

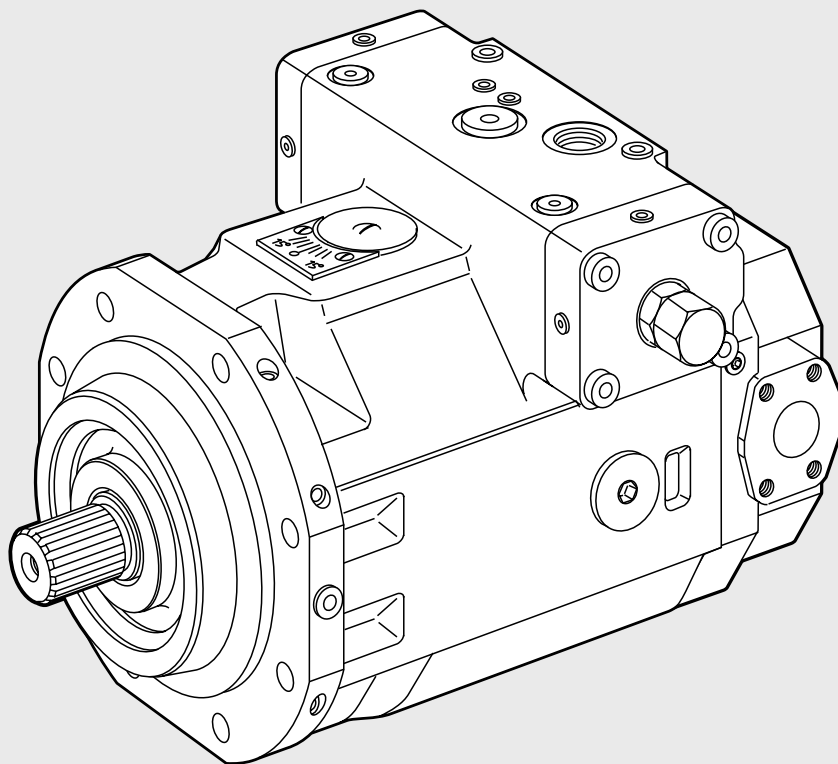
Axial piston variable pump A4VSO

RE 92 050-01-B/03.05

Replaces RDE 92050-1-B/08.93



Operating Instructions



Manufacturer

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Avoiding hazards

DANGER

To ensure reliable operation and to avoid damage when performing repair work, study these operating instructions carefully and thoroughly!

Bosch Rexroth will not be held liable for any personal injuries or machine damage arising from non-compliance to these operating instructions. In the event of damage caused by disregard of these operating instructions, any warranty provided by Bosch Rexroth will be rendered null and void and liability placed with the operator.

1. About these instructions

1.1 Structure and requirements

These instructions are intended to assist you in the installation, initial start-up and operation of Rexroth A4VSO axial piston units. These instructions are structured as follows:

- Safety on page 7.

This informs you how the instructions in this document are to be read and you will also receive some basic safety instructions with regard to handling and operating axial piston units.

- Product description on page 11.

This includes information on identifying axial piston units as well as how to use them properly.

- Installation on page 15.

This comprises all necessary information for installation, but also deinstallation and storage of axial piston units.

- Commissioning on page 29.

This chapter shows all information about the commissioning of the axial piston unit and the system.

- Trouble shooting on page 35.

This overview will assist you in locating and tracing faults on the axial piston unit and the overall system.

- Maintenance on page 37.

This includes information on servicing, repair and maintenance of the axial piston unit.

Area of validity for these instructions

These operating instructions are valid for Rexroth A4VSO axial piston units for operation with approved hydraulic fluids. Information on approved hydraulic fluids is available in the attendant technical data sheet RE 92 050.

These operating instructions are for the:

- system manufacturer,
- operator,
- user.

Each respective installation drawing, technical data sheet and order confirmation from Bosch Rexroth AG is also binding for the system manufacturer.

Important documents Before starting with the tasks described in these operating instructions, you must have the following documentation close to hand:

- **Order confirmation**

The order confirmation includes the preset technical data. The axial piston unit may only be operated using the values and conditions as specified in the order confirmation.

- **Installation drawing**

The installation drawing for the axial piston unit contains the outer dimensions, all connections and the hydraulic schematic.

- **Technical data sheet**

The technical data sheet includes among other things the maximum permissible technical data for an axial piston unit. The data sheet valid for the A4VSO is RE 92 050.

Additional data sheets are valid depending on the displacement device for your axial piston unit: RE 92 060, RE 92 064, RE 92 076, RE 92 080, and RE 92 084.

- **System hydraulic schematic**

- **System wiring diagram**

The hydraulics schematic and wiring diagram contain information on the hydraulic or electrical connections. You will require this data to operate the axial piston unit as part of the system. The documents are available from the system manufacturer.

The following Rexroth publications provide you with additional information on installation and operation of the axial piston unit:

- **RD 90 220: Mineral-oil based hydraulic fluid**

Describes the requirements placed on a mineral-oil based hydraulic fluid for operation of a Rexroth axial piston unit and assists you in the selection of a hydraulic fluid for your system.

- **RD 90 221: Environmentally acceptable pressure fluids HEES, HEPG, HETG for axial piston units**

Describes the requirements placed on an environmentally acceptable hydraulic pressure fluid for operation of a Rexroth axial piston unit and assists you in the selection of a hydraulic fluid for your system.

- **RD 90 300-B: General installation instructions**

Contains additional information on the configuration of a hydraulic system and for general installation of an axial piston unit in a system.

- **RD 90 300-03-B: Information on using hydraulic drives at low temperatures**

Contains additional information on use of Rexroth axial piston units at low temperatures.

- **RD 90 223: Axial piston unit for operation with HF hydraulic fluids**

Contains additional information on the use of Rexroth axial piston units with HF hydraulic fluids.

1.2 Personnel requirements

General requirements, qualification

Persons currently being instructed or undergoing training or persons under 18 who are under supervision may not perform any work on Rexroth hydraulic products.

This does not apply for juveniles with a minimum age of 16, if

- the occupation with Rexroth hydraulic products is necessary to complete the training objective,
- the protection of the juveniles is guaranteed by supervision by an experienced specialist and only equipment, tools and protective equipment are used which rule out any injuries.

Qualified personnel is deemed to be anyone who because of his/her vocational training, knowledge and experience along with knowledge of the pertinent regulations is capable of evaluating the tasks charged to him/her, of recognizing potential hazards and of instigating necessary measures to remove any accident hazards.

Generally, anyone under the influence of alcohol, other drugs or medication, which impair a person's reaction capability may not operate or repair Rexroth hydraulic products.

Maintenance personnel requirements

Maintenance measures may be necessary to ensure that the axial piston unit retains its full functional capability. Details are available in the chapter on maintenance (page 39).

Maintenance measures include inspection, servicing and maintenance of hydraulic and electrical components. For each different activity different levels of minimum qualifications for the personnel are required.

To perform inspections on the outer parts of the axial piston unit personnel must fulfill the following requirements:

- he/she must have been trained in the task at hand.

To perform service tasks on hydraulic parts of the axial piston unit personnel must fulfill the following requirements:

- he/she must have been trained in the task at hand.
- detailed specific knowledge of hydraulics is required
- he/she must be capable of reading and fully understanding hydraulic diagrams
- he/she must fully understand the correlation between the installed protection devices and
- he/she must have knowledge of the function and design of the hydraulic components.

Maintenance work on an axial piston unit may be performed by Rexroth authorized workshops only. Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Generally for work on the electrical system the following applies:

- Work on electrical equipment must only be carried out by an authorized trained electrician or by instructed persons under the direction and supervision of an authorized trained electrician in accordance with electro-technical regulations.

1.3 Hazard markings and pictograms

These instructions differentiate between categories of hazards as per ISO Guide 37:

DANGER

This hazard marking indicates a high level of risk, lethal hazards and severe injuries.

WARNING

This hazard marking indicates a medium level of risk, injuries and severe property damage.

CAUTION

This hazard marking indicates a low level of risk and property damage.

Note

This identifies information, which contributes to better understanding of the machine processes or which points to a special or important circumstance.

Tip

This identifies information, which contributes to more efficient operation.



This symbol identifies information on disposal of components and operating materials.

2. Safety

Read through this chapter carefully before you start to work on the axial piston unit.

The Rexroth axial piston units are components within the meaning of the Machine Directive 98/37/EG, which are used for installation in a system. The safety regulations in these instructions relate to axial piston units only. Please also observe the system manufacturer's safety regulations.

2.1 Basic safety instructions

Observe the following safety instructions and the system manufacturer's safety instructions precisely, to avoid any injuries and health hazards and to rule out any property damage and environmental pollution.

DANGER

Danger to life

Working on systems that have not been shut-down represents a hazard to life and limb.

The work described in this document may only be performed on systems that have been shut down. Before starting work:

- Make sure that the drive motor cannot be switched on.
- Make sure that all power transmitting components and terminals (electric, pneumatic, hydraulic) are switched off in accordance with the manufacturer's specifications and secured against being switched on again. If possible, remove the system's main fuse.
- Make sure that the system has been completely discharged. To do so follow the system manufacturer's specifications.

WARNING

Risk of injury

To avoid any injuries, please observe the following recommendations with regard to safety clothing:

- When working on the system always wear safety shoes with steel toe-caps.
- When working with hazardous material (for example special hydraulic fluids) always wear protective gloves and safety goggles.

DANGER

Risk of poisoning and injury

Contact with hydraulic fluids is hazardous to health (e. g. eye injuries, skin lesions, poisonous when inhaled).

- Always check the lines for signs of wear or damage before any start-up.
- When dealing with hydraulic fluids always observe the safety instructions issued by the pressure fluid manufacturer.

⚠ WARNING**Risk of burns!**

The axial piston unit heats up during operation. The solenoids in the pump also heat up during operation. Fingers and hands may suffer severe burn injuries if the axial piston unit or the solenoids are touched.

- Always allow the axial piston unit to cool down before touching it.
- Protect yourself by wearing heat-resistant gloves and protective clothing.

⚠ DANGER**Risk of poisoning**

When searching for leakages, escaping hydraulic fluid may penetrate the skin and cause severe poisoning.

- Always use a piece of paper or cardboard as an indicator.

⚠ WARNING**Risk of injury and damage**

Incorrectly connected components can cause severe malfunctions.

- Ensure that pipes are connected according to the hydraulic schematic.
- Perform the component-oriented functional tests.

⚠ DANGER**Fire hazard**

Hydraulic fluid is highly flammable.

- Do not subject the axial piston unit to open flame.

⚠ WARNING**Hearing damage**

Depending on the position and interacting components involved an excessively high continuous sound level may damage hearing.

- Always wear hearing protection when working in the proximity of the axial piston unit when it is operating.

⚠ CAUTION**Environmental pollution**

If hydraulic fluid escapes it will lead to poisoning of the ground water and ground contamination.

- A drip tray must be positioned underneath the axial piston unit.
- Repair leaks immediately.
- In Germany hydraulic systems are classed as "Systems for dealing with water-polluting substances within the meaning of the Water resources law (WHG)". In this context please note in particular §1 and §19 of the WHG (§19g, 19i, 19l). Any additional national regulations and standards must also be observed.
- You can find further information on the correct handling of Bosch Rexroth hydraulic products in our publication "General Product Information for Hydraulic Products", RE 90 220 and "Environmentally acceptable rapid biologically degradable hydraulic fluids HEPG, HEES for axial piston units", RE 90 221.

2.2 What to do in event of an accident

You are told here what measures you should be taken in the event of an accident or catastrophe.

Preparations

Perform the following measures regularly to ensure that you are well prepared for any emergency:

- You should attend first-aid courses on a regular basis to ensure that you are capable of performing first-aid measures in an emergency.
- Keep updated on of developments in terms of rescue equipment and options available in your company for first aid.
- Maintain a list of important telephone numbers and contacts at your workplace for an emergency.
- Observe the company safety regulations.

What to do in event of an accident

If an accident occurs proceed as follows:

- 1 In the event of injured parties:
Start by performing first-aid measures.
- 2 In the event personal injury and property damage:
Record the severity of injury to persons or damage to property, to enable targeted deployment of rescue personnel and vehicles.
- 3 In the event of a catastrophe (fire):
Leave the system area immediately.
Use the designated escape facilities and escape routes.
- 4 In event of injury to persons or damage to equipment and buildings:
Notify your supervisor immediately.

2.3 Operator's and user's obligations to exercise due care

The operator or user must ensure that

- the axial piston unit is used for its proper and intended use only (see "Usage in accordance with intended purpose" on page 12).
- the axial piston unit is stored, operated and repaired in accordance with the operating and environment conditions contained in the technical specifications, and in particular that the limits given in the technical specifications are adhered to.
- the axial piston unit once repaired may only be operated if in perfect working order.
- required personal protective equipment is made available to personnel and that it is also worn.
- while work is being conducted on the axial piston unit the power supply has been disconnected.
- the operating instructions are always maintained in a legible and complete condition at the deployment location for the axial piston unit.
- only qualified and authorized personnel conduct repairs on the axial piston unit.
- this personnel is regularly instructed in all pertinent matters of labor safety and environmental protection, and that they are aware of repair instructions and, in particular, the safety instructions contained therein.
- in the event of personal injury sufficient bandaging material and "first-aid personnel" are available.

Note

Note

In addition to the operating instructions generally valid, statutory and other binding regulations on accident prevention and environmental protection must be observed.

2.4 Responsibilities of system manufacturer

The Rexroth axial piston units are components within the meaning of the Machine Directive 98/37/EG, which are used for installation in a machine or system.

Bosch Rexroth AG emphasizes that the equipment supplied is designed exclusively for installation in a machine or for connection to other machines to form a machine.

These instructions form the basis for the instructions for the overall machine, which must be prepared by the machine manufacturer.

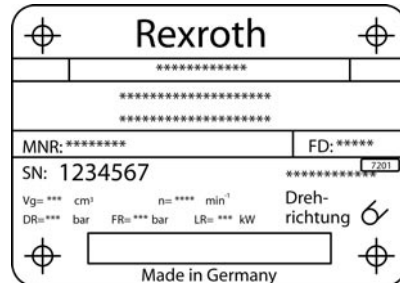
Initial start-up is not permitted until it has been determined that the machine or system into which this product has been installed corresponds with the EU Directives and all other relevant guidelines.

3. Product description

This chapter explains how to identify an axial piston unit using the name plate. In addition to this you will also be provided with information on how to use the axial piston unit properly.

3.1 Identification of axial piston unit

The axial piston unit can be identified by means of the name plate:



The name plate contains the following information:

- Manufacturer (Rexroth)
- Type code
- Serial number
- Specific technical data (rotational speed, pressure cut-off, flow rate, output, direction of rotation)
- Material number
- Production date

3.2 Functional description

The A4VSO axial piston unit is an axial piston variable displacement pump in swashplate design for hydrostatic drives in open circuit. The flow is proportional to the drive speed and displacement.

The A4VSO axial piston unit has the following features:

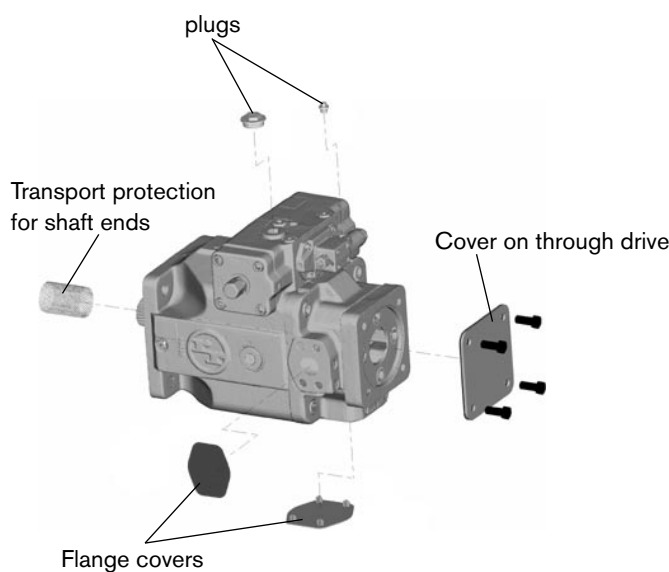
- High pressure range; nominal pressure 350 bar, max. pressure 400 bar
- Nominal sizes A4VSO: 40, 71, 125, 180, 250, 355, 500, 750, and 1000 cm³
- Long service life, low noise values
- Through drive for pump combinations up to identical nominal size
- 100 % through drive torque
- Suitable for operation with special fluids (RE 92 053)
- Comprehensive displacement control program (RE 92 060, RE 92 064, RE 92 076, RE 92 080, and RE 92 084)

3.3 Scope of supply

The following components are part of the axial piston unit's scope of supply:

- Axial piston unit with transport protection

All covers and plastic plugs must be removed before installation. See p. 20 on completion of installation.



- Cover
- Flange
- Tag with instructions
- Operating instructions

3.4 Technical data

The set technical data for the axial piston unit are shown in the order confirmation. This data are supplemented by the respective catalog sheet. Catalog sheet RE 92 050 is relevant for A4VSO. The following data sheets are valid depending on the displacement device for your axial piston unit: RE 92 060, RE 92 064, RE 92 076, RE 92 080, and RE 92 084.

3.5 Use according to specifications

Observe the following when operating the axial piston unit:

- The axial piston unit may only be stored in a dry, dust-free environment, which is free of corrosive substances and vapors.

The ex-factory corrosion protection is sufficient when stored under the specified conditions, insofar as condensate or leakage water cannot penetrate the axial piston unit.

- The axial piston unit may only be operated using the approved hydraulic fluids.

The axial piston unit may only be operated using the hydraulic fluids specified in the order confirmation. The hydraulic fluids may not be mixed with each other. Information on how to use the products with other hydraulic fluids is available on request.

- The axial piston unit may only be operated under the specified operating conditions.

The axial piston unit may only be operated when technically in perfect working order and further it may only be stored, operated and maintained in accordance with the technical data, operating and environmental conditions stated on the order confirmation. The limits specified in the technical data in particular may not be exceeded.

- The axial piston unit may only be operated within the specified performance range.

Operation with connection, replacement or output data other than those stated in these operating instructions is only permissible with the previous written permission of Bosch Rexroth AG. In addition to this, the technical details specified in the respective order confirmation of Bosch Rexroth AG relative to the system are valid. The order confirmation is available to the system manufacturer and is binding.

- The axial piston unit may be used for the specified purpose only.

The axial piston unit may not be used for other purposes than the specified one, unless Bosch Rexroth AG expressly authorizes such usage in writing. The operating instructions of the system manufacturer and, where applicable, the technical specifications are to be strictly observed.

- The axial piston unit may not be used in potentially explosive environments.

Ignition sources are not allowed in the immediate vicinity of the axial piston unit, because pressure fluid that escapes may be flammable or indeed even explosive.

- Commissioning may only be performed in a system, which complies with all relevant guidelines.

The Rexroth axial piston units are components within the meaning of the Machine Directive 98/37/EG, which are used for installation in a machine or system.

Commissioning is not permitted until it has been determined that the machine or system into which this product has been installed corresponds with the EU Directives and all other relevant guidelines.

Note

Any deviations from the intended usage or specifications contained in these instructions, technical modifications and conversions to the axial piston unit, and the operation of individual parts or the installation into other products will impair safety and thus render any warranty null and void.

4. Installation

This chapter describes the installation of the A4VSO axial piston unit.

You should read this chapter if you:

- wish to install an A4VSO axial piston unit in a stationary or mobile hydraulics system
- wish to deinstall or dispose of an A4VSO axial piston unit

Once you have read through this chapter you will then be capable of unpacking, mounting and connecting the axial piston unit. After this you can then start-up the axial piston unit.

Procedure

Proceed as follows for installation:

- 1 Make all necessary preparations and then unpack the axial piston unit.
- 2 Mount the axial piston unit at the intended installation position.
- 3 Connect all lines and hoses.
- 4 Connect the controller.

4.1 Safety instructions

Please always observe the following safety instructions when working on an axial piston unit:

DANGER

Danger to life

Working on systems that have not been shut-down represents a hazard to life and limb.

The work described in this chapter may only be performed on **systems that have been shut down**. Before starting work:

- Make sure that the drive motor cannot be switched on.
- Make sure that all power transmitting components and terminals (electric, pneumatic, hydraulic) are switched off in accordance with the manufacturer's specifications and secured against being switched on again. If possible, remove the system's main fuse.
- Make sure that the system has been completely discharged. To do so follow the system manufacturer's specifications.

DANGER

Risk of toxic poisoning and injury

Contact with hydraulic fluids is hazardous to health (e. g. eye injuries, skin lesions, poisonous when inhaled).

- Always check the lines for signs of wear or damage before any start-up.
- When dealing with hydraulic fluids always observe the safety instructions issued by the fluid manufacturer.

⚠ WARNING**Risk of injury**

To avoid any injuries, please observe the following recommendations with regard to **safety clothing**:

- When working on the system always wear safety shoes with steel toe-caps.
- When working with hazardous material (for example special hydraulic fluids) always wear protective gloves and safety goggles.

⚠ CAUTION**Risk of damage**

Impact loadings or impulsive forces to the drive shaft will damage the bearings in the axial piston unit.

During installation make sure that the axial piston unit's drive shaft is not subjected to any impact shock or hammering forces. Specifically this means:

- Do not hit onto the coupling of the drive shaft of the pump.
- Do not let the axial piston unit rest on its drive shaft.
- Refer to the Technical data sheet for the permissible axial and radial forces.

The drive shafts of the axial piston unit **can** be used to transport the axial piston unit as long as only axial forces directed outwards are acting. In other words, you can hook the axial piston unit up on the drive shaft.

4.2 Before starting

Do not start with the installation procedure until you have the following documents:

- Axial piston unit installation drawing (available from Rexroth)
- Hydraulic schematic for system (available from system manufacturer)
- If necessary, pump hydraulic schematic (shown on installation drawing)
- Order confirmation

The order confirmation contains the axial piston unit's performance settings.

- Data sheet for axial piston unit

The data sheet contains the technical data for the axial piston unit. The data sheet provides data on, e. g. drive power, pump flow and weight of your axial piston unit.

Tools required

You will require suitable tools:

The installation drawing contains the dimensions of all connections on the axial piston unit. Please also observe the of the manufacturer's instructions for the other hydraulic components when selecting the required tools.

Fluid required

You will require an approved hydraulic fluid:

The system manufacturer can provide you with precise details on the hydraulic fluid. The Rexroth data sheets RE 90 220 and RE 90 221 contain the minimum specifications for the hydraulic fluids based on mineral oil or ecologically acceptable pressure fluids for the axial piston unit.

4.3 Unpacking instructions

When unpacking the axial piston unit please observe the following instructions:

⚠ CAUTION

Risk of parts falling down

If the packaging is not opened correctly parts may fall out and cause damage or result in injury.

- Place the packaging on a level, load-bearing base.
- Open the packaging from the top only.



When disposing of the packaging always observe the local regulations.

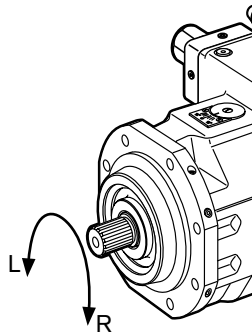
4.4 Preparing axial piston unit for installation

To prepare the axial piston unit for installation:

- 1 Remove the packaging material and dispose of it in accordance with regulations.
- 2 Compare the part number and designation with those on the order confirmation.

If the part number for the axial piston unit does not correspond with the one on the order confirmation, please contact Rexroth-Service to clarify the matter.

- 3 Compare the axial piston unit's direction of rotation (on name plate) with motor direction of rotation.



Note

Please note that the direction of rotation as shown on the name plate determines the direction of rotation viewing onto the shaftend of the pump. The drive motor's direction of rotation is **also** stated as viewing on the shaftend.

Consequently, a **clockwise** rotating axial piston unit is connected to an **anti-clockwise** drive motor.

4 Check the swivel angle indicator on the axial piston unit.

Note

Please note that if the swivel angle indicator is not on "0", the axial piston unit will start supplying fluid as soon as it is started up during the initial start-up.



5 If available use eye bolts for transport. Turn the eyebolts into the threads on the axial piston unit to lift it. Make sure that each eyebolt can bear the total weight of the axial piston unit plus roughly 20%.

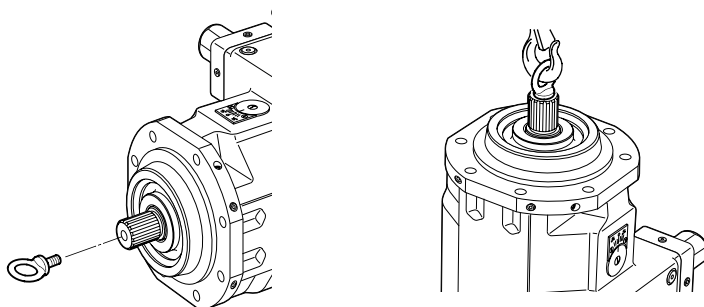
4.5 Transporting the axial piston unit to installation location

To transport the axial piston unit to the installation location:

1 Screw the eyebolt as shown into the drive shaft. For the thread size see the technical data sheet, unit dimensions.

2 Bring the axial piston unit as shown into the vertical position.

You can raise the axial piston unit as shown using the eyebolt screwed into the drive shaft without any risk of damaging it.



4.6 Installing axial piston unit

Note

The mounting of the axial piston unit depends on the installation interface to the drive motor.

The following descriptions serve to explain how the axial piston unit can be installed:

- via a flexible coupling
- via a transmission
- via a universal shaft

Following this you will be informed how to complete the assembly process.

If you have to install an axial piston unit directly into a tank, please observe the installation instructions on page 20.

Flexible coupling

To mount the axial piston unit with a flexible coupling:

- 1 Mount the specified coupling half to the drive shaft of the axial piston unit in accordance with the coupling manufacturer's specifications.

The drive shaft of the pump is provided with a threaded hole. For thread size please refer to the installation drawing. This threaded hole can be used for the mounting of the coupling.

 **CAUTION**
Risk of damage

Impact loadings or impulsive forces to the drive shaft will damage the bearings in the axial piston unit.

During installation make sure that the axial piston unit's drive shaft is not subjected to any impact shock or hammering forces. Specifically this means:

- Do not hit onto the coupling of the drive shaft of the pump.
- Do not let the axial piston unit rest on its drive shaft.
- Refer to the Technical data sheet for the permissible axial and radial forces.

- 2 Make sure that the installation location is free of dirt and foreign matter.

- 3 If the drive shaft on the axial piston unit is a splined shaft, brace the hub on the drive shaft or guarantee a durable lubricating of the drive shaft.

- 4 Transport the axial piston unit to the installation location and assemble the coupling on the motor side in accordance with the coupling manufacturer's specifications.

Please note that the axial piston unit should not be tightened until the coupling has been correctly mounted.

- 5 Fasten the axial piston unit at the installation location. If necessary, details on the tools required and tightening torques for the fastening bolts can be procured from the system manufacturer.

a) When mounting a **bell housing** check the axial play of the coupling through the bell window in accordance with the manufacturer's specifications.

b) If fastened to a **mounting bracket** align the axial piston unit carrier to the drive motor.

Installation on a transmission

Fasten the axial piston unit at the installation location. If necessary, details on the tools required and tightening torques for the fastening bolts can be procured from the system manufacturer.

Installation with universal shafts

To connect the axial piston unit using an universal shaft to the drive motor:

- 1 Position the axial piston unit close to the intended installation location. You should leave sufficient space to enable the universal shaft to be adjusted on both sides.

- 2 Mount the universal shaft into the drive shaft of the drive motor.

- 3 Bring the axial piston unit close to the universal shaft and connect the universal shaft to the axial piston unit's drive shaft.

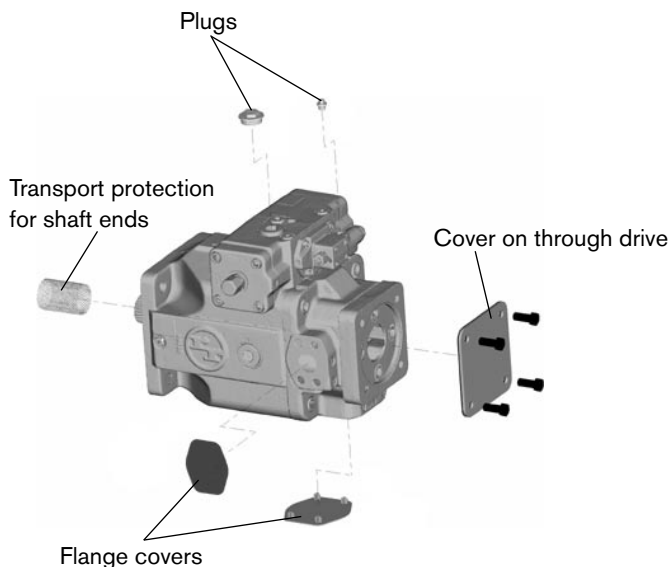
- 4 Move the axial piston unit into the installation location and fasten it in place. If necessary, details on the tools required and tightening torques for the fastening bolts can be procured from the system manufacturer.

The axial piston unit is to be fastened such that the expected acting forces and torques can be transferred without any danger.

Finalising installation To complete the installation:

- 1 Remove any eyebolts.
- 2 Remove transport protection.

The axial piston unit is delivered with protective caps and plastic plugs. They have to be removed before it is connected.



Generally the plastic caps and plugs can be removed by hand. If necessary a pair of pliers can also be used.

Note

Sealing rings and sealing surfaces may be damaged if the transport protection is not removed correctly.

Please note the following:

- Do not damage the sealing surfaces!
- The protective caps on the adjuster screws must not be removed.
- All ports must be connected to piping or hoses as shown in the schematic or the ports must be plugged.
- The hydraulic ports are meant to be used exclusively for connecting hydraulic lines. (see also Point 4.8)

3 Without through drive:

If used without through drive elements (auxiliary pump, PTO) replace the flange cover with a pressure-resistant, oil tight cover.

4 With through drive:

If a through drive element is used (auxiliary pump, PTO), remove the flange cover and mount the auxiliary pump as shown in the pump manufacturer's instructions.

4.7 Installation instructions

Valid for all installation positions:

- The pump housing must be filled with hydraulic fluid at commissioning and during operation.
- To achieve favorable noise values, use flexible elements between the reservoir and the hydraulic lines (suction, pressure, leakage) to the pump.
- Avoid having a check valve in the leakage fluid line (permissible in individual cases after consultation).
- Route the leakage fluid lines straight to the tank without any reductions in the cross section.

 CAUTION**Risk of damage**

The axial piston unit must always be filled with hydraulic fluid.

- During commissioning make sure that the axial piston unit is supplied with sufficient hydraulic fluid.
- In the event of unusual noise or vibrational development switch the system off immediately and check whether the axial piston unit has been filled with hydraulic fluid.

Vertical installation position

For a vertical installation position (end of shaft upright) Rexroth recommends the use of bearing flushing, to ensure that the front bearing and shaft sealing ring are lubricated. Without bearing flushing the installation must always then be performed as described below to ensure lubrication.

Note the following installation positions:

- **Location in tank for vertical installation position**

- a) **If the minimum fluid level is even with or higher than the pump:**

- Fill the unit **before installation** via the "R(L)" terminal.
 - Pipe ports "R(L)", "S", "T" and "U" as shown on the drawing.

The "R(L)"-port brings the leakage fluid back into the tank. It must be ensured that the "R(L)" leakage line ends in the reservoir away from the suction pipe ("S"-port).

The "T"-port must be plugged when in operation.

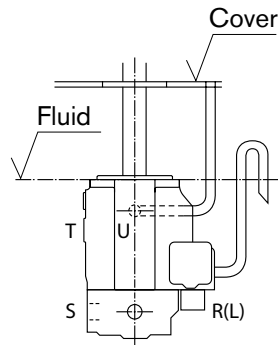
The "U"-port leads to ventilation outside the tank.

- Fill the unit **in installed condition** through the "T"-port.

In addition to the afore mentioned please note the following:

- The axial piston unit must be filled with hydraulic fluid during operation. Otherwise bearing lubrication on the drive shaft is not assured and damage to the axial piston unit can occur.
- Absolute cleanliness is of utmost priority. The axial piston unit must be installed in the tank in an absolutely clean condition. Contamination in the hydraulic fluid may severely impair the service life of the axial piston unit.
- To in such a manner, avoid any immediate re-entry of the leakage oil into the pump, pipe the "T" or "R(L)"-port away from the unit's suction area.

- Bleed the unit during commissioning through the "U"-port routed outwards, then seal this terminal after the bleeding process airtight (bond).

**Note**

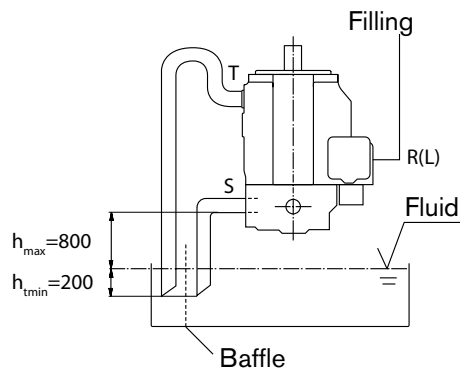
For this installation position the minimum fluid level must always be even with or above the pump flange surface.

b) If the minimum fluid level is below the pump flange area:

- Pipe the ports "R(L)", "T" and "S" as shown on the drawing opposite.
- Fill the unit **before installation** via the "R(L)"-port.
- Fill the unit **in installed condition** through the "T"-port.
- Bleed the unit during commissioning via the "U" terminal.

Note

A minimum pump inlet pressure (suction pressure) of 0.8 bar abs. must be maintained.



- **Location outside the tank for vertical installation position**

- Fill the pump housing **before installation** in the horizontal installation position through the "R(L)"-port.
- Plug the "R(L)".
- Install the unit and pipe the "S" suction port to tank.
- Pipe the "T"-port to the tank.
- Filling option **when installed**: Fill unit through the "T"-port.

Note

A minimum pump inlet pressure (suction pressure) of 0.8 bar abs. must be maintained.

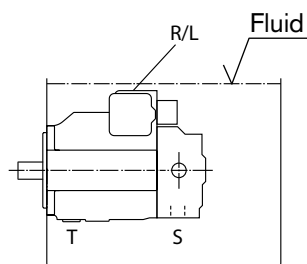
Horizontal installation position

In each case use the uppermost port "T", "K₁", "K₂" or "R(L)" for filling and afterwards as a leakage oil connection.

- **Location in tank for horizontal installation position**

- a) **If the minimum fluid level is even with or higher than the upper edge of the pump:**

- Leave the uppermost leakage oil port ("T", "K₁", "K₂" or "R(L)") and suction port "S" open.

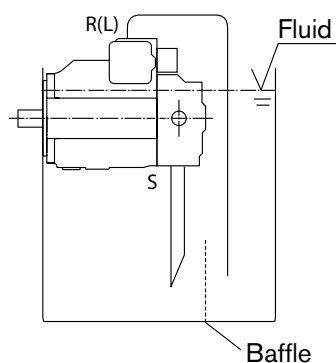


- b) **If the minimum fluid level is below the upper edge of the pump:**

- Pipe the leakage oil port and the suction port "S" as shown below.
- Fill the unit **before installation** or **in installed condition** through the leakage oil port ("T", "K₁", "K₂" or "R(L)").

Note

A minimum pump inlet pressure (suction pressure) of 0.8 bar abs. must be maintained.



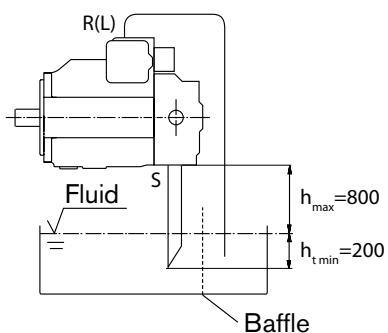
- **Location outside the tank for horizontal installation position**

- a) **Over tank installation**

- Pipe the suction port "S" and the uppermost leakage oil port as shown in picture below.
 - Fill the unit before installation or when in installed condition through the uppermost leakage oil port.

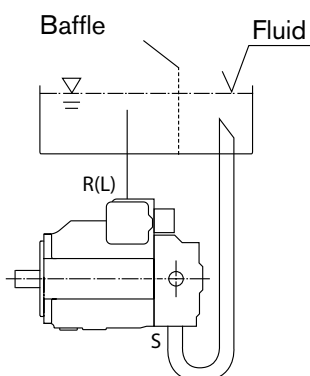
Note

A minimum pump inlet pressure (suction pressure) of 0.8 bar abs. must be maintained.



- b) **Below tank location**

- Pipe the suction port "S" and the uppermost leakage oil port as shown in picture below.
 - Fill the unit before installation through the uppermost leakage oil port.



4.8 Connecting lines

The systems manufacturer is responsible for the piping of the system. The axial piston unit must be connected to the rest of the hydraulics system in accordance with the system manufacturer's specifications.

CAUTION

Risk of damage

Lines and hoses that are installed under tension, generate additional mechanical forces under operation and thus reduce the service life of the axial piston unit and the overall system.

- Install all lines and hoses free of tension.

To connect the axial piston unit hydraulically to the hydraulics system:

1 Remove transport protection.

The axial piston unit is delivered with protective caps and plastic plugs. The protective caps and plastic plugs must be removed before the connection process.

Generally the caps and plugs can be removed by hand. If necessary a pair of pliers can also be used.

2 Clean the lines.

Contamination in the hydraulic fluid may severely impair the service life of the axial piston unit. The lines must be cleaned before installation.

3 Fasten the lines in accordance with the fitting manufacturer's specifications.

All ports must be connected to pipes or hoses as shown in the system diagram or the ports must be plugged.

Note

The main and control pressure ports are designed exclusively for connecting hydraulic lines.

Tightening torques

Note manufacturer's specifications on the permissible tightening torques for the fittings used!

For fastening screws acc. to DIN 13/ISO 68 we recommend checking the tightening torque in individual cases as per VDI 2230 Status 2003.

Make sure:

- that on pipe fittings and flanges the union nuts and flanges are correctly tightened.

Note

Mark all checked screw connections using, e.g. a permanent marker.

- that pipe and hose lines and any combination of connecting pieces, couplings or connecting points with hoses or pipes are checked by an expert to ensure that they are safe to operate.

3 When switching on for the first time listen for any noise and check for any leaks. Proceed as follows:

- a) Electric motor: In jog mode, start rotating several times only, do not press switch all way down.
- b) Combustion engine: Switch on with starter, but do not yet start.

4.9 Connecting electronic controller

For electronically controlled axial piston units the electronic controller must be connected as shown in the system manufacturer's wiring diagram.

DANGER

Risk of electric shock

When connecting the electronic controller there is a risk of experiencing an electric shock.

- Make sure that the controller is switched off before the connecting process and secured against being switched on again (e. g. by removing the main fuse). Notes on how to safely shut down the controller are available in the system manufacturer's specifications.

4.10 Deinstalling axial piston unit

DANGER

Danger to life

Working on an axial piston unit with the drive motor switched on presents a hazard to life and limb.

- Shut the system down and discharge it before deinstalling the axial piston unit. The procedure for shutting down and discharging the system is available in the system manufacturer's specifications.

To deinstall the axial piston unit proceed as follows:

- 1 Switch off the system.
- 2 Discharge hydraulic system in accordance with the system manufacturer's specifications.
- 3 Allow the axial piston unit to cool down. Check whether the axial piston unit has cooled down far enough so that it can be dismantled without any problems.
- 4 Place an oil collector under the axial piston unit, to collect any fluid that may escape.
- 5 Disconnect the axial piston unit using a suitable tool from the pipelines, so that any escaping fluid drops into the collector as provided.
- 6 Drain the axial piston unit.
- 7 If necessary, prepare the axial piston unit for storage as described on the following pages.

4.11 Preparing axial piston unit for storage

The axial piston unit is provided ex-factory with a corrosion protection packaging (corrosion protection plastic bag).

The active substance in the corrosion protection bag evaporates into the interior onto the metal surface and forms a separating layer between material and electrolyte (water).

Note

When Rexroth axial piston units are placed into storage, do not remove them from the corrosion protection bags until needed.

If the bag is damaged or opened, the active substance enters the immediate environment; the corrosion protection capability has then been destroyed. For this reason seal any openings in the bag immediately.

The active substance is not a health hazard!

If the axial piston unit is to be stored for an extended period or if it is to be removed from the system and then not immediately installed again, then it has to be preserved to safeguard it against corrosion during the storage period.

Note

The storage areas must be free of corrosive material and vapor. The professional storage of the axial piston unit must be inspected occasionally.

The following instructions only refer to units which are operated with a mineral-oil based hydraulic fluid. Other operating fluids requires conservation methods that are specifically designed for them. In such an instance please contact Rexroth.

When storing axial piston units the following instructions must be adhered, to taking the external and internal corrosion protective measures into account.

The axial piston unit may not be stored under conditions that are less favorable than those stated in the table.

Prepare the axial piston unit for storage in accordance with the following specifications:

Storage conditions	Storage period	
	Up to 12 months	12 to 24 months
	Protective method	
Solid, dry, uniformly temperate room	Drain the axial piston unit and seal all connections. Pack the axial piston unit air tight in a corrosion protection bag. (Standard protection method)	Drain the axial piston unit and fill with approx. 10 to 20 ml of corrosion protection VCI 329. Seal all connections. Pack the axial piston unit air tight in a corrosion protection bag.
Dry room, max. temperature difference <10°C	Drain the axial piston unit and fill with approx. 10 to 20 ml of corrosion protection VCI 329. Seal all connections. Pack the axial piston unit air tight in corrosion protection bag and in a wooden crate.	

Note

The corrosion protection VCI 329 is only compatible with mineral oil.

4.12 Disposing of axial piston unit

In the event of a defective axial piston unit you can proceed in one of the following manners:

- Have the axial piston unit repaired by a Rexroth authorized workshop
- Have selected units reconditioned at Rexroth (REMAN program)
- Have it scrapped by observing the following points:
 - Professional disposal of fluid residue in accordance with manufacturer's specifications and the valid laws
 - Professional disassembly and separation of materials to cast parts, steel, nonferrous metals, electronic waste, seals and delivery for recycling at a specialist company

The axial piston unit does not contain any pollutants.

Disposal



When disposing of the axial piston unit always observe the local regulations.

5. Commissioning

Note

The axial piston unit is a component within the meaning of Machine Directive 98/37/EG, which is used for installation in a machine or system.

Commissioning is not permitted until it has been determined that the machine or system into which this product has been installed corresponds with the EU Directives and all other relevant guidelines.

Absolute cleanliness is required during commissioning. Contamination of the medium may lead to increased wear and malfunctions. In particular solid foreign matter in the suction line such as, e.g. welding beads and metal shavings may damage the axial piston unit.

DANGER

Danger to life

Working in the hazard area of a system represents a risk to life and limb.

- Eliminate all potential sources of danger in the system.
- No-one may stand in the system's hazard area.
- The emergency-stop button for the system must be within easy range.
- The system manufacturer's specifications must be observed during commissioning.

This chapter explains the correct start up procedure for A4VSO axial piston unit. Follow the instructions in this chapter if:

- you are starting operation of the axial piston unit for the first time,
- you are going to operate the axial piston unit again after having had it repaired,
- you are going to operate the axial piston unit after a standstill with an empty suction line, or
- you are going to operate the axial piston unit again following an extended idle period (> 6 months).

Proceed as follows for the start-up:

- Prepare the necessary equipment (provide tool and hydraulic fluid)
- Fill the axial piston unit with hydraulic fluid
- Test the hydraulic fluid supply
- Perform a function test of the overall system
- Perform a flushing run on the overall system

The above mentioned steps are described in more detail below.

5.1 Before starting

Before initial start-up of the axial piston unit, you should take all necessary precautions and have all required equipment ready.

Tool required

You will require the following tools:

The installation drawing contains the dimensions for all connections on the axial piston unit. Please also observe the instructions of the manufacturers of the other hydraulic components when selecting the required tools.

Pressure fluid required

You will require an approved hydraulic fluid:

The system manufacturer can provide you with precise details on the hydraulic fluid. The Rexroth data sheets RE 90220 and RE 90221 contain the minimum specifications for the hydraulic fluids based on mineral oil or ecologically acceptable hydraulic fluids for the axial piston unit.

5.2 Filling axial piston unit

Before operating the axial piston unit, it must be filled first with the operating hydraulic fluid using a filler device and a 10µm filter unit.

To fill the axial piston unit proceed as follows:

- 1 Open the uppermost leakage oil port.
- 2 Fill the axial piston unit with the operating hydraulic fluid using a filler device with a 10µm filter unit.
- 3 Close the port.

Small residue quantities of air are absorbed into the hydraulic fluid during operation.

DANGER

Risk of injury

Contact with hydraulic fluids may cause burns, allergic reactions, poisoning or skin lesions!

- For this reason only tighten the screwed connections, flanges and plugs when the system has been depressurized (to avoid any hydraulic fluid escaping under pressure) and when filling the axial piston unit avoid any overflow and spillage of hydraulic fluid!

DANGER

Fire hazard

Hydraulic pressure fluid is highly flammable.

- Do not subject the axial piston unit to open flame.

CAUTION

Risk of damage

The axial piston unit must always be filled with hydraulic fluid.

- During initial start-up make sure that the axial piston unit is supplied with sufficient hydraulic fluid. In the event of unusual noise or vibrationals switch the system off immediately and check whether the axial piston unit has been filled with hydraulic fluid.

5.3 Testing drive motor direction of rotation

Rotate the drive motor briefly at lowest rotational speed (jog). Make sure that the direction of rotation for the axial piston unit matches the direction specified on the name plate.

See also 4.4 Preparing axial piston unit for assembly.

5.4 Testing hydraulic fluid supply

The axial piston unit must always have a sufficient supply of hydraulic fluid. For this reason, it is not essential that there is sufficient hydraulic fluid at start-up.

If you test the hydraulic fluid supply, perform a constant check on the noise development and check the leakage oil flow. If the axial piston unit starts to get louder (cavitation) or the leakage oil contains bubbles, then the axial piston unit may not have a sufficient supply of hydraulic fluid. See page 33 for fault diagnosis information.

To test the hydraulic fluid supply:

- Allow the drive motor to run at the lowest rotational speed for roughly one minute. The axial piston unit must be operated without load. Check the axial piston unit's leakage oil line here. The leakage oil should be free of bubbles. See page 33 for fault diagnosis information.

5.5 Performing functional test

Once you have tested the pressure fluid supply, you must perform a functional test on the system. Perform the functional test in accordance with the system manufacturer's specifications. Note noise development and leakage oil. Please note that brief changes in noise development are perfectly normal.

The axial piston unit is checked for functional capability before delivery in accordance with the technical details. During commissioning it must be ensured that the axial piston unit was installed into the system as planned. Use the swivel angle indicator to check whether the axial piston unit swivels in and out correctly when in operation.

The correlation between the position of the swivel angle (direction of pump swivel) and the direction of rotation and control input is shown in the relevant technical data sheets.

DANGER

Danger if system not connected properly

Any mix up of the connections will lead to functions being performed inversely (e.g. lift instead of lower) and thus represents a corresponding hazard to persons and equipment.

- When connecting the hydraulic cylinders, pumps and motors make sure that the specified connections on the hydraulic hoses are correct.

DANGER

Hot surfaces

The axial piston unit heats up during operation. The solenoids in the pump also heat up during operation. Fingers and hands may suffer severe burn injuries if the axial piston unit or the solenoids are touched.

- Allow the axial piston unit to cool down and protect yourself against burn injuries by wearing heat-resistant gloves and protective clothing.
-

5.6 Performing system flushing

Rexroth recommends that flushing takes place for the overall system. This serves to remove foreign matter from the system.

The flushing can only be performed with a special flushing device.

Note

Observe the specifications of the flushing device manufacturer with regard to the precise procedure for performing a flushing run.

The axial piston unit must be operated without load during the flushing run.

6. Trouble shooting

The following table may be of assistance to you when diagnosing a fault.

The table does not claim to be complete. It lists typical features and faults, which may occur on the axial piston unit and the system. Practically, problems may also occur that are not considered here.

Components	Irregular noise	No or insufficient flow rate
Drive elements	Mechanical parts on drive shaft faulty (coupling seat, misalignment etc.)	Speed transfer or travel transfer defective
Hydraulic cylinder/ hydraulic motor	Insufficient speed or velocity, overtaking process (hydraulic motor driven by machine to pump), braking noise, faulty inner seal, rotary group damage	Internal losses, leaking packing, dirt-specific wear
Flow control valves	Air inclusions, differential pressure too low, vibrations	Control orifice clogged up, throttle-check valve misadjusted
Pressure valves (sec.)/ Anti-cavitation valves	Vibration, chattering, fluttering indicates air inclusions or faulty damping, wrong pressure setting, anti-cavitation suction insufficient, opening pressure of anti-cavitation valves too high, cavitation on hydraulic motor	Adjustment too low, valve seat damaged, jammed through contamination
Directional-control valves	Actuation faulty, wrong dimensioning (size), throttling points	Wrong or inaccurate spool position, negative overlap, control pressure too low - fails to shift through
Pressure valves (primary)	Vibration, chattering, fluttering indicates air inclusions or faulty damping, wrong pressure setting,	Adjustment too low, valve seat damaged, jammed through contamination
Hydraulic accumulator	Accumulator bladder faulty, nitrogen filling enters hydraulic circuit, faulty seals, inflow or discharge rates too high Accumulator in connection with throttle losses may induce vibration-prone systems	Nitrogen filling pressure too low
Return lines	Line does not end under the oil, turbulence towards suction side, no baffle, mechanical vibrations, insufficient fastening	–
Filter	Insufficient fastening, mechanical vibrations	For high-pressure filters: Elements contaminated, bypass valve jammed
Cooler	Air-oil cooler-fan noise, mechanical vibrations	–
Pressure lines, pressure gauges	Wrong fastening method, structure-borne sound, pipe cross section too small	Screwed connections not tight, cross section too small, throttling point pressure increase
Drive motor	Wrong direction of rotation, drive speed too high, bearing play, bearing damage	Speed too low
Coupling	Coupling seat faulty, misalignment, flexible elements defective	Drive speed transfer faulty
Variable displacement pump with pressure controller	Drive speed too high, air intake, cavitation, mechanical damage	Power comparison drive motor pump (do powers match?), pump fails to swivel out, inner leakage, dirt-specific wear (stroke limiter on too small swivel angle), throttling of flow rate upstream of consumer, this causes pump to swivel back
Leakage oil line	Insufficient fastening	–
Suction conditions	Insufficient suction cross section, suction height too large, elbows, cross section reductions, suction line air intake, air bubbles, tank shut-off valve not opened, suction screen clogged	Suction behavior interrupted, insufficient suction cross section, suction height too high, elbows, cross section reductions, suction line air intake
Pressure fluid container	Oil level too low, oil foaming, water in oil (milky), cold operating fluid, viscosity too high, ineffective tank ventilation	Oil level too low, ineffective tank ventilation

No or insufficient pressure	Pressure / flow fluctuation	Hydraulic fluid temperature too high
Torque transfer defective	Drive elements defective	–
Inner or external leakage, dirt-specific wear, rotary group damage	No or insufficient bleeding, defective packing, stick-slip effect, alternating load directions, hydraulic motor displacement too small or too large	Inner leakage, gap leakages, wear-related damage, hydraulic motor and cylinder configuration too small
–	Air inclusions, differential pressure too low, flow control valve contaminated, check valve defective	Wear, gap leakages
Adjustment too low, valve seat damaged, spring fracture, foreign matter in valve seat	Rattling, alternating back pressure, pressure valve set too low, valve seat damaged	Setting too high: Increase in gap leakages in all components, increased leakage. Load rhythm by machine too high. Setting too low: Power loss, heat development, valve cone jams when opened
Wrong position, mechanically jammed, reset spring fracture, leaking, plugs loose	Flow forces influence spool position and flow paths, positioning fault, unstable position, control pressure fluctuations	Wrong position, throttle losses, valve size too small, cross section too small, wear
Adjustment too low, valve seat damaged, spring fracture, foreign matter in valve seat	Rattling, alternating back pressure, pressure valves set too low, valve seat damaged	Setting too high: Increase in gap leakages in all components, increased leakage. Load rhythm by machine too high. Setting too low: Power loss, heat development, valve cone jams when opened
Nitrogen filling pressure too low or too high: Stored fluid volume insufficient	Vibration-prone system between hydraulic accumulator, pressure and flow-control valves and pumps	–
–	–	Cross section too narrow
For high-pressure filters: Element contaminated, bypass valve jammed	–	Bypass valve opening pressure too high
–	–	Unit too small, cooling effect too low, room or ambient temperature too high, external ventilation or water supply interrupted, surface contaminated, bypass valve opens
Line rupture, screwed connections not tight, read out or gauging equipment defective	Improperly de-aerated, fault assembly of hose fittings caused loose innerlining and fluttering noise, read out or gauging equipment defective	Cross section too narrow, throttling through insufficient bending radii
Wrong direction of rotation, drive power too low, electric motor incorrectly connected.	Drive motor irregularity too large, for diesel motors idling speed too low (hunts), frequency fluctuations for electric motors	Rotational speed too high
Torque transfer defective	–	–
Power comparison drive motor-pump (do powers match?), pump fails to swivel out, inner leakage, dirt-specific wear rotary group damage (stroke limiter on too small swivel angle), throttling of flow rate upstream of consumer, this causes pump to swivel back	Air intake, inner leakage, dirt-specific wear, rotary group damage, controller unstable. For motor overload or for temporary overload interrupted control behavior as consequence of dirt jamming. Motor overload through excess power consumption on power take-off, controller fluctuates in unstable controller circuit	Inner leakage, wear-related damage
–	–	High temperature as consequence of greater leakage indicates expected breakdown in a component
Suction behavior interrupted, insufficient suction cross section, suction height too high, elbows, cross section reductions, suction line air intake, air inclusions	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section reductions, suction line air intake, air inclusions	–
Oil level too low, hydraulic fluid viscosity too low thus causing high leakages, gap leakages	Air bubbles, turbulence from return to intake side, wrong tank design, no baffle between return and intake chamber	Wrong viscosity, operating fluid too thin, oil filling too low, tank too small. In event of major local heating, lubricity, pressure load and aging resistance of hydraulic fluid is impaired. Component wear, gap leakages, heating

7. Maintenance

- Remove external coarse contamination

CAUTION

Electrostatic charge

- To prevent electrostatic charge, clean the proportional solenoid using a cloth dampened with water only.

7.1 Service

The axial piston unit is by itself a maintenance free unit. The service life of the axial piston unit is dependent to a major extent on the quality of the hydraulic fluid. For this reason Rexroth urgently recommends that the hydraulic fluid be changed once a year or every 2000 operating hours or analyzed in a laboratory.

The service life of the hydraulic fluid is to a significant degree dependent on the system, thus the system manufacturer is responsible for defining the change intervals.

Changes in the leakage oil flow indicate wear in the axial piston unit. For this reason Rexroth recommends that the leakage oil flow be measured and documented at regular intervals. This will enable unscheduled wear in the axial piston unit to be detected at an early stage and thus enable the cause to be rectified quickly.

7.2 Inspection

To enable the axial piston unit to run long and reliably, Rexroth recommends regular inspection of the hydraulic system and that the following operating conditions be documented:

- Operating temperature at a comparable load condition (weekly)
- Hydraulic fluid level (daily)
- Hydraulic fluid quality (once a year or after 2000 operating hours)

The axial piston unit itself should be checked regularly for the following:

- Leakages (daily)

Early detection of hydraulic fluid losses can help to identify faults in the system and to rectify them. For this reason Rexroth recommends that the axial piston unit and system are kept clean at all times.

- Unusual noise development (daily)

Unusual noise development may have various reasons. The Trouble shooting chapter on page 35 will help you in searching for possible fault causes.

- All fastening elements (monthly)

The fastening elements are to be checked when the system is at a standstill and when it has cooled down.

Systematic documentation of the operating conditions (such as, e.g. increasing operating temperatures) will enable you to detect increased wear at an early stage and to ultimately take the necessary countermeasures.

WARNING

Risk of damage

The axial piston unit may be operated with the technical data as listed in the order confirmation only.

- If the axial piston unit deviates from the permissible operating range, shut down the system and initiate measures to correct the fault.

7.3 Repair

Repairs to the axial piston unit may only be performed by authorized, skilled and instructed personnel. Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Only original Rexroth service parts may be used for repairs to Rexroth axial piston units.

Tested parts and pre-assembled original Rexroth modules enable successful repairs to be conducted within a minimum of time outlay.

The list of spare parts for axial piston units is order specific. You will receive the correct parts a great deal quicker if you quote the type number and serial number when ordering.

Repair contact

Bosch Rexroth AG
Mobile Hydraulics
Horb Plant
An den Kelterwiesen 14
72160 Horb am Neckar, Germany

Telephone +49 (0)74 51 - 92 0

Fax +49 (0)74 51 - 82 21

info.brm-ak@boschrexroth.de

www.boschrexroth.com/addresses

Information is available at this Internet address on contacts in the various countries.

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