



***Axial Piston Variable Pump
(Hydrostatic Transmission Pump)
Service Manual***

***Model
TH306D***

***31211262
UENR7957-00***

*Original
December 01, 2016*

DISCLAIMER: Information provided within (excluding Section 1) is supplied directly from the component manufacturer. Due to continuous improvements, the component manufacturer reserves the right to make changes without prior notification.

EFFECTIVITY PAGE

DATE	REVISION	DESCRIPTION
December 01, 2016	A	Original Issue Of Manual.

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Section 1

JLG Safety Practices

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1.1 INTRODUCTION

This service manual provides general directions for accomplishing service and repair procedures. Following the procedures in this manual will help assure safety and equipment reliability.

Read, understand and follow the information in this manual, and obey all locally approved safety practices, procedures, rules, codes, regulations and laws.

These instructions cannot cover all details or variations in the equipment, procedures, or processes described, nor provide directions for meeting every possible contingency during operation, maintenance, or testing. When additional information is desired consult the local Caterpillar Dealer.

Many factors contribute to unsafe conditions: carelessness, fatigue, overload, inattentiveness, unfamiliarity, even drugs and alcohol, among others. For optimal safety, encourage everyone to think, and to act, safely.

Appropriate service methods and proper repair procedures are essential for the safety of the individual doing the work, for the safety of the operator, and for the safe, reliable operation of the machine. All references to the right side, left side, front and rear are given from the operator's seat looking in a forward direction.

Supplementary information is available on SIS Web.

1.2 DISCLAIMER

All information in this manual is based on the latest product information available at the time of publication. The manufacturer reserves the right to make changes and improvements to its products, and to discontinue the manufacture of any product, at its discretion at any time without public notice or obligation.

1.3 OPERATION & MAINTENANCE MANUAL

The mechanic must not operate the machine until the Operation & Maintenance Manual has been read and understood, training has been accomplished and operation of the machine has been completed under the supervision of an experienced and qualified operator.

An Operation & Maintenance Manual is supplied with each machine and must be kept in the manual holder located in the cab. In the event that the Operation & Maintenance Manual is missing, consult the local Caterpillar Dealer before proceeding.

1.4 DO NOT OPERATE TAGS

Place Do Not Operate Tags on the ignition key switch and the steering wheel before attempting to perform any service or maintenance. Remove key and disconnect battery leads.

1.5 SAFETY INFORMATION

To avoid possible death or injury, carefully read, understand and comply with all safety messages.

In the event of an accident, know where to obtain medical assistance and how to use a first-aid kit and fire extinguisher/fire suppression system. Keep emergency telephone numbers (fire department, ambulance, rescue squad/paramedics, police department, etc.) nearby. If working alone, check with another person routinely to help assure personal safety.

1.5.1 Safety Alert System and Signal Words

 **DANGER**

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



1.6 SAFETY INSTRUCTIONS

Following are general safety statements to consider **BEFORE** performing maintenance procedures on the telehandler. Additional statements related to specific tasks and procedures are located throughout this manual and are listed prior to any work instructions to provide safety information before the potential of a hazard occurs.

For all safety messages, carefully read, understand and follow the instructions **BEFORE** proceeding.

1.6.1 Personal Hazards

PERSONAL SAFETY GEAR: Wear all the protective clothing and personal safety gear necessary to perform the job safely. This might include heavy gloves, safety glasses or goggles, filter mask or respirator, safety shoes or a hard hat.

LIFTING: **NEVER** lift a heavy object without the help of at least one assistant or a suitable sling and hoist.

1.6.2 Equipment Hazards

LIFTING OF EQUIPMENT: Before using any lifting equipment (chains, slings, brackets, hooks, etc.), verify that it is of the proper capacity, in good working order, and is properly attached.

NEVER stand or otherwise become positioned under a suspended load or under raised equipment. The load or equipment could fall or tip.

DO NOT use a hoist, jack or jack stands only to support equipment. Always support equipment with the proper capacity blocks or stands properly rated for the load.

HAND TOOLS: Always use the proper tool for the job; keep tools clean and in good working order, and use special service tools only as recommended.

1.6.3 General Hazards

SOLVENTS: Only use approved solvents that are known to be safe for use.

HOUSEKEEPING: Keep the work area and operator's cab clean, and remove all hazards (debris, oil, tools, etc.).

FIRST AID: Immediately clean, dress and report all injuries (cuts, abrasions, burns, etc.), no matter how minor the injury may seem. Know the location of a First Aid Kit, and know how to use it.

CLEANLINESS: Wear eye protection and clean all components with a high-pressure or steam cleaner before attempting service.

When removing hydraulic components, plug hose ends and connections to prevent excess leakage and contamination. Place a suitable catch basin beneath the machine to capture fluid run-off.

It is good practice to avoid pressure-washing electrical/electronic components. In the event pressure-washing the machine is needed, ensure machine is shut down before pressure-washing. Should pressure-washing be utilized to wash areas containing electrical/electronic components, it is recommended a maximum pressure of 750 psi (52 bar) at a minimum distance of 12 in (30.5 cm) away from these components. If electrical/electronic components are sprayed, spraying must not be direct and for brief time periods to avoid heavy saturation,

Check and obey all Federal, State and/or Local regulations regarding waste storage, disposal and recycling.



JLG Safety Practices

1.6.4 Operational Hazards

ENGINE: Stop the engine before performing any service unless specifically instructed otherwise.

VENTILATION: Avoid prolonged engine operation in enclosed areas without adequate ventilation.

SOFT SURFACES AND SLOPES: NEVER work on a machine that is parked on a soft surface or slope. The machine must be on a hard level surface, with the wheels blocked before performing any service.

FLUID PRESSURE: Before loosening any hydraulic or diesel fuel component, hose or tube, turn the engine OFF. Wear heavy, protective gloves and eye protection. **NEVER** check for leaks using any part of your body; use a piece of cardboard or wood instead. If injured, seek medical attention immediately. Diesel fluid leaking under pressure can explode. Hydraulic fluid and diesel fuel leaking under pressure can penetrate the skin, cause infection, gangrene and other serious personal injury.

Refer to the engine manufacturers manual for specific details concerning the fuel system.

Relieve all pressure before disconnecting any component, part, line or hose. Slowly loosen parts and allow release of residual pressure before removing any part or component. Before starting the engine or applying pressure, use components, parts, hoses and pipes that are in good condition, connected properly and are tightened to the proper torque. Capture fluid in an appropriate container and dispose of in accordance with prevailing environmental regulations.

COOLANT SYSTEM CAP: The cooling system is under pressure, and escaping coolant can cause severe burns and eye injury. To prevent personal injury, **NEVER** remove the coolant system cap while the cooling system is hot. Wear safety glasses. Turn the coolant system cap to allow pressure to escape before removing the cap completely. Failure to follow the safety practices could result in death or serious injury.

FLUID FLAMABILITY: DO NOT service the fuel or hydraulic systems near an open flame, sparks or smoking materials.

Properly disconnect battery prior to servicing the fuel or hydraulic systems.

NEVER drain or store fluids in an open container. Engine fuel and hydraulic fluid are flammable and can cause a fire and/or explosion.

DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause an explosion.

PRESSURE TESTING: When conducting any test, only use test equipment that is correctly calibrated and in good condition. Use the correct equipment in the proper manner, and make changes or repairs as indicated by the test procedure to achieve the desired result.

LEAVING MACHINE: Lower the forks or attachment to the ground before leaving the machine.

TIRES: Always keep tires inflated to the proper pressure to help prevent tipover. **DO NOT** over-inflate tires.

NEVER use mismatched tire types, sizes or ply ratings. Always use matched sets according to machine specifications.

MAJOR COMPONENTS: Never alter, remove, or substitute any items such as counterweights, tires, batteries or other items that may reduce or affect the overall weight or stability of the machine.

BATTERY: DO NOT charge a frozen battery. Charging a frozen battery may cause it to explode. Allow the battery to thaw before jump-starting or connecting a battery charger.

1.7 SAFETY DECALS

Check that all safety decals are present and readable on the machine. Refer to the Operation & Maintenance Manual supplied with machine for information.



Section 2

About this Manual

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About this Manual

This manual contains important information on the safe and proper repair of the axial piston variable pump A4VG Series 40.

- Read this manual completely, especially Section 3, “General Safety Instructions”, before working with the axial piston variable pump A4VG.

2.1 RELATED DOCUMENTS

The axial piston variable pump A4VG is a system component. Also observe the manuals for the other system components. Further information on the axial piston variable pump A4VG and its installation, commissioning and operation can be found in the manufacturer’s documents listed in the following table.

Note: Documents are available from component manufacturer.

Related Documents	Contents
Order Confirmation	Contains the preset technical data of your axial piston variable pump A4VG.
Installation Drawing	Contains the outer dimensions, all connections and the hydraulic circuit diagram for your axial piston variable pump A4VG.
Special Tool Catalog RE 92004-01-S082	The product-specific special tool catalog contains the special tools required for the axial piston variable pump A4VG.
Instruction Manual RE 92004-01-B	Contains important information for safely and properly transporting, installing, commissioning, maintaining and removing the axial piston variable pump A4VG.
Data sheet RE 92004	Contains the permissible technical data for the axial piston variable pump A4VG Series 40.
Data sheet RE 90220	Describes the requirements on a mineral-oil based hydraulic fluid and related hydrocarbons for the operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your system.
Data sheet RE 90221	Describes the requirements on an environmentally acceptable hydraulic fluid for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your system.
Data sheet RE 90223	Contains additional information on the use of axial piston units with HF hydraulic fluids.
Data sheet RE 90300-03-B	Contains additional information on the use of axial piston units at low temperatures.

Also observe the generally applicable, legal or otherwise binding regulations of the European and national legislation and the rules for accident prevention and for environmental protection applicable in your country.



2.2 ABBREVIATIONS USED

As umbrella term for "axial piston variable pump A4VG", the designation "axial piston unit" will be used in the following.

Abbreviation	Meaning
A4VG	Axial piston variable pump, closed circuits
DA	Automatic control, hydraulic, speed related
EP	Proportional control, electric
HP	Proportional control, hydraulic, pilot-pressure related
HW	Proportional control, hydraulic, mechanical servo
RD	Rexroth document in the German language
RE	Rexroth document in the English language



About this Manual

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Section 3 General Safety Instructions

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General Safety Instructions

The axial piston unit has been manufactured according to the generally accepted rules of current technology. There is, however, still a danger of personal injury or damage to equipment if the following general safety instructions and the warnings before the steps contained in this manual are not complied with.

- Read this manual completely and thoroughly before starting work with the axial piston unit.
- Keep this manual in a location where they are accessible to all users at all times.
- Always include the instruction manual when you pass the axial piston unit on to third parties.

3.1 INTENDED USE

Axial piston units are hydraulic components, meaning that in their application they are classified neither as complete nor as incomplete machines in the sense of the EU machine directive 2006/42/EC. A component is exclusively intended to form an incomplete or a complete machine together with other components. The component may only be commissioned after it has been installed in the machine/system for which it is intended.

The axial piston unit is only approved for use in hydrostatic drive systems.

- Observe the technical data, operating conditions and performance limits as specified in the data sheet and order confirmation.

The axial piston unit is intended for professional use and not for private use. Intended use includes having read and understood this documentation, especially the Section 3, "General Safety Instructions".

3.2 IMPROPER USE

Any use other than that described as intended use shall be considered as improper and is therefore impermissible. Manufacturer shall accept no liability whatsoever for damage resulting from improper use. The user shall bear all risks arising from improper use.

Improper use of the product includes:

- Using the axial piston unit in an explosive environment
- Pumping non-approved fluids, e.g. water or polyurethane components. Information about approved hydraulic fluids can be found in manufacturer's data sheet.

3.3 PERSONNEL QUALIFICATIONS

Repair, installation, commissioning and operation, removal, care and maintenance require basic mechanical, hydraulic and electrical knowledge, as well as knowledge of the appropriate technical terms. For transporting and handling the product, additional knowledge is necessary with regard to working with a lifting device and the corresponding attachment equipment. In order to ensure operating safety, these activities may therefore only be carried out by qualified personnel or an instructed person under the direction and supervision of qualified personnel.

Qualified personnel are those who can recognize possible hazards and institute the appropriate safety measures due to their professional training, knowledge, and experience, as well as their understanding of the relevant regulations pertaining to the work to be done. Qualified personnel must observe the rules relevant to the subject area.

3.4 SAFETY INSTRUCTIONS IN THIS MANUAL

In this manual, there are safety instructions before the steps whenever there is a danger of personal injury or damage to equipment. The described danger prevention measures must be observed.

Safety instructions are set out as follows:

 SIGNAL WORD
Type of Danger! Consequences <ul style="list-style-type: none"> • Precautions

- **Safety signs (warning triangle):** draw attention to danger
- **Signal word:** identifies the degree of the danger
- **Type of danger:** identifies the type or source of the danger
- **Consequences:** describes what occurs if the safety instructions are not complied with
- **Precautions:** states how the danger can be avoided

See Section 1.5.1, "Safety Alert System and Signal Words", for further details.



3.5 ADHERE TO THE FOLLOWING INSTRUCTIONS

a. General Instructions

- Observe the regulations for accident prevention and environmental protection for the country where the product is used and at the workplace.
- Only operate axial piston units in good technical order and condition.
- Use the product only within the performance range provided in the technical data.
- Repairs to the axial piston unit may only be performed by authorized, skilled and instructed personnel.
- Persons who repair, install, commission, operate, remove or maintain manufacturer products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- The warranty applies only to the delivered configuration.
- The warranty is rendered void if the product is incorrectly repaired, installed, commissioned or operated, and also if not used as intended and/or handled improperly.
- Do not expose the product to any mechanical loads under any circumstances. Never use the product as a handle or step. Do not place/lay any objects on it.
- The noise emission of axial piston units depends on speed, operating pressure and installation conditions. The sound pressure level may rise above 70 dBA during normal application conditions. This can cause hearing damage.
 - Always wear hearing protection while working in the vicinity of the operating axial piston unit.
- The axial piston unit heats up during operation to such an extent that you can be burnt by touching it.
 - Allow the axial piston unit to cool down sufficiently before touching it.
 - Wear heat-resistant protective clothing, e. g. gloves.
- Hydraulic fluid is easily flammable.
 - Keep open flames and ignition sources away from the axial piston unit.

b. During Transport

Make certain that the lifting device has adequate lifting capacity. The weight can be found in chapter. 5, "Transport and Storage" of manufacturer's instruction manual.

c. During Removal

- Make sure the relevant system component is depressurized and voltage-free before removing the product or when disconnecting plugs. Protect the system against being energized.
- Before removing, place a drip tray under the axial piston unit to prevent environmental pollution through hydraulic fluid that may escape.

d. During Repair

- Before repairing, ensure that all fluids are removed from the axial piston unit.
- During installation, provide for absolute cleanliness in order to prevent contaminants, such as dirt, welding beads or metal cuttings, from getting into the components and causing product wear or malfunctions.
- Special tools are required for the repair. Repair without the required special tools is not permissible.
- Use only original spare parts from manufacturer for the repair.
- Replace the seals with new ones during the repair operation.
- All components must be clean and undamaged.
- Damaged components must not be reused.
- It is not permissible to retap threads.
- It is not permissible to remachine boreholes.

e. During Installation and Commissioning

- Observe the notes in manufacturer's instruction manual.

f. During Cleaning

- Plug all openings with the appropriate protective equipment in order to prevent detergents from penetrating the system.
- Never use solvents or aggressive detergents. Use only water and, if necessary, a mild detergent to clean the axial piston unit.
- Do not point the power washer at sensitive components, e.g., shaft seal ring, electrical connections and electrical components.



General Safety Instructions

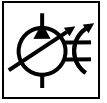
g. Disposal

- Dispose of the product and the hydraulic fluid according to the currently applicable national regulations in your country.

3.6 OPERATOR'S OBLIGATIONS

The operator of the axial piston unit must provide personnel training on a regular basis regarding the following subjects:

- Observation and use of the instruction manual and the legal regulations
- Intended use and operation of the axial piston unit
- Observation of the instructions from the factory security offices and of the work instructions from the operator.



Section 4

Product Description

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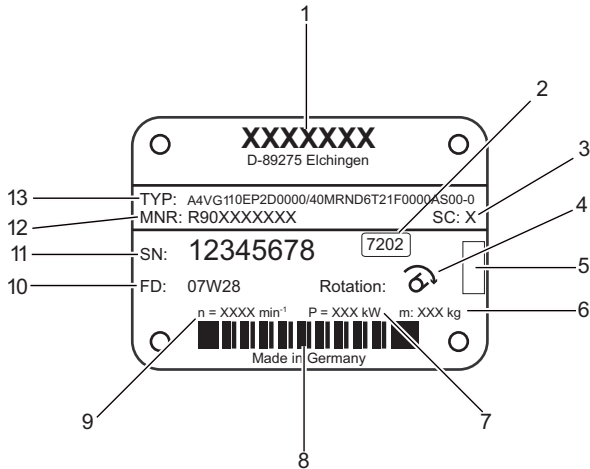
Product Description

This chapter provides a general overview of the functionality of the variable pump.

Familiarize yourself with the contents of this chapter before you begin working on a variable pump.

4.1 NAME PLATE

The variable pump can be identified by means of the name plate.



MAE5780

The name plate contains the following information:

1. Manufacturer
2. Internal plant designation
3. Sample category (optional)
4. Direction of rotation (viewed on drive shaft) – here: clockwise
5. Specified area for test stamp
6. Weight (optional)
7. Power (optional)
8. Bar code
9. Rotational speed (optional)
10. Production date
11. Serial number
12. Material number of the axial piston unit
13. Ordering code

Ensure that the type and nominal size of the variable pump to be repaired correspond to this repair manual.

4.2 FUNCTIONAL DESCRIPTION

In order for you to be in a position to identify problems in a variable pump and to perform repairs effectively, knowledge of the functionality and the overall structure of the device is essential.

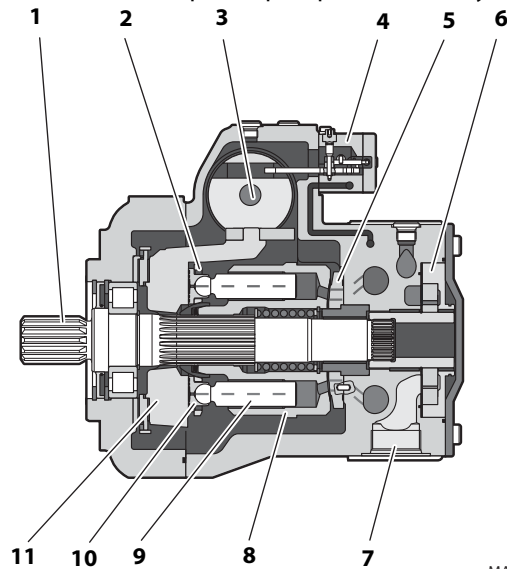
This section gives you a high level overview.

The variable pump is an axial piston variable pump in a swash plate design for hydrostatic drives in closed circuit.

The volumetric flow is proportional to the drive speed and the displacement. The flow rate can be varied continuously by adjustment of the swashplate.

A detailed functional description is contained in the product-specific manufacturer's instruction manual.

The following sectional drawing shows the design of the A4VG series 40 axial piston pump schematically.



MAE5790

1. Drive shaft
2. Retaining plate
3. Stroke piston
4. Controller
5. Control plate
6. Internal gear pump
7. Suction port
8. Cylinder
9. Piston
10. Slipper pad
11. Swashplate



4.3 TECHNICAL DATA

The technical data of the variable pump can be found in the order confirmation. These are supplemented by the technical data sheet. Contact manufacturer for technical data sheet that applies to the A4VG variable pump.



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Section 5 Controller

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Controller

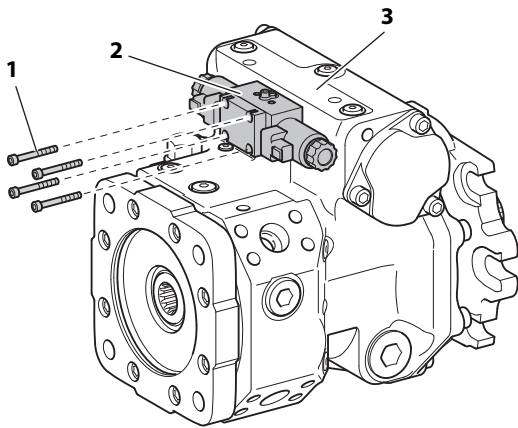
The material numbers for the special tools are to be found in the manufacturer Special Tool Catalog. If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

5.1 REMOVING CONTROLLER

This section describes how you remove the controller from the pump.

There is a wide variety of controllers.

Please note that the removal of only one such controller is shown here exemplarily.



MAE5800

1. Fixing Screws
2. Controller
3. Pump Case

a. Procedure

To remove the controller:

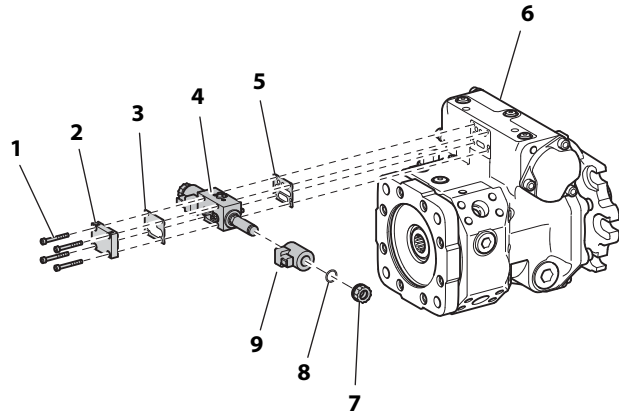
1. Loosen and remove the fixing screws (1) of the controller (2).
2. Detach the controller (2) from the pump casing (3).

5.2 SEALING CONTROLLER

This section describes how you seal the controller.

There is a wide variety of controllers.

Please note that the sealing of only one such controller is shown here exemplarily.



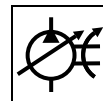
MAE5810

1. Fixing Screws
2. Cover
3. Seal
4. Controller
5. Seal
6. Pump Case
7. Mounting Nut
8. O-ring
9. Coil

a. Procedure

To replace the seals:

1. Loosen and remove the fixing screws (1) of the controller (4).
2. Remove the cover (2) and the seals (3 and 5) from the controller (4).
3. Check the seals, the sealing surfaces and the case for damage, wear and contaminants.
4. Exchange the seals (3 and 5).
The individual components and removal/installation of the left-hand and right-hand solenoids are identical.
5. Loosen and remove the mounting nuts (7) on the coil (9).



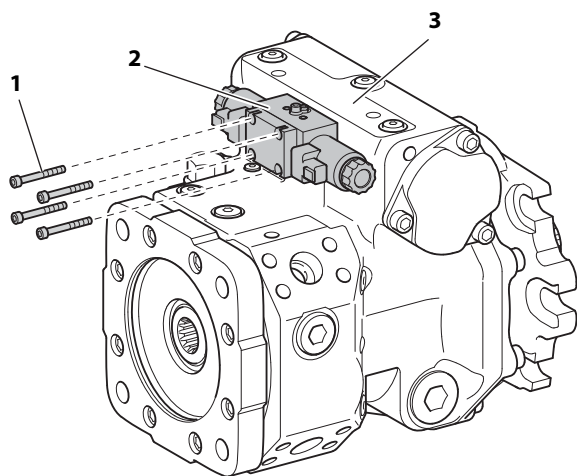
6. Check the o-ring and o-ring groove for damage, wear or contaminants.
7. Exchange the o-ring (8) for a new one.
8. Tighten the mounting nuts (7) with 5 Nm.

5.3 INSTALLING THE CONTROLLER

This section describes how you install the controller.

There is a wide variety of controllers.

Please note that the installation of only one such controller is shown here exemplarily.



MAE5820

1. Fixing Screws
2. Controller
3. Pump case

a. Procedure

To install the new or newly-sealed controller:

1. Using two fixing screws (1) center the seals, cover and the controller (2) on the pump case (3).
2. Screw in the two remaining fixing screws (1).

Note: Tighten the fixing screws crosswise according to the specified tightening torque - see Section 12, "Settings".

Note: After installation of the controller, the hydraulic neutral position must be set anew.

5.4 SETTING CONTROLLER (HYDRAULIC NEUTRAL POSITION)

This section describes how you set the hydraulic neutral position.

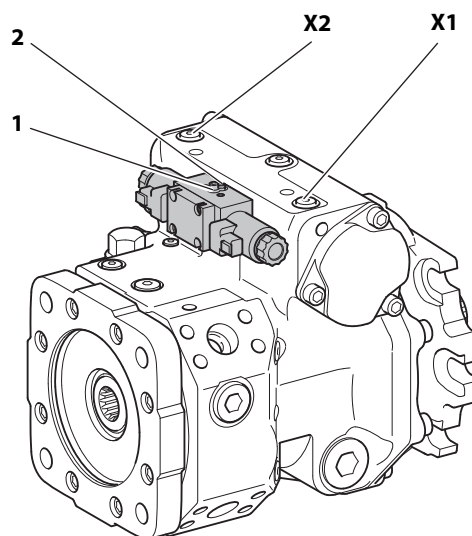
Note: There is a wide variety of controllers. Please note that the configuration of only one such controller is shown here exemplarily.

WARNING

Risk of injury!

The following works on the variable pump are dangerous.

- Pay close attention to the safety instructions (See Section 3, "General Safety Instructions").
- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.



MAE5830

1. Clamping Screw
2. Eccentric Pin



Controller

a. Procedure

To set the hydraulic neutral position:

1. Connect pressure gauges (max. 40 bar) to ports **X₁** and **X₂**.

Note: *The oil temperature in the closed circuit should be approx. 65 °C.*

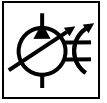
2. Secure the vehicle against unintended motion and then switch the control device to the neutral position.

Note: *Test speeds for the engine: Idle and maximum rpm.*

3. At both speeds check that both pressure gauges on the ports **X₁** and **X₂** give the same reading.
4. If the pressure values do not agree, loosen the clamping screw (1).
5. Turn the eccentric pin (2) until the same pressure reading is indicated on both gauges.

Note: *Do not turn the eccentric pin on the control unit beyond 90°.*

6. Tighten the clamping screw (1).



Section 6

Internal Gear Pump

Contents

PARAGRAPH	TITLE	PAGE
6.1	Remove Internal Gear Pump Cover	6-2
6.1.1	Exchange Internal Gear Pump	6-2
6.2	Seal/Install Internal Gear Pump Cover	6-3



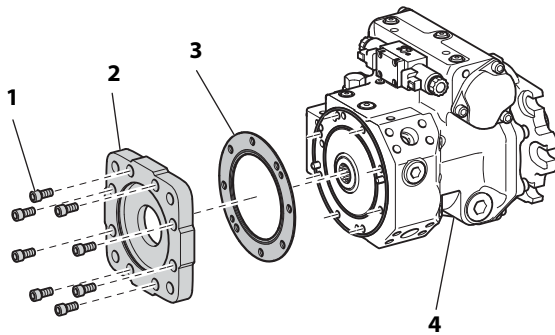
Internal Gear Pump

The material numbers for the special tools are to be found in the manufacturer's Special Tool Catalog.

If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

6.1 REMOVE INTERNAL GEAR PUMP COVER

This section explains how you remove the cover on the internal gear pump.



MAE5840

1. Fixing Screws
2. Internal Gear Pump Cover
3. Intermediate Plate
4. Pump Case

Note: The pump case is foreseen for two nominal sizes. These constitute a nominal size pair e.g. (85/110). The larger nominal size (110) is equipped with a standard intermediate plate and the smaller nominal size is without intermediate plate. Please note that the replacement of the seals with intermediate plate is presented here.

a. Procedure

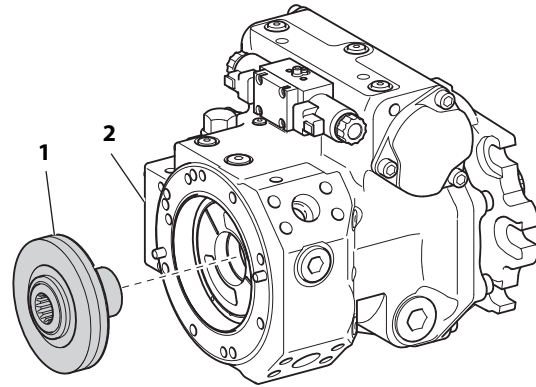
To remove the internal gear pump cover:

1. Loosen and remove the fixing screws (1) of the internal gear pump cover (2) on the pump case (4).
2. Remove the internal gear pump cover (2) and the intermediate plate (3).

6.1.1 Exchange Internal Gear Pump

This section describes how you exchange the internal gear pump.

Requirements: The internal gear pump cover must have been removed.



MAE5850

1. Internal Gear Pump
2. Pump Case

a. Procedure

To replace the internal gear pump:

Note: Pay close attention to the installation position of the internal gear pump.

1. Extract the Internal gear pump (1) from the pump case (2).
2. Check the internal gear pump, the sealing surfaces and the case for damage, wear and contaminants.
3. Exchange the internal gear pump (1) for a new one.

CAUTION

Risk of injury!

The splines on the drive shaft and the internal splines of the internal gear pump can be damaged.

- Do not hammer the internal gear pump onto the drive shaft.

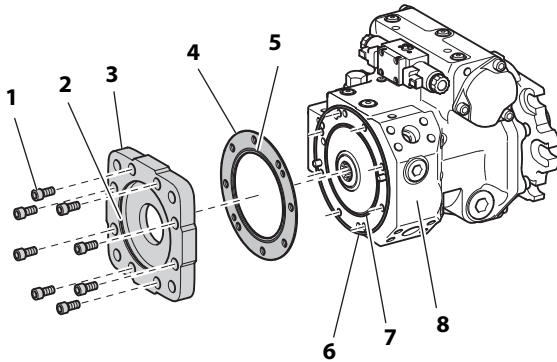
Note: Pay close attention to the installation position of the internal gear pump.

4. Insert the internal gear pump (1) carefully into the pump case (2).
5. Slide the internal gear pump (1) into the pump case (2) as far as it will go.



6.2 SEAL/INSTALL INTERNAL GEAR PUMP COVER

This section describes how you seal/install the internal gear pump cover.



MAE5860

1. Fixing Screws
2. O-ring
3. Internal Gear Pump Cover
4. Intermediate Plate
5. O-ring
6. Kant Seal
7. O-ring
8. Pump Case

a. Procedure

To replace the seals:

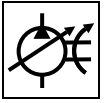
1. Check the kant seal, o-rings and sealing surfaces for damage, wear and contaminants.
2. Exchange the kant seal (6) and o-rings (2, 5 and 7) for new ones.
3. Screw the internal gear pump cover (2) and the intermediate plate (3) with the fixing screws (1) to the pump case (4).

Note: Tighten the fixing screws crosswise according to the specified tightening torque - see Section 12, "Settings".



Internal Gear Pump

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Section 7 Shaft Seal

PARAGRAPH	TITLE	PAGE
7.1	Exchange Shaft Seal	7-2



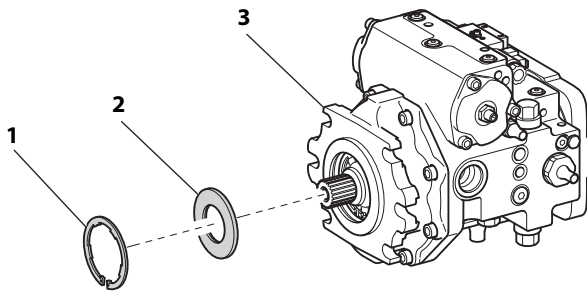
Shaft Seal

The material numbers for the special tools are to be found in the manufacturer's Special Tool Catalog.

If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

7.1 EXCHANGE SHAFT SEAL

This section explains how you exchange the shaft seal.
Required special tools: See manufacturer's Special Tool Catalog.



MAE5870

1. Retaining ring
2. Shaft seal
3. Bearing flange

a. Procedure

To replace the shaft seal:

1. Remove the retaining ring (1).
2. Using the demounting pliers remove the shaft seal (2) from the bearing flange (3).
3. Lightly grease the new shaft seal between the sealing and dust lip to prevent dry running.

Note: Mask the splines on the drive shaft to prevent damage to the shaft seal during installation.

4. Using the installation bush, press the shaft seal (2) into the bearing flange (3) as far as it will go.
5. Install the retaining ring (1) in such a way that it seats into the corresponding slot.
6. Remove the masking on the drive shaft.



Section 8 Valves

PARAGRAPH	TITLE	PAGE
8.1	Seal/Replace the High Pressure Relief Valve	8-2
8.2	Seal/Replace Low Pressure Relief Valve	8-3
8.3	Seal/Replace Pressure Cut-off	8-3
	8.3.1 Set Pressure Cut-off	8-4
8.4	Seal Control Cartridge	8-5
	8.4.1 Set Beginning of Control	8-5
8.5	Seal Shuttle Valve	8-6
8.6	Exchange Angle Position Sensor	8-6



Note: The material numbers for the special tools are to be found in the manufacturer's Special Tool Catalog.

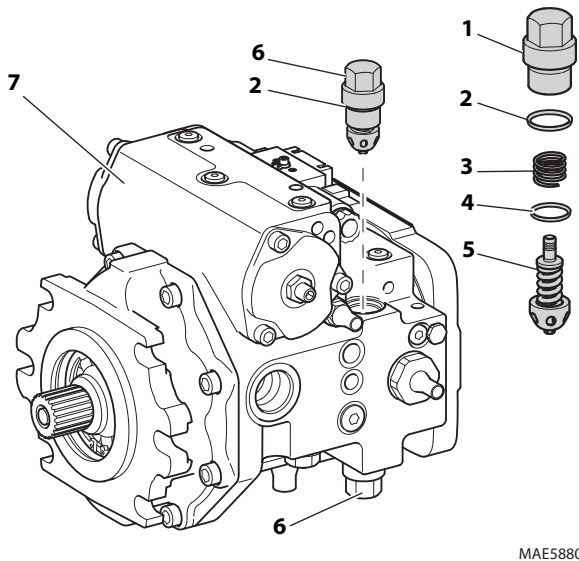
Note: If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

8.1 SEAL/REPLACE THE HIGH PRESSURE RELIEF VALVE

This section describes how you seal/replace the high pressure relief valve.

Note: Depending on the model, valves not shown in the diagram may be present on your unit.

Note: The variable pump is equipped with two high pressure relief valves. The same steps are required to seal each of the high pressure relief valves.



MAE5880

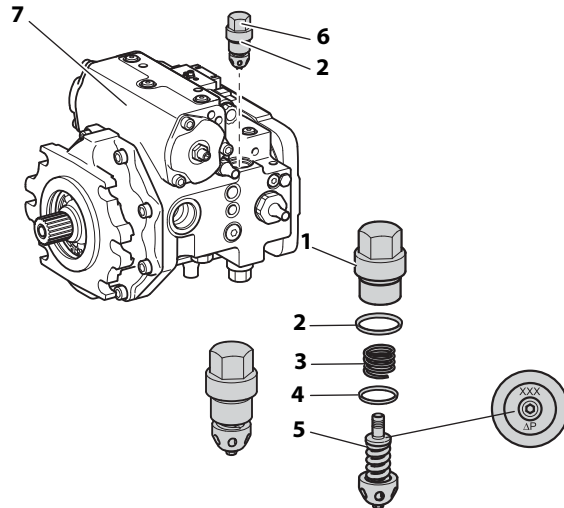
1. Threaded plug
2. O-ring
3. Pressure spring
4. O-ring
5. Valve insert
6. High pressure relief valve
7. Pump case

a. Procedure

To replace the valve seal and the valve insert:

1. Loosen the high pressure relief valve (6) and screw the high pressure relief valve (6) out of the pump case (7).
2. Extract the valve insert (5) with the pressure spring (3) out of the threaded plug (1).

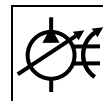
3. Check the o-rings and o-ring grooves for damage, wear or contaminants.
4. Exchange the o-rings (2 and 4) for new ones.
5. Check the valve insert for damage, wear and contaminants.



MAE5890

Note: Checking the valve setting ΔP of the valve insert with the target pressure value as per the order documentation.

1. Threaded plug
 2. O-ring
 3. Pressure spring
 4. O-ring
 5. Valve insert
 6. High pressure relief valve
 7. Pump case
6. Replace the valve insert (5).
 7. Insert the valve insert (5) with pressure spring (3) into the threaded plug (1).
 8. Screw the high pressure relief valve (6) into the pump case (7).



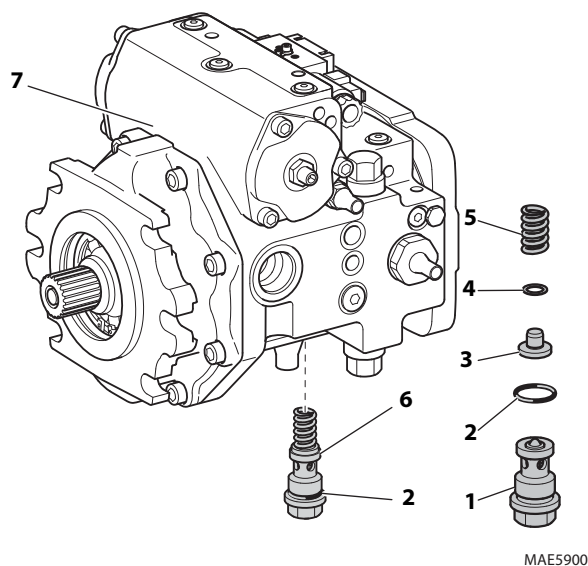
- Tighten the high pressure relief valve with the tightening torque necessary for the corresponding model:

Size	Required Tightening Torque
up to 110	250 Nm
250 Nm	375 Nm

Note: Check high pressure - see Section 12, "Settings".

8.2 SEAL/REPLACE LOW PRESSURE RELIEF VALVE

This section describes how you seal/replace the low pressure relief valve.



- Threaded plug with valve piston
- O-ring
- Spring disc
- Shim
- Pressure spring
- Low pressure relief valve
- Pump case

a. Procedure

To replace the valve seal:

- Loosen the low pressure relief valve (6) and screw the low pressure relief valve (6) out of the pump case (7).
- Check the o-ring and o-ring groove for damage, wear or contaminants.

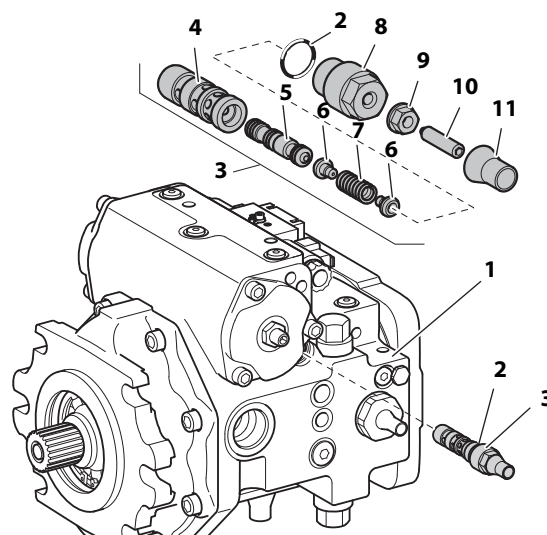
- Exchange the o-ring (2) for a new one.
- Screw the low pressure relief valve (6) into the pump case (7).
- Tighten the low pressure relief valve with the tightening torque necessary for the corresponding model:

Size	Required Tightening Torque
up to 110	90 Nm
above 145	120 Nm

Note: Check low pressure - see Section 12, "Settings".

8.3 SEAL/REPLACE PRESSURE CUT-OFF

This section describes how you check the pressure cut-off.



- Pump case
- O-ring
- Pressure cut-off
- Sleeve
- Control piston
- Spring disc
- Pressure spring
- Threaded plug
- SEAL LOCK sealing nut
- Adjusting screw
- Protective caps



a. Procedure

To replace the valve seal and pressure cut-off:

Note: When replacing the SEAL LOCK sealing nut on the valve, re-insert the yellow protective cap.

1. Loosen the pressure cut-off (3) and screw the pressure cut-off (3) out of the pump case (1).
2. Check the o-ring and o-ring groove for damage, wear or contaminants.
3. Exchange the o-ring (2) for a new one.
4. Check the pressure cut-off for damage, wear and contaminants.
5. Exchange the pressure cut-off (3) for a new one.
6. Screw the pressure cut-off (3) into the pump case (1).
7. Tighten the pressure cut-off with 60 Nm.

8.3.1 Set Pressure Cut-off

This section describes how you check the pressure cut-off.

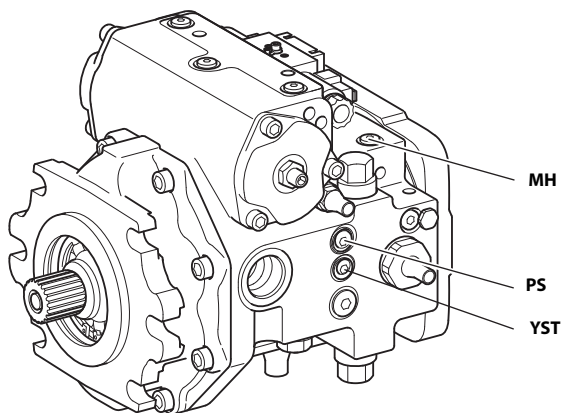


WARNING

Risk of injury!

The following works on the variable pump are dangerous.

- Pay close attention to the safety instructions (see Section 3, "General Safety Instructions").
- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.



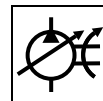
MAE5920

a. Procedure

To check the pressure cut-off:

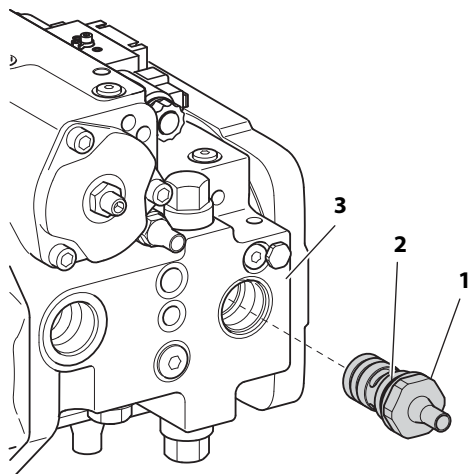
1. Connect a pressure gauge (600 bar) to port MH.
2. Check pressure cut-off.

Note: The exact settings are to be found in the data sheet in your order documentation or in your specification.



8.4 SEAL CONTROL CARTRIDGE

This section describes how you seal the control cartridge.



MAE5930

1. Control cartridge
2. O-ring
3. Pump case

a. Procedure

To replace the valve seal:

Note: When replacing the SEAL LOCK sealing nut on the adjusting screw for the beginning of control, re-insert the yellow protective cap.

1. Loosen the control cartridge (1) and screw the control cartridge (1) out of the pump case (3).
2. Check the o-ring and o-ring groove for damage, wear or contaminants.
3. Exchange the o-ring (2) for a new one.
4. Screw the control cartridge (1) into the pump case (3).
5. Tighten the control cartridge with 50 Nm.

8.4.1 Set Beginning of Control

Note: The exact settings are to be found in the data sheet in your order documentation or in your specification.

a. Procedure

To set the beginning of control:

1. Warm up the drive (oil temperature 50 - 60 °C).
2. A pressure gauge (600 bar) is required on the gauge port MH - gauge port pump and a device to measure the rotational speed for the engine is required.
3. Switch the driveline to forwards in on-road mode and brake firmly (Wheels must not spin).
4. Check the DA-beginning of control according to the data in your order.

To set the beginning of control on the setting screw for beginning of control:

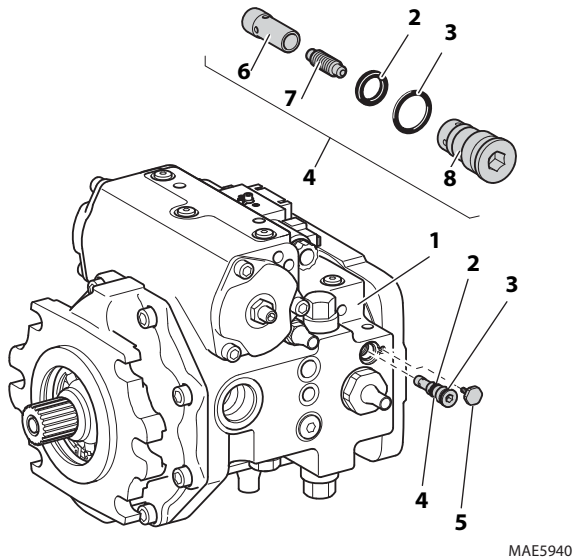
- Turn in a clockwise direction - retard beginning of control
- Turn in an anti clockwise direction - advance beginning of control

Note: The rotational speed at beginning of control should be approx. 200 rpm above the idle speed of the drive motor. High pressure is approx. 50 bar.



8.5 SEAL SHUTTLE VALVE

This section describes how you seal the shuttle valve.



1. Pump case
2. O-ring
3. O-ring
4. Shuttle valve
5. Stop screw
6. Sleeve
7. Piston
8. Threaded plug

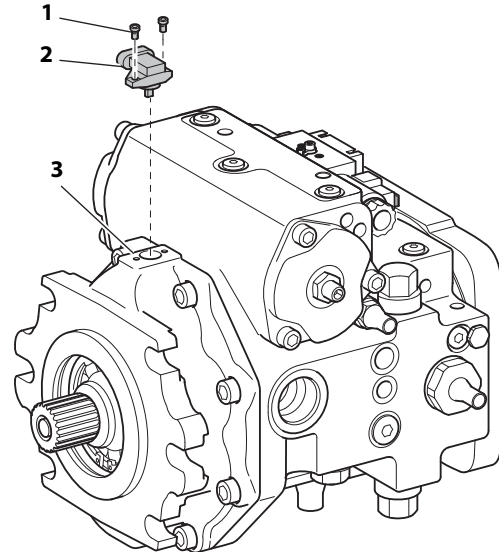
a. Procedure

To replace the valve seal:

1. Loosen and remove the stop screw (5).
2. Loosen the shuttle valve (4) and screw the shuttle valve (4) out of the pump case (1).
3. Check both o-rings and o-ring grooves for damage, wear or contaminants.
4. Exchange the o-rings (2 and 3) for new ones.
5. Screw the shuttle valve (4) into the pump case (1).
6. Tighten the shuttle valve with 50 Nm.
7. Screw the stop screw (5) into the pump case (1).
8. Tighten the stop screw with 5.5 Nm.

8.6 EXCHANGE ANGLE POSITION SENSOR

This section explains how to replace the angle position sensor.



1. Fixing screws
2. Angle position sensor
3. Bearing flange

a. Procedure

To replace the angle position sensor:

1. Loosen and remove the fixing screws (1) of the angle position sensor (2).

Note: Pay close attention to the installation position of the angle position sensor.

2. Detach the angle position sensor (2).
3. Check the angle position sensor and the sealing surface for damage, wear and contaminants.
4. Replace the angle position sensor (2).

Note: Pay close attention to the installation position of the angle position sensor.

5. Place the angle position sensor (2) on the bearing flange (3).
6. Fasten the angle position sensor (2) using the fixing screws (1).

Note: Tighten the fixing screws according to the specified tightening torque - see Section 12, "Settings".



Section 9

Filter

Contents

PARAGRAPH	TITLE	PAGE
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9.2	Seal/Replace Filter Head	9-2



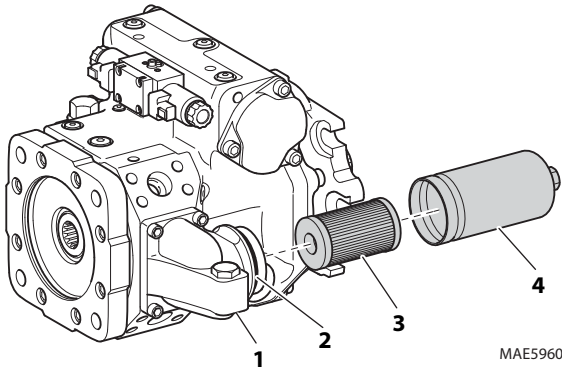
Filter

The material numbers for the special tools are to be found in the manufacturer's Special Tool Catalog.

Note: If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

9.1 MOUNTABLE FILTER

This section describes how you exchange the filter cartridge and seal the filter housing.



This section describes how you seal/replace the high pressure relief valve.

1. Filter head
2. O-ring
3. Filter cartridge
4. Filter housing

DANGER

Risk of poisoning and injury!

Contact with hydraulic fluid damages your health (e.g. eye injuries, skin and tissue damage, poisoning through inhalation).

- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.

a. Procedure

To replace the filter cartridge and the filter case seal:

1. Loosen and remove the filter housing (4) from filter head (1).
2. Withdraw the used filter cartridge (3) from the filter housing (4).
3. Check the filter head and filter housing for damage, wear and contaminants.

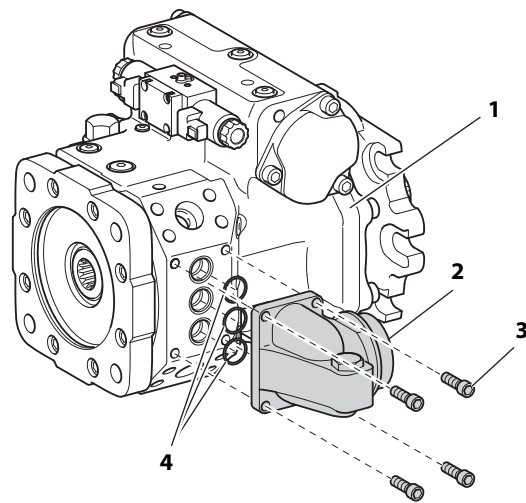
4. Insert the new filter cartridge (3) into the filter housing (4).
5. Check the o-ring and o-ring groove for damage, wear or contaminants.
6. Exchange the o-ring (2) for a new one.

Note: Lightly grease the o-ring.

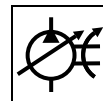
7. Screw the filter housing (4) onto the filter Head (1).
8. Tighten the filter housing (4) with 45 Nm.

9.2 SEAL/REPLACE FILTER HEAD

This section describes how you seal/replace the filter head.



1. Pump case
2. Filter head
3. Fixing screws
4. O-rings



a. Procedure

To replace the seals and the filter head:

1. Loosen and remove the fixing screws **(3)** for the Filter Head **(2)** on the pump case **(1)**.
2. Remove the filter head **(2)**.
3. Check the o-rings and o-ring grooves for damage, wear or contaminants.
4. Exchange the o-rings **(4)** for new ones.
5. Check the filter head for damage, wear and contaminants.
6. Exchange the filter head **(2)** for a new one.
7. Fasten the filter head **(2)** with the fixing screws **(3)** to the pump case **(1)**.

Note: Tighten the fixing screws crosswise according to the specified tightening torque - see Section 12, "Settings".



Filter

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Section 10

Threaded plugs

Contents

PARAGRAPH	TITLE	PAGE
10.1	Seal/Replace Threaded Plugs.....	10-2



Threaded plugs

Note: The material numbers for the special tools are to be found in the manufacturer's Special Tool Catalog.

Note: If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

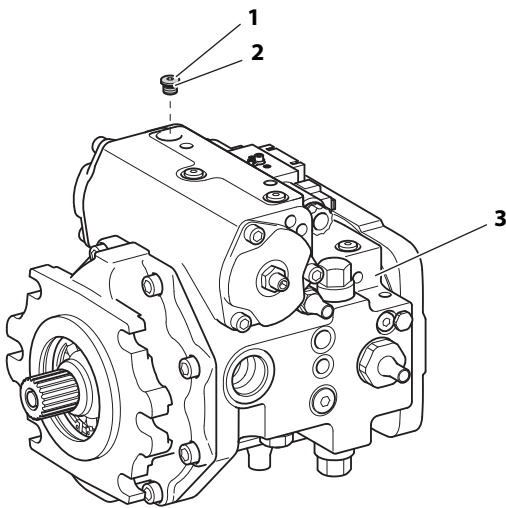
6. Tighten the threaded plug with the necessary tightening torque.

Note: For the tightening torques for threaded plugs, see Section 12, "Settings".

10.1 SEAL/REPLACE THREADED PLUGS

The section describes how you seal/replace the threaded plugs.

Note: There are many threaded plugs on the variable pump. Please note that the replacement of only one such threaded plug is presented here exemplarily.



MAE5980

1. Threaded plug
2. O-ring
3. Pump case

a. Procedure

To seal the threaded plug:

1. Loosen and remove the threaded plug (1) on the pump case (3).
2. Check the bore holes for damage, wear and contaminants.
3. Check the o-ring and o-ring groove for damage, wear or contaminants.
4. Exchange the o-ring (2) for a new one.
5. Screw the threaded plug (1) into the pump case (3).



Section 11

Pump Case/Rotary Group/Stroke Piston

Contents

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11.3	Demount Swashplate.....	11-3
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11.10	Sealing Stroke Piston.....	11-7
11.11	Installing Stroke Piston.....	11-8
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11.14	Sealing Timing Screw.....	11-10
11.14.1	Initial Setting Timing Screw.....	11-10



Note: The material numbers for the special tools are to be found in the manufacturer's Special Tool Catalog.

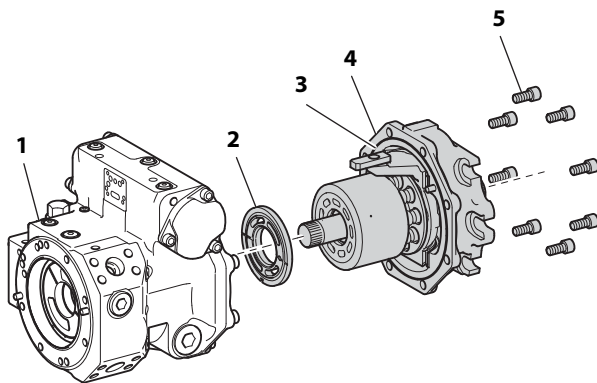
Note: If not explicitly specified, permissible tightening torques for the bolted connections are to be found in Section 12, "Settings".

11.1 PUMP CASE

This section explains how you remove/install the pump case. Requirements: The internal gear pump must have been removed.

Required special tools: See manufacturer's Special Tool Catalog.

Note: For safe removal/installation the variable pump must be placed in a mounting device!



MAE6100

1. Pump case
2. Control plate
3. O-ring
4. Bearing flange
5. Fixing screws

a. Procedure

To remove the pump case:

1. Screw the mounting rail to the pump case (1).

Note: Loosen the pre-charge pressure on the fixing screws diagonally.

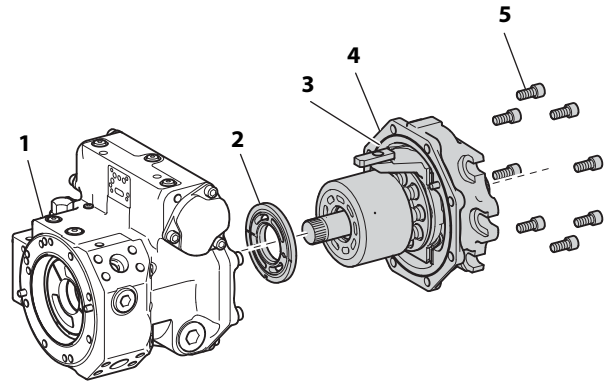
2. Remove the fixing screws (5) of the bearing flange (4).

Note: The control plate can fall out of the pump case!

3. Using lifting tackle, lift the pump case (1) by the mounting rail from the bearing flange (4).

Note: Set the pump case down in a clean, safe place.

4. Check the o-ring, the o-ring groove and the sealing surfaces for damage, wear or contaminants.
5. Exchange the o-ring (3) for a new one.



MAE6100

1. Pump case
2. Control plate
3. O-ring
4. Bearing flange
5. Fixing screws

a. Procedure

To install the pump case:

Note: Pay close attention to the installation position of the control plate.

1. Lightly grease the control plate (2) and place it in the pump case (1).
2. If a timing screw is present, then position it as described in Section 12, "Settings".
3. Screw the two guide bolts into any threaded bores on the pump case (1).

Note: Pay close attention to the installation position of the sliding block on the swash plate.

4. Using lifting tackle lift the pump case (1) by the mounting rail onto the bearing flange (4).
5. Remove the two guide bolts.

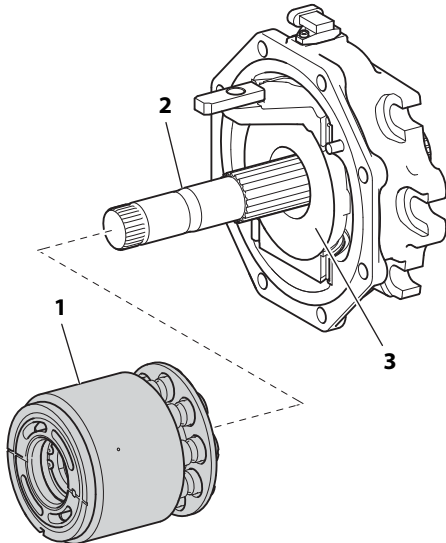
Note: Tighten the fixing screws crosswise according to the specified tightening torque - see Section 12, "Settings".

6. Fasten the bearing flange (4) with the fixing screws (5) to the pump case (1).
7. Remove the mounting rail.



11.2 DEMOUNT ROTARY GROUP

This section explains how you demount the rotary group.
Requirements: The pump case must have been removed.



MAE6110

1. Rotary group hydraulic part
2. Drive shaft
3. Swashplate

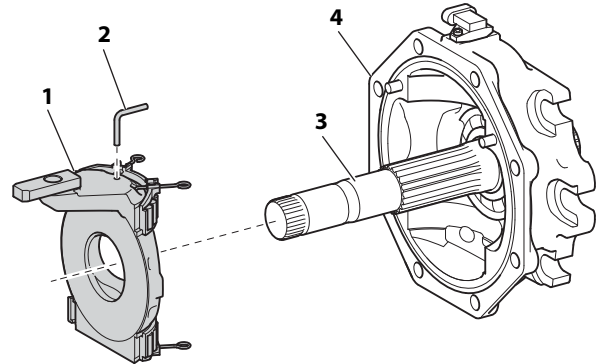
a. Procedure

To demount the rotary group:

1. Pull the rotary group (1) off the drive shaft (2).
2. Check the drive shaft and the sliding surface of the swash plate for damage, wear or contaminants.

11.3 DEMOUNT SWASHPLATE

This section describes how you replace the swashplate.
Requirements: The pump case must have been disconnected and the rotary group removed.



MAE6120

1. Swashplate
2. Wire
3. Drive shaft
4. Bearing flange

a. Procedure

To remove the swashplate:

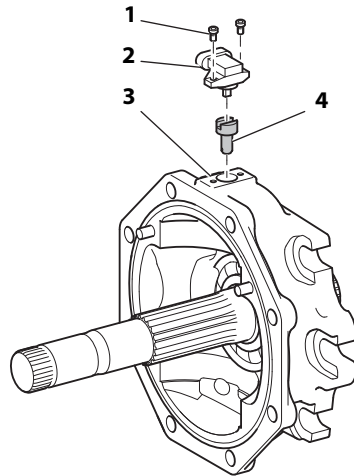
1. Lift the swashplate (1) up out of the bearing flange (4).
2. Remove the wire (2) of the swivel angle sensor from the swashplate (1).
3. Check the swashplate for damage, wear and contaminants.



11.4 REPLACE SENSOR SHAFT

This section describes how to replace the sensor shaft with a new one.

Requirements: The swashplate must have been removed.



MAE6130

1. Fixing screws
2. Angle position sensor
3. Bearing flange
4. Sensor shaft

a. Procedure

To replace the sensor shaft:

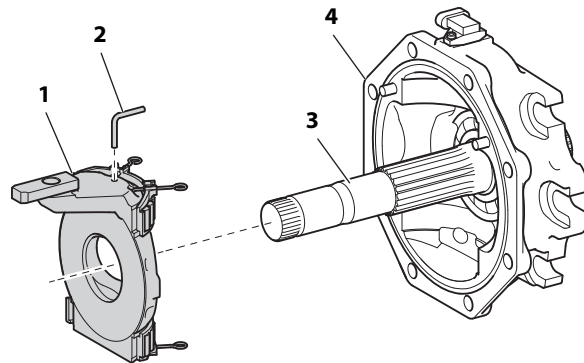
1. Loosen and remove the fixing screws (1) of the angle position sensor (2).
2. Detach the angle position sensor (2).

Note: Pay close attention to the installation position of the sensor shaft.

3. Draw the sensor shaft (4) out of the bearing flange (3).
4. Check the sensor shaft and the borehole for damage, wear and contaminants.
5. Exchange the sensor shaft (4) for a new one.
Pay close attention to the installation position of the sensor shaft.
6. Insert the sensor shaft (4) into the bearing flange (3).
7. Place the angle position sensor (2) on the bearing flange (3).
8. Fasten the angle position sensor (2) using the fixing screws (1).

11.5 REPLACING/INSTALLING SWASHPLATE

This section describes how you replace/install the swashplate.



MAE6140

1. Swashplate
2. Wire
3. Drive shaft
4. Bearing flange

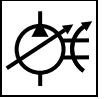
a. Procedure

To replace/install the swashplate:

1. Install the wire (2) in the swashplate (1).
2. Lift the swashplate (1) carefully over the drive shaft (3) into the bearing flange (4).

Note: Ensure that the wire of the swivel angle sensor is inserted into the borehole on the sensor shaft. Check the wire for ease of motion.

Note: Check the position of the swashplate in the bearing.

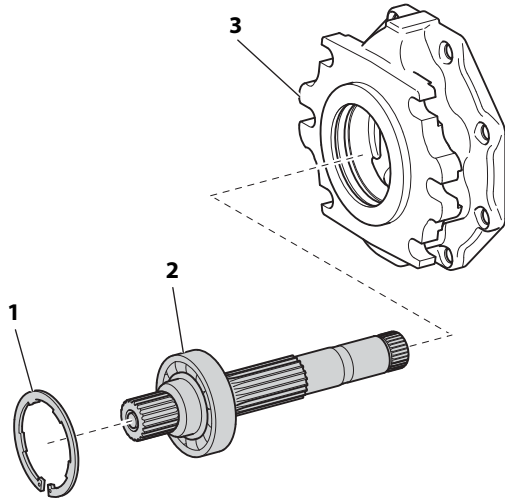


11.6 REMOVING DRIVE SHAFT WITH BEARING

This section describes how you demount the drive shaft with bearing.

Requirements: Shaft seal, pump case, swashplate and rotary group must have been removed.

Required special tools: See manufacturer's Special Tool Catalog.



MAE6150

1. Retaining ring
2. Drive shaft with bearing
3. Bearing flange

a. Procedure

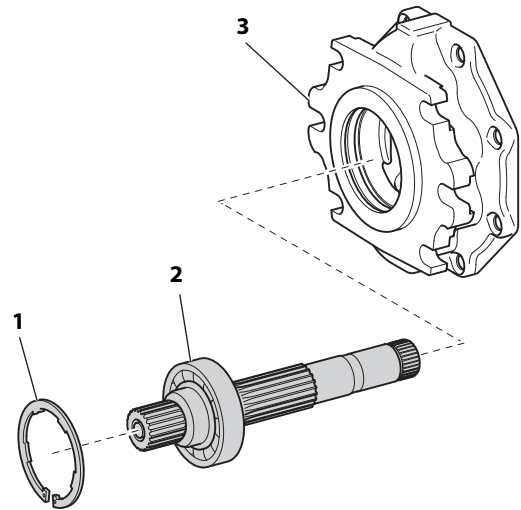
To remove the drive shaft with bearing:

1. Remove the retaining ring (1).
2. Press the drive shaft with bearing (2) out of the bearing flange (3).
3. Check the drive shaft with bearing for damage, wear and contaminants.

11.7 REPLACING/INSTALLING DRIVE SHAFT WITH BEARING

This section describes how you replace/install the drive shaft with bearing.

Required special tools: See manufacturer's Special Tool Catalog.



MAE6160

1. Retaining ring
2. Drive shaft with bearing
3. Bearing flange

a. Procedure

To replace/install the drive shaft with bearing:

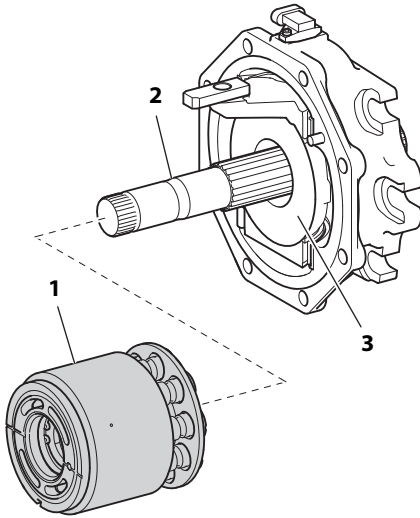
1. Using the installation bush, press the drive shaft with bearing (2) into the bearing flange (3) as far as it will go.
2. Install the retaining ring (1) in such a way that it seats into the corresponding slot.



11.8 REPLACING/INSTALLING ROTARY GROUP

This section explains how you replace/install the rotary group.

Requirements: The pump case must have been removed.



MAE6170

- 1. Rotary group hydraulic part
- 2. Drive shaft
- 3. Swashplate

a. Procedure

To replace/install the rotary group:

CAUTION

Risk of damage!

The splines on the drive shaft and the internal splines of the rotary group can be damaged. Pay close attention to the safety instructions (See Section 3, "General Safety Instructions").

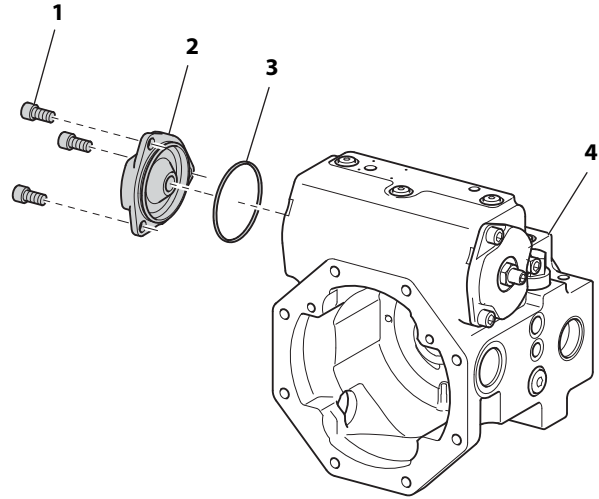
- Do not hammer the rotary group onto the drive shaft.

1. Lightly grease the sliding surface of the Swashplate (3).
2. Install the rotary group (1) carefully onto the drive shaft (2).
3. Slide the rotary group (1) up to the swashplate (3) as far as possible.

11.9 SEALING COVER ON STROKE PISTON

This section explains how you seal the cover on the stroke piston.

Requirements: The pump case must have been removed.



MAE6180

- 1. Fixing screws
- 2. Cover
- 3. O-ring
- 4. Pump case

The two sides of the stroke piston have different covers. The steps necessary to replace the cover seals are therefore different.

a. Procedure

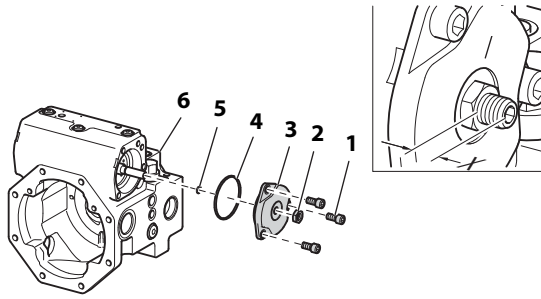
To replace the left-hand seal:

Note: Mark the position of the cover, so that it is correctly positioned when you put it back on after sealing.

1. Loosen and remove the fixing screws (1) on the left-hand cover (2).
2. Turn the cover (2) and loosen it carefully from the pump case (4) with light blows of a hammer (rubber hammer).
3. Check the o-ring, the o-ring groove and the pump case for damage, wear or contaminants.
4. Exchange the o-ring (3) for a new one.
5. Place the cover (2) on the pump case (4). Pay due attention to the marking made previously.

Note: Tighten the fixing screws according to the specified tightening torque - see Section 12, "Settings".

6. Fasten the cover (2) using the fixing screws (1).



MAE6190

1. Fixing screws
2. Lock nut
3. Cover
4. O-ring
5. O-ring
6. Pump case
7. Rod

b. Procedure

To replace the right-hand seal:

Note: Mark the position of the cover, so that it is correctly positioned when you put it back on after sealing.

1. Loosen and remove the fixing screws (1) on the right-hand cover (3).
2. Measure and note the dimension X of the lock nut for the installation later.
3. Remove the lock nut (2). To this end maintain a firm grip on the rod (7).
4. Screw the cover (3) off the rod (7).
5. Check the o-rings, o-ring grooves and pump case for damage, wear or contaminants.

Note: Mask the thread on the rod to prevent damage to the O-rings.

6. Exchange the o-rings (4 and 5) for new ones.
7. Remove the masking from the thread on the rod.
8. Screw the cover (3) onto the rod (7).

Note: Tighten the fixing screws diagonally according to the specified tightening torque - see Section 12, "Settings".

9. Fasten the cover (3) using the fixing screws (1). Pay due attention to the marking made previously.

c. Procedure

To set dimension X:

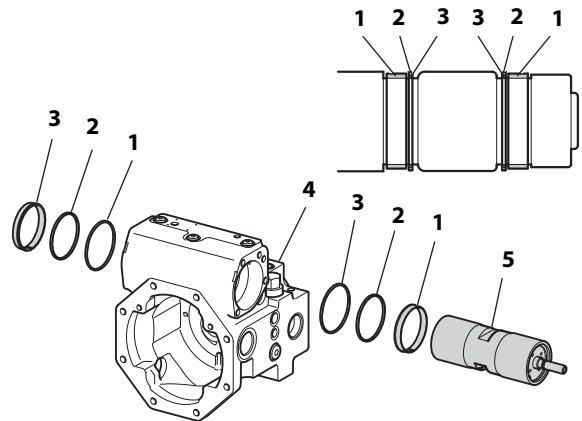
1. Screw the lock nut (2) onto the rod (7).
2. By unscrewing the rod (7), set the dimension X.
3. Clamp the rod (7) while you tighten the lock nut (2).
4. Inspect dimension X after installing.

11.10 SEALING STROKE PISTON

This section explains how you exchange the stroke piston and seals.

Requirements: Pump case and cover must have been removed.

Required special tools: See manufacturer's Special Tool Catalog.



MAE6200

1. Guide ring
2. Turcon slide ring
3. O-ring
4. Pump case
5. Stroke piston

a. Procedure

To replace the stroke piston and seals:

1. Extract the stroke piston (5) from the pump case (4).
2. Check the seals, o-ring groove and pump case for damage, wear or contaminants.
3. Exchange the o-ring (3), the turcon slide ring (2) and the guide ring (1) for new ones.



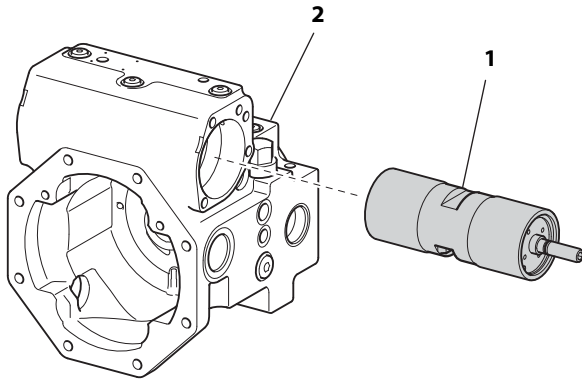
4. Lay the o-ring (3) in the o-ring groove and insert the turcon slide ring (2) into the pump case (4), placing it in the groove. Check the position of the turcon slide ring (2). Insert the guide ring (1) into the pump case (4).
5. Check the stroke piston for damage, wear and contaminants.
6. Exchange the stroke piston (5) for a new one.

11.11 INSTALLING STROKE PISTON

This section describes how you install the stroke piston.

Requirements: Pump case and cover must have been removed.

Required special tools: See manufacturer's Special Tool Catalog.



MAE6210

1. Stroke piston
2. Pump case

Note: Mount the installation aid on the mechanical-neutral side (X) and insert it from the other side. Pay close attention to the installation position of the stroke piston.

1. Slide the stroke piston (1) into the pump case (2).
2. Remove the installation aid.
3. Screw the aligning device to the pump case and align the stroke piston using it.
4. Remove the aligning device.
5. Install the covers.

11.11.1 Mechanical Neutral Position

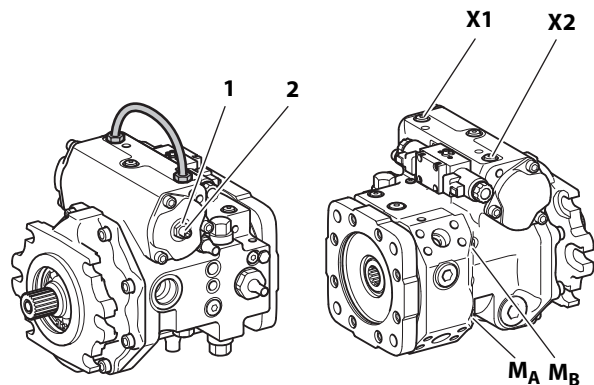
This section explains how you check the mechanical neutral position.

! WARNING

Risk of injury!

The following works on the variable pump are dangerous.

- Pay close attention to the safety instructions (See Section 3, "General Safety Instructions").
- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.



MAE6220

1. Locknut
2. Rod

a. Procedure

To check the mechanical neutral position:

1. Connect the ports **X₁** and **X₂** with a hose of nominal width NW6 at least.
2. Attach pressure gauges to the gauge ports **M_A** and **M_B**.
3. Check whether the two pressure gauges show the same pressure reading.
4. Loosen the lock nut (1).
5. Turn the rod (2) until the same pressure value is displayed on both gauges.

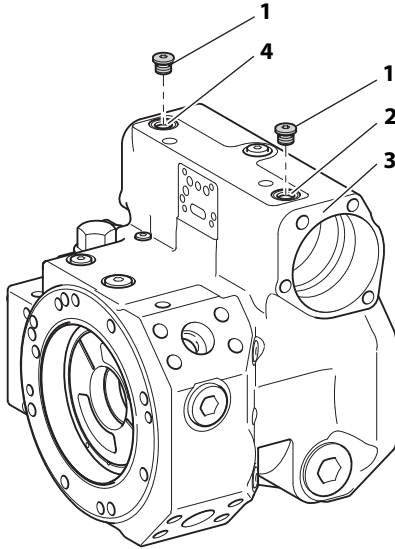
Note: Pay close attention to play in the rod, tighten the rod by rotating outwards.

6. Clamp the rod (2) while you tighten the lock nut (1).



11.12 CHECKING ORIFICES X1 AND X2

This section describes how you check the orifices **X₁** and **X₂**.



MAE6230

1. Threaded plugs
2. Orifice X1
3. Pump case
4. Orifice X2

a. Procedure

To check the orifices:

1. Loosen and remove the threaded plugs (1) on the pump case (3).
2. Check the bore holes and orifices for damage, wear and contaminants.
3. Exchange orifice **X₁** (2) and orifice **X₂** (4) for new ones.
4. Screw the threaded plugs (1) into the pump case (3).
5. Tighten the threaded plug with the necessary tightening torque.

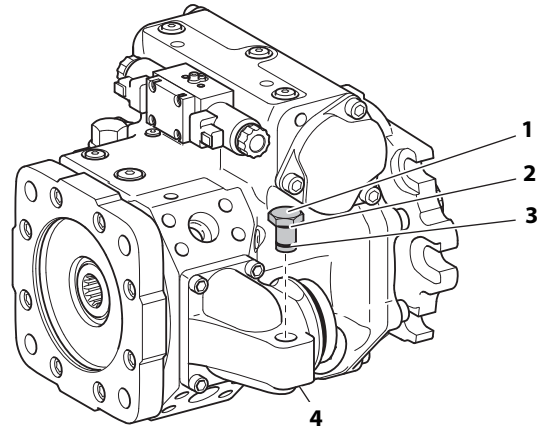
Note: For the tightening torques for threaded plugs and orifices, see Section 12, "Settings".

11.13 SEALING THREADED PLUG (COLD START VALVE)

This section describes how you seal the threaded plug.

Note: There is an option to replace the threaded plug with a contamination indicator.

Note: The steps necessary to seal the contamination indicator are the same.



MAE6240

1. Threaded plug (contamination indicator)
2. Seal ring
3. O-ring
4. Filter head

a. Procedure

To replace the seals:

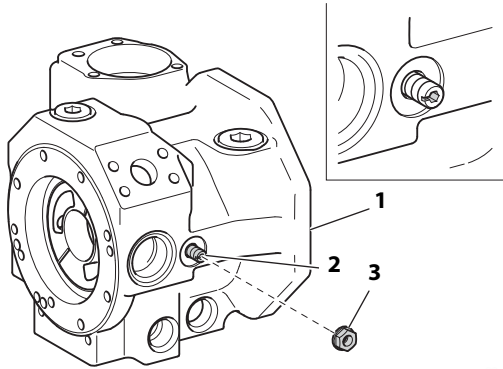
1. Loosen the threaded plug (1) and screw it out of the filter head (4).
2. Check the seal ring, the sealing surface, the o-ring and the o-ring groove for damage, wear or contaminants.
3. Exchange the seal ring (2) and the o-ring (3) for new ones.
4. Screw the threaded plug (1) into the filter head (4).
5. Tighten the threaded plug (1) with 50 Nm.

Note: Tightening torque for the contamination indicator 30 Nm.



11.14 SEALING TIMING SCREW

This section describes how you seal the timing screw.



MAE6250

1. Pump case
2. Timing screw
3. SEAL LOCK sealing nut

a. Procedure

To seal the timing screw:

Note: Do not turn the timing screw. Mark the position of the timing screw on the pump case.

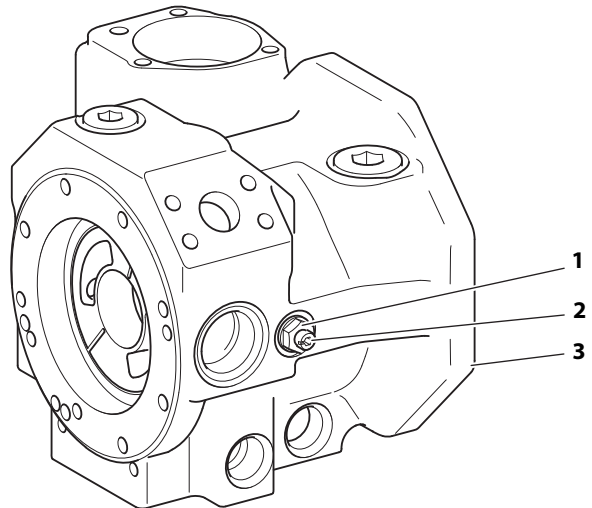
Note: The notch on the timing screw points towards the internal gear pump.

1. Loosen and remove the SEAL LOCK sealing nut (3). While doing that maintain a firm grip on the timing screw (2).
2. Exchange the SEAL LOCK sealing nut (3) for a new one.
3. Screw on the new SEAL LOCK sealing nut (3). Clamp the timing screw (2) while you tighten the SEAL LOCK sealing nut (3).

Note: For the tightening torques for the SEAL LOCK sealing nut, see Section 12, "Settings".

11.14.1 Initial Setting Timing Screw

This section describes how you set the timing screw.



MAE6260

1. SEAL LOCK sealing nut
2. Timing screw
3. Pump case

a. Procedure

To set the timing screw:

1. Loosen the SEAL LOCK sealing nut (1) on the timing screw (2).
2. Screw the timing screw (2) into the pump case (3) as far as it will go and then retract it by one full turn.

Note: The notch on the timing screw points towards the internal gear pump (For this, the control plate must be installed).

3. Clamp the timing screw (1) while you tighten the SEAL LOCK sealing nut (2).

Note: For the tightening torques for the SEAL LOCK sealing nut, see Section 12, "Settings".



Section 12 Settings

Contents

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Settings

As part of the first commissioning after a repair, you need to check the original settings of the variable pump. This chapter explains the following settings:

Test bed settings:

- High pressure
- Low pressure

Installation settings:

- Tightening torques

Note: Make all settings with the equipment at operating temperature (Oil temperature 50 - 60 °C).

Note: If the values checked deviate from the original settings, contact manufacturer service regarding the setting.

WARNING

Risk of injury!

Working on the variable pump at operating temperature is dangerous.

- Pay close attention to the safety instructions (See Section 3, "General Safety Instructions").
- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.

WARNING

Risk of wear and malfunctions!

The cleanliness of the hydraulic fluid influences directly the service life of the hydraulic system.

- During functional testing ensure that gauge ports, hoses and measuring equipment are clean. Clean the measuring points thoroughly before you open them and begin the adjustment process.
- Also when the measuring points are subsequently closed, ensure that no contamination occurs.

12.1 LOW PRESSURE

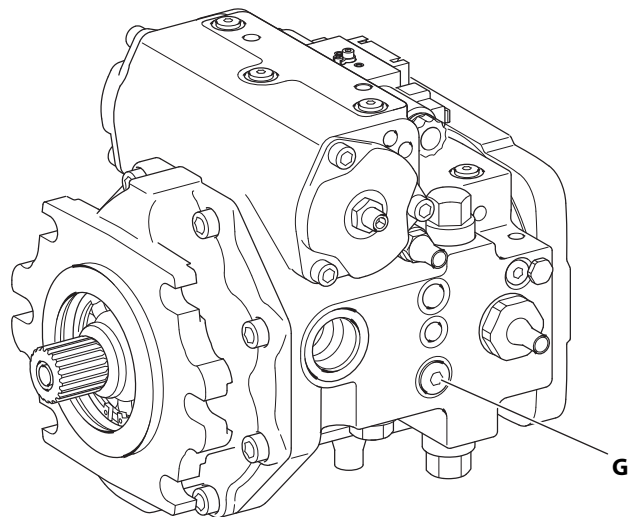
This section describes how you check low pressure.

WARNING

Risk of injury!

The following works on the variable pump are dangerous.

- Pay close attention to the safety instructions (See Section 3, "General Safety Instructions").
- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.



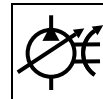
MAE6270

a. Procedure

To check low pressure:

1. Attach a pressure gauge to port G.
2. Check the low pressure at operating temperature (oil temperature 50 - 60 °C).

Note: The exact settings are to be found in the data sheet in your order documentation or in your specification.



12.2 HIGH PRESSURE

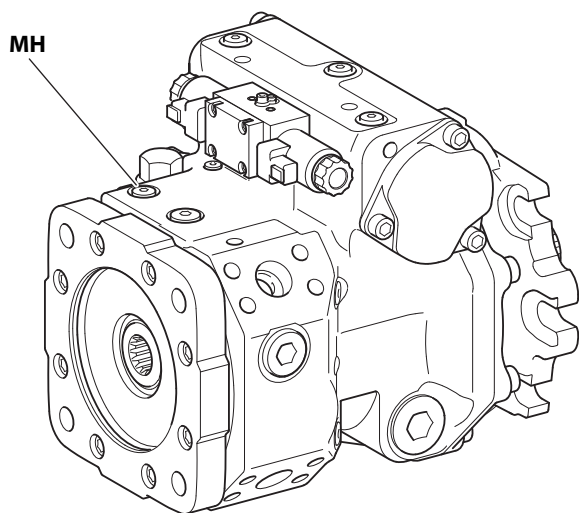
This section describes how you check high pressure.

WARNING

Risk of injury!

The following works on the variable pump are dangerous.

- Pay close attention to the safety instructions (See Section 3, "General Safety Instructions").
- While working with hazardous materials (for example, hydraulic fluids), always wear safety gloves and safety glasses.



MAE6280

a. Procedure

To check high pressure:

1. Attach a pressure gauge to port M_H.
2. Check high pressure at operating temperature (Oil temperature 50 - 60 °C, forward and reverse vehicular motion).

Note: The exact settings are to be found in the data sheet in your order documentation or in your specification.

12.3 TIGHTENING TORQUES

The following tightening torques apply:

- **Fittings:**
Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
- **Internal threads of the axial piston unit:**
The maximum permissible tightening torques MG_{max} are the maximum values of the internal threads and must not be exceeded. Please refer to Table below for the values.
- **Threaded plugs:**
For the locking screws supplied with the axial piston unit, the required tightening torques of threaded plugs MV apply. Please refer to Table below for the values.
- **Fixing screws:**
For fixing screws according to DIN 13/ISO 68, we recommend checking the tightening torque in individual cases as per VDI 2230. Please refer to Table below for the values.
- **SEAL-LOCK sealing nuts:**
The tightening torques necessary for SEAL-LOCK sealing nuts MA apply. Please refer to Table below for the values.



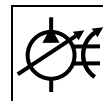
12.3.1 Tightening torques of the female threads and threaded plugs

Ports		Maximum permissible tightening torque of the female threads $M_{G \max}$	Required tightening torque of the threaded plugs M_V	WAF hexagon socket for Standard Thread size the threaded plugs
Standard	Thread size			
DIN 3852 ¹⁾	M10 x 1	30 Nm	15 Nm ²⁾	5 mm
	M12 x 1.5	50 Nm	25 Nm ²⁾	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M27 x 2	330 Nm	135 Nm	12 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
	M48 x 2	900 Nm	400 Nm	24 mm
ISO 11926	5/16-24 UNF-2B	10 Nm	7 Nm	1/8 in
	3/8-24 UNF-2B	20 Nm	10 Nm	5/32 in
	7/16-20 UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18 UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16 UNF-2B	160 Nm	70 Nm	5/16 in
	7/8-14 UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12 UN-2B	360 Nm	170 Nm	9/16 in
	1 5/16-12 UN-2B	540 Nm	270 Nm	5/8 in
	1 5/8-12 UN-2B	960 Nm	320 Nm	3/4 in
	1 7/8-12 UN-2B	1200 Nm	390 Nm	3/4 in

NOTE:

1. The tightening torques of the MV threaded plugs apply for screws in the "dry" and received on delivery and in the "lightly oiled" state for installation.

2. In the "lightly oiled state", MA is reduced to 10 Nm for M10x1 and to 17 Nm for M12x1.5.



12.3.2 Tightening torques for the fixing screws

Thread	Tightening torque ¹⁾ Strength classes		
	8.8	10.9	12.9
M3	1.1 Nm	1.6 Nm	1.9 Nm
M4	2.6 Nm	3.9 Nm	4.5 Nm
M5	5.2 Nm	7.6 Nm	8.9 Nm
M6	9.0 Nm	13.2 Nm	15.4 Nm
M8	21.6 Nm	31.8 Nm	37.2 Nm
M10	43 Nm	63 Nm	73 Nm
M12	73 Nm	108 Nm	126 Nm
M14	117 Nm	172 Nm	201 Nm
M16	180 Nm	264 Nm	309 Nm
M18	259 Nm	369 Nm	432 Nm
M20	363 Nm	517 Nm	605 Nm
M22	495 Nm	704 Nm	824 Nm
M24	625 Nm	890 Nm	1041 Nm

NOTE: ¹⁾The tightening torques of the slotted screw apply for screws in the "dry".

The values apply for slotted screws with metric ISO-thread according to DIN 13 Part 13, as well as under-cap bearing areas according to DIN 912 Socket Head Cap Screws, DIN 931 Hexagonal Cap Screws Partially Threaded or DIN 933 Hexagon Cap Screws Fully Threaded.



12.3.3 Tightening torques SEAL-LOCK sealing nuts

Thread size	Required tightening torque SEAL-LOCK sealing nut MA
M6	10 Nm
M6 x 0.5	11 Nm
M8	22 Nm
M8 x 1	24 Nm
M10	40 Nm
M10 x 1	44 Nm
M12	69 Nm
M12 x 1.5	72 Nm
M14	110 Nm
M14 x 1.5	120 Nm
M16	170 Nm
M16 x 1.5	180 Nm



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