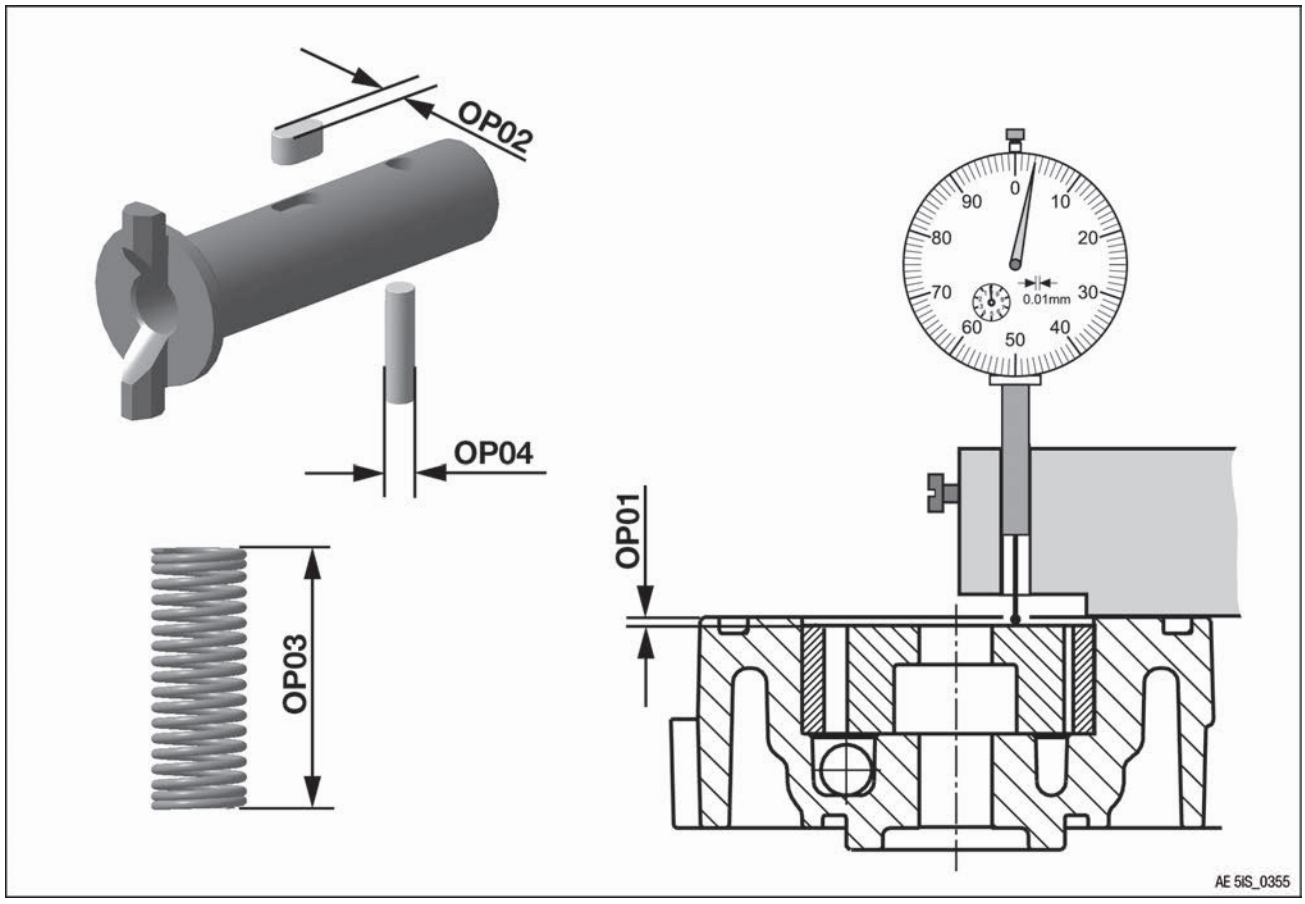


Figure 22.30: Oil pump

Description	Code	Current measurement value		Tolerance limit	Tolerance limit		Measure-ments
		min	max	100 %	50 %		
Main pump spacing (pump cover/rotor)	OP01	0.02 mm 0.00079 in.	0.07 mm 0.0027 in.	0.20 mm 0.0079 in.	0.14 mm 0.0053 in.	current replaced	
Width of feather key in shaft	OP02	4 mm 0.1575 in.	4.085 mm 0.1604 in.	4.150 mm 0.163 in.	4.11 mm 0.1619 in.		
Pressure spring length	OP03	65.6 mm (2.58 in.)		62.6 mm (2.46 in.)	64.1 mm 2.52 in.		
Needle pin	OP04	4 mm (0.158 in.)		3.20 mm 0.126 in.	3.60 mm 0.142 in.		

OIL TANK

OIL TANK — REMOVAL

Follow the aircraft manufacturer's instructions for removal.

⚠ WARNING

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

⚠ WARNING

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

Preparation

- Turn the Master, Start and Lane Switch OFF
- Drain the oil
- Remove the oil tank according to the aircraft manufacturer's specifications.

ENVIRONMENTAL NOTE

Dispose of used oil according to local environmental regulations.

ATTENTION

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

NOTE

The assemblies, hoses and lines are only to be removed if necessary and only as far as is necessary.

Step	Procedure
1	Remove surrounding assemblies and detach oil hoses.

ENVIRONMENTAL NOTE

Ensure that no oil gets into the waste water system or the ground – risk of contaminating drinking water!

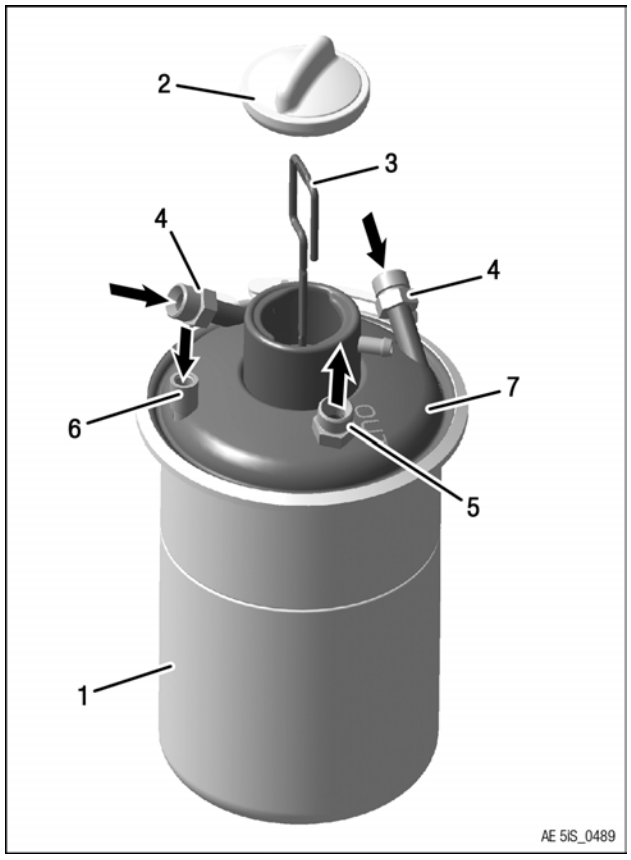


Figure 22.31

1 *Oil tank*
2 *Oil tank cover*
3 *Oil dipstick*
4 *Oil return lines*
5 *Oil pump supply*
6 *Turbo scavenge*
7 *Cover*

OIL TANK — DISASSEMBLY

Step	Procedure
1	Open profile clamp 163.
2	Remove the oil tank cover assy. and O-ring.

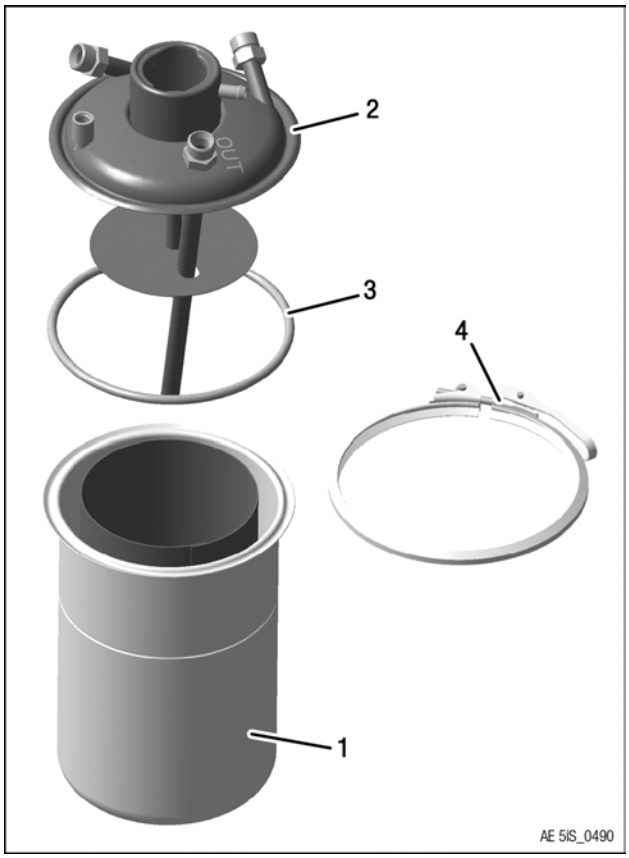


Figure 22.32

1 *Oil tank*
2 *Oil tank cover assy.*
3 *O-Ring*
4 *Profile clamp 163*

Step	Procedure
3	Remove the baffle insert (screen) and partition from the oil tank.

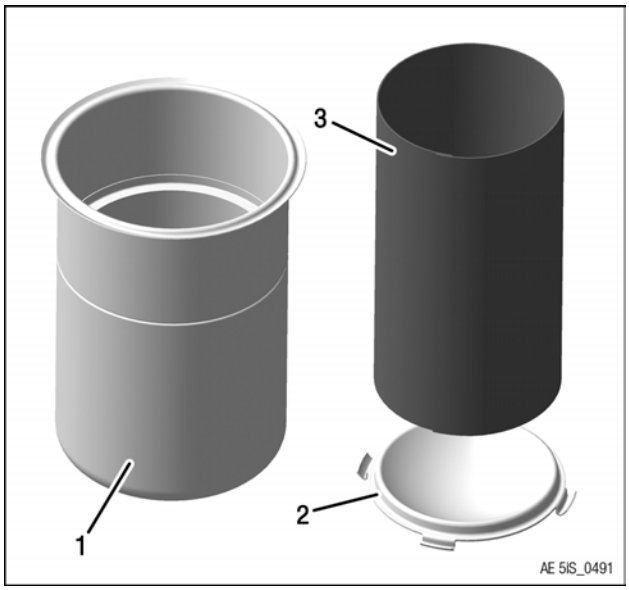


Figure 22.33

1 Oil tank *2 Partition*

3 Baffle insert (screen)

OIL TANK SINGLE PARTS — CHECK

Preparation

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

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

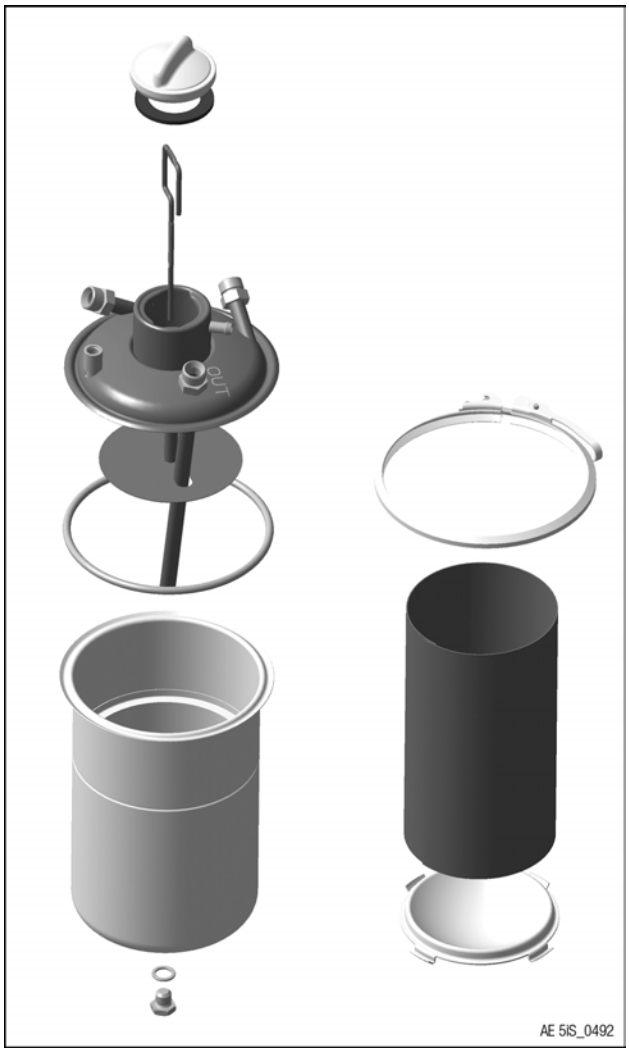


Figure 22.34: Typical

OIL TANK — INSTALLATION

Preparation

Install the oil tank according to the aircraft manufacturer's specifications.

CHECK VALVE – REMOVAL

For removal of the check valve. see the latest documentation of the aircraft manufacturer.

CHECK VALVE – INSPECTION

For inspection of the check valve. see the latest documentation of the aircraft manufacturer.

NOTE

Check valve opening pressure: 170 - 220 mbar.

CHECK VALVE – INSTALLATION

For installation of the check valve. see the latest documentation of the aircraft manufacturer.

FINISHING WORK

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

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

- Carry out an engine test run and leakage check.

OIL RADIATOR

For removal, inspection and installation of the oil radiator, see SI-PAC 014.

OIL HOSES

REMOVAL OF THE OIL HOSES

ATTENTION

The oil hoses are not included in the delivery of the engine and must be maintained according to the aircraft manufacturer's instructions.

Remove the oil hoses and clamps according to the instructions in the aircraft manufacturer's manual.

REMOVAL OF THE OIL LINE (STEEL LINE)

ATTENTION

The steel oil lines, which are included in the delivery, are only removed if they are damaged, maintenance or for cleaning.

Step	Procedure
1	Remove the cable clamp for supporting the line on the side of the gearbox.
2	Loosen the M10 banjo bolt and gasket ring on the governor flange. See Chapter 61-20-00 section Governor.
3	Loosen the banjo bolt on the oil pump housing and remove it along with the gasket rings. See Chapter 61-20-00 section Governor.
4	Loosen cap nut from the turbo oil suction line.

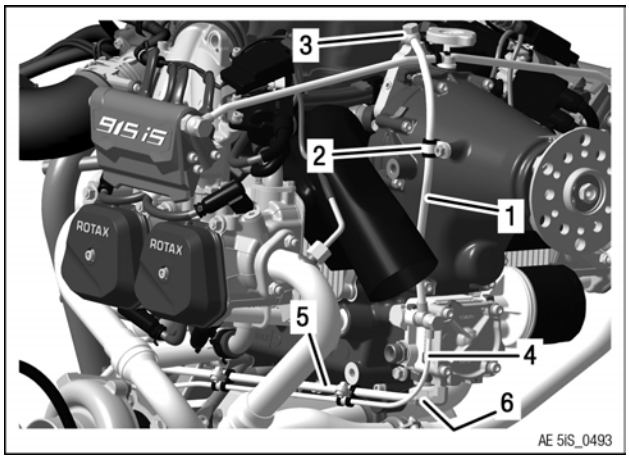


Figure 22.35

1 *Governor pressure oil line* *2* *Cable clamp*
3 *M10 banjo bolt* *4* *Turbo pressure oil line*
5 *Turbo oil suction line* *6* *Cap nut*

Step	Procedure
5	Remove the cable clamp from the turbo oil lines.

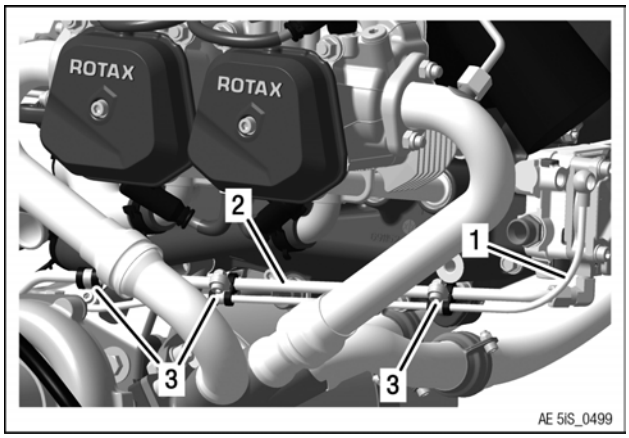


Figure 22.36

1 *Turbo pressure oil line* *2* *Turbo oil suction line*
3 *Cable clamp*

Step	Procedure
6	Loosen the M10 banjo bolt and sealing ring on the turbo housing. Remove the ball and compression spring.
7	Loosen cap nut on oil sump.
8	Remove the turbo return line from turbo and oil pump housing. See also Chapter 78–20–00 section Turbocharger.
9	Remove oil return line.

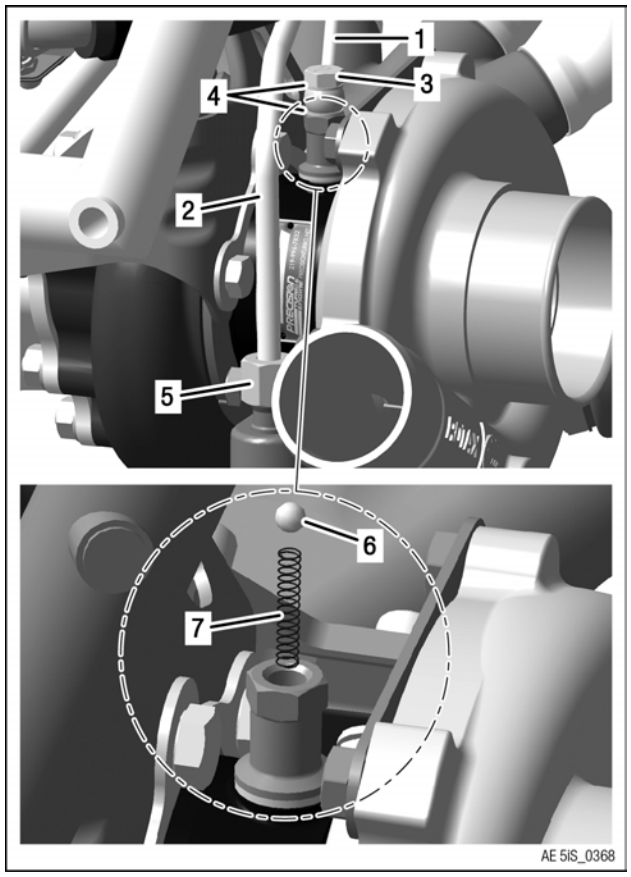


Figure 22.37

1 Turbo pressure line
2 Turbo oil suction line
3 Banjo bolt M8x1x17
4 Sealing ring
5 Cap nut
6 Ball
7 Compression spring

OIL HOSE— INSPECTION

Preparation

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

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

OIL HOSES — INSTALLATION

ATTENTION

Ensure that the hoses are installed without tension and are not scuffed. Observe minimum distances, e.g. 2 mm (0.0787 in.) from the housing.

Step	Procedure
1	Install the oil hoses and clamps according to the instructions in the aircraft manufacturer's manual.
2	Use original hoses with the corresponding aircraft manufacturers certification for replacement.
3	Only use suitable clamps, or crimp connections to fasten the hoses.

OIL LINE (STEEL LINE) INSTALLATION

Step	Procedure
1	Install the governor pressure oil line with the M10 banjo bolt and gasket ring on the governor flange. Tightening torque 17 Nm (150 in. lb). See also Chapter 61-20-00 section Governor.
2	Install the governor pressure oil line and turbo pressure oil line with the M10 banjo bolt on the oil pump housing with the gasket rings. Tightening torque 12 Nm (106 in. lb). See also Chapter 61-20-00 section Governor.

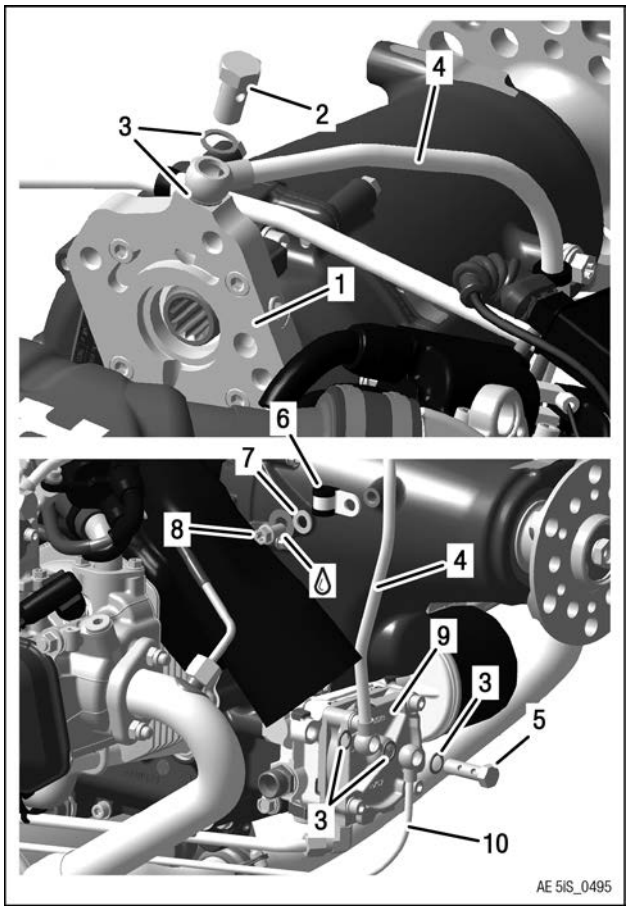


Figure 22.38

1	*Governor flange*	*2*	*Banjo bolt M10x1x23*
3	*Sealing ring A 10x14*	*4*	*Governor pressure oil line*
5	*Banjo bolt M10x1x34*	*6*	*Cable clamp*
7	*Lock washer A8*	*8*	*Hex/torx-flange screw M8x16*
9	*Oil pump*	*10*	*Turbo pressure oil line*

Step	Procedure
3	Install the turbo pressure oil line on the turbo housing. Tightening torque 17 Nm (150 in. lb). See also 78–20–00 Turbocharger. **NOTE** *Do not forget to install the ball and spring.*
4	Install the turbo suction oil line on the turbo and on the oil pump housing. See also 78–20–00 Turbocharger.

ATTENTION

Do not install ball and spring for check valve in wrong order. In this case the oil supply will be blocked completely.

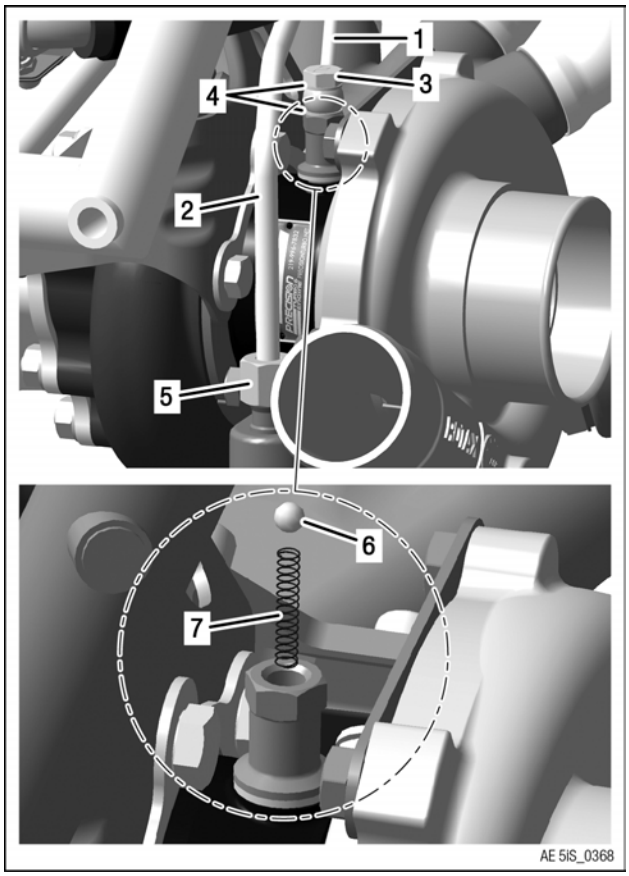


Figure 22.39

1	*Turbo pressure oil line*	*2*	*Turbo suction line*
3	*Banjo bolt M8x1x17*	*4*	*Sealing ring*
5	*Cap nut*	*6*	*Ball*
7	*Spring*		

Step	Procedure
5	Install the cable clamp for supporting the turbo oil suction line on the turbocharger bracket. Tightening torque 5 Nm (44 in. lb).
6	Install the cable clamps on the turbo pressure and oil suction line. Tightening torque 5 Nm (44 in. lb).

NOTE

Always use new lock nuts.

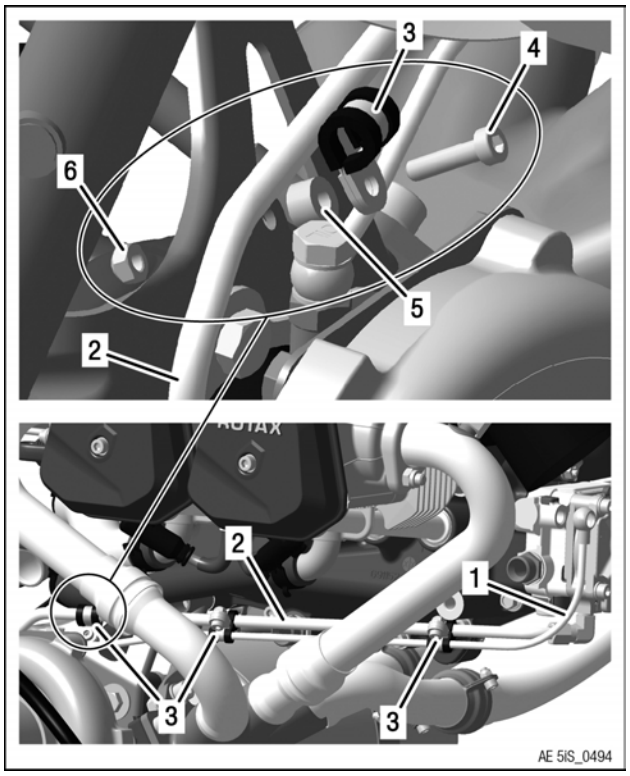


Figure 22.40

1	*Turbo pressure oil line*	*2*	*Turbo oil suction line*
3	*Cable clamp*	*4*	*Hex. screw*
5	*Washer*	*6*	*Lock. nut*

FINISHING WORK

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

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

- Carry out an engine test run and leakage check.

TEMPERATURE AND PRESSURE MEASUREMENT SYSTEM

OIL TEMPERATURE SENSOR (OTS)

General note

The temperature sensor for measuring the oil temperature is screwed into the crankcase. The sensor is a NTC resistor and identical to the sensor for the engine coolant temperature.

ATTENTION

The max. operating temperature must not be exceeded.

If it rises above this, the following must be checked:

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

- the temperature sensor
- the indicating instrument
- the wire connection
- the measurement wire

NOTE

The ground connection of the temperature sensor is established directly via the housing.

OIL TEMPERATURE SENSOR (OTS) — REMOVAL

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators.
2	Clean the thread of the oil temperature sensor.

OIL TEMPERATURE SENSOR (OTS) — INSPECTION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators.

OIL TEMPERATURE SENSOR (OTS) — INSTALLATION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators.

OIL PRESSURE SENSOR (OPS)

General note

The pressure sensor for measuring the oil pressure is screwed into the ignition housing.

NOTE

The pressure sensor has a range from 0 to 10 bar (0–145 psi). This indicator can be seen on the circumference of the pressure sensor.

ATTENTION

The pressure range of the display device must match the pressure range of the pressure sensor. Otherwise the oil pressure will not be displayed correctly.

ATTENTION

The temperature must be within the specified operating temperature range.

See relevant Operators Manual for the 915 i A Series.

OIL PRESSURE SENSOR (OPS) — REMOVAL

Step	Procedure
1	To do this, see Chapter 76-70-00 section Pressure Sensor-removal.
2	Clean the thread of the pressure sensor.

OIL PRESSURE SENSOR (OPS) — INSPECTION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators inspection.

OIL PRESSURE SENSOR (OPS) — INSTALLATION

Step	Procedure
1	To do this, see Chapter 76-70-00 section Sensors and actuators-installation.

COMPONENT REPAIR

THREAD REPAIR

Magnetic drain plug

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

NOTE

It is possible to repair the thread of the magnetic plug in the crankcase with a HeliCoil.

Drain plug

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

MACHINED AREAS

ATTENTION

The sealing surfaces on oil pump components must not be repaired! If damage to these sealing surfaces is found, the corresponding component must be replaced with a new part.

- Machine areas on lubricant supply components (oil pump cover) up to a maximum of 0.3 mm (0.0118 in.).
- The indentations must not have sharp edges! Remove sharp edges carefully with a sharpening stone. Damage limits must not be exceeded!