Axial Piston Variable Pump
A4VG 71–180
Series 32

Product-Specific Operating Instructions
Manufacturer

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Details on the manufacturer are available on the axial piston unit’s name plate.

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Avoiding dangers

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<th>DANGER!</th>
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To ensure reliable operation and to avoid damage when performing an installation, commissioning or servicing, study these operating instructions carefully and thoroughly!

Bosch Rexroth AG cannot be held liable for any personal injuries or machine damage arising from non-adherence to these operating instructions. In case of damage induced by disregard of these operating instructions, any warranty provided by Bosch Rexroth AG will be rendered null and void and liability placed with the operating company.

1 About these instructions

1.1 Structure and requirements

Documents

Operating instructions for Rexroth axial piston units consist of three sub-documents:

- General operating instructions for axial piston units, RE 90 300-B
  The general operating instructions for axial piston units will assist you during installation, commissioning, operation and servicing of Rexroth axial piston units. These include axial piston pumps and motors for use in open or closed hydraulic circuits.
  Unless stated differently, the information in the general operating instructions applies to all Rexroth axial piston units. Information which only applies to specific pumps or motors or hydraulic concepts is marked in the text accordingly.

- Product-specific operating instructions, RE 92 003-21-B
  These product-specific operating instructions for the axial piston variable displacement pump A4VG, sizes 71–180 contain additional, specific information on installation, commissioning and operation.
  Always observe both the details in the product-specific operating instructions and the details in the general operating instructions.

- Technical data sheet, RE 92 003
  The technical data sheet for the axial piston variable displacement pump A4VG contains the complete technical data.

Please contact Rexroth to request the missing parts of the documentation if you are not in possession of the entire set of documents. Safe operation of Rexroth axial piston units can only be guaranteed if you observe the details in all available sub-documents.

General operating instructions

The general operating instructions will assist you during installation, commissioning and operation of Rexroth axial piston units. The chapter sequence is the same in both the general as well as the product-specific operating instructions. The general operating instructions contain additional chapters however:

- In "Servicing", you will find information about maintenance, inspection and repair of Rexroth axial piston units.
- In the appendix, you will find project planning notes for the selection of hydraulic fluid, the design of the tank, the filters and the heat exchanger as well as the correct piping of the hydraulic system.
The chapters of these product-specific operating instructions are structured analogous to the chapters in the general operating instructions and supplement the general operating instructions with specific information on the axial piston variable displacement pump A4VG. Therefore, always observe the general operating instructions as well.

You will need the individual chapter of these instruction during the various phases of working with the axial piston variable displacement pump A4VG, sizes 71–180:

- "Safety" on page 7 explains how the instructions in this document are to be understood and contains several basic safety instructions on working with axial piston units.
- "Product description" on page 11 provides you with information on the identification of the axial piston variable displacement pump A4VG, sizes 71–180 as well as its conventional use.
- "Installation" on page 23 provides you with information on the installation as well as on the disassembly and storage of the axial piston variable displacement pump A4VG, sizes 71–180.
- "Commissioning" on page 31 explains what you must observe during commissioning of the axial piston variable displacement pump A4VG, sizes 71–180 and the machine or system.
- The overview in "Troubleshooting" on page 35 assists you in searching for and tracing faults on the axial piston variable displacement pump A4VG, sizes 71–180 and the entire machine or system.

**Note**

Always observe the safety instructions in "Safety".

**Area of validity for these instructions**

These operating instructions are valid for the axial piston variable displacement pump A4VG, sizes 71–180 for operation with approved hydraulic fluids. Information on the approved hydraulic fluids is available in technical data sheet RE 92 003.

These operating instructions are for the:

- machine or system manufacturer,
- the operating company,
- the operator.

The respective installation drawing, technical data sheet and order confirmation of Bosch Rexroth AG are also binding for the machine or system manufacturer.

**Important documents**

Before starting with the tasks described in these operating instructions, make sure that the following documents are already available:

- **General operating instructions for axial piston units, RE 90 300-B**
  The general operating instructions contain all general information which is to be observed independent of the specific axial piston unit. During work with the axial piston variable displacement pump A4VG, sizes 71–180, always observe the general operating instructions and the product-specific operating instructions.

- **Order confirmation**
  The order confirmation contains the preset technical data. The axial piston variable displacement pump A4VG, sizes 71–180 may only be operated using the values and conditions specified in the order confirmation.

- **Installation drawing**
  The installation drawing of the axial piston variable displacement pump A4VG, sizes 71–180 contains the outer dimensions, all connections and the hydraulic circuit diagram for the axial piston unit.
• Technical data sheet "Axial piston variable displacement pump A4VG", RE 92 003
  The technical data sheet contains, among other information, the permissible technical data for the axial piston variable displacement pump A4VG, sizes 71–180.

• General circuit diagram of the machine or system
  The hydraulic and electrical circuit diagrams of the machine or system contain the information of the hydraulic or electrical connections. You need these data to work with the axial piston variable displacement pump A4VG, sizes 71–180 as part of the machine or system. You will receive the documents from the machine or system manufacturer.

The following Rexroth documents provide further information about installation and operation of the axial piston unit:

• RE 90 220: Mineral-oil based hydraulic fluids
  Describes the requirements on a mineral-oil based hydraulic fluid for the operation with Rexroth axial piston units and assists you in selecting a hydraulic fluid for your system.

• RE 90 221: Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units
  Describes the requirements on an environmentally acceptable hydraulic fluid for the operation with Rexroth axial piston units and assists you in selecting a hydraulic fluid for your system.

• RE 90 223: Axial piston units for operation with HF hydraulic fluids
  Contains additional information on the use of Rexroth axial piston units with HF hydraulic fluids.

• RE 90 300-03-B: Information on using hydraulic drives at low temperatures.
  Contains additional information on the use of Rexroth axial piston units at low temperatures.

Note
Also observe the details on "staff requirements" given in the general operating instructions RE 90 300-B.
### 1.2 Hazard markings and pictograms

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

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER!</strong></td>
<td>This hazard marking warns of high risk, lethal dangers and severe injuries.</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>This hazard marking warns of medium risk, injuries and severe property damage.</td>
</tr>
<tr>
<td><strong>CAUTION</strong></td>
<td>This hazard marking warns of low risk and property damage.</td>
</tr>
</tbody>
</table>

**Note**

This marking refers to information which helps to better understand the machine processes or which refers to special or important circumstances.

**Tip**

This marking refers to information which assists in improving work efficiency.
2 Safety

Due to its special importance, this chapter repeats the basic safety instructions in the general operating instructions RE 90 300-B.

Read this chapter carefully before starting to work with the axial piston unit.

Rexroth axial piston units are to be installed as components in machines or systems. The safety directives in these instructions relate to axial piston units only. Please also note the manufacturer’s safety directives for the machine or system.

2.1 Basic safety instructions

Please strictly observe the following safety instructions as well as the safety instructions of the machine or system manufacturer to avoid any injuries and health damages as well as property damage and environmental pollution.

⚠️ DANGER! ⚠️

Danger to life

Working on operating machines or systems poses a danger to life and limb.

The work described in this document may only be performed on disconnected machines or systems. Before beginning work:

- Ensure that the engine is switched off and cannot be switched on.
- Ensure that all power-transmitting components and connections (electric, pneumatic, hydraulic) are switched off according to the manufacturer's instructions and cannot be switched on again. If possible, remove the main fuse on the machine or system.
- Ensure that the machine or system is completely hydraulically relieved (depressurized). Please follow the instructions of the machine or system manufacturer.

⚠️ WARNING ⚠️

Risk of injury

To prevent injuries, observe the following recommendations regarding safety clothing:

- While working on the machine or system, always wear safety shoes with steel caps.
- While working with hazardous materials (for example hydraulic fluids), always wear safety gloves, safety glasses and suitable working clothes.

⚠️ DANGER! ⚠️

Risk of toxification and injury

Contact with hydraulic fluids may damage your health (e.g. eye injuries, skin and tissue damage, toxification resulting from the inhalation of vapors).

- Check the lines for wear or damage before each commissioning.
- Wear safety gloves and safety glasses when performing this inspection.
- If hydraulic fluid should, nevertheless, come into contact with your eyes or penetrate your skin, consult a doctor immediately.
- When working with hydraulic fluids, strictly observe the safety instructions provided by the hydraulic fluid manufacturer.
**WARNING**  
**Risk of burns!**

The axial piston unit heats up during operation. The solenoids on the axial piston unit heat up during operation as well. Touching the axial piston unit or solenoids could result in severe burn injuries.

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

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**! DANGER!**  
**Risk of toxication and injury**

While searching for leakages, escaping hydraulic fluid can penetrate the skin and cause severe toxication and injuries.

- Only search for leakages when the machine is switched off and depressurized.

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**WARNING**  
**Risk of injury and damage**

Incorrectly connected components can cause severe malfunctions.

- Ensure that piping is connected according to the circuit diagram.
- Perform component-oriented functional tests.

---

**! DANGER!**  
**Fire hazard**

Hydraulic fluid is flammable.

- Keep open flames and ignition sources from the axial piston unit.

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**WARNING**  
**Hearing damage**

The noise emission of axial piston units depends on, among other factors, speed, operating pressure and installation conditions. You can be certain that the sound pressure level will rise above 70 dBA during normal application conditions. This may cause hearing damage.

- Always wear hearing protection while working in the vicinity of the operating axial piston unit.
**WARNING**

**Environmental pollution**

Hydraulic fluids are water-endangering fluids. Leaking hydraulic fluid can cause toxication of the groundwater and ground contamination.

- Place a catch pan under the axial piston unit.
- Remedy the leakage immediately.
- National laws and regulations must be observed at all times. In Germany, hydraulic machines or systems are classified as "systems for working with water-endangering materials within the scope of the Federal Water Act (WHG)". In this context, please especially note §1 and §19 of the WHG (§19g, 19i, 19l).
- Further information is available in the Rexroth publication "Mineral-oil based hydraulic fluids", RE 90 220, "Environmentally Acceptable Hydraulic Fluids HEPG, HEES for Axial Piston Unit", RE 90 221 and "Axial piston units for operation with HF hydraulic fluids", RE 90 223.

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**Note**

Also observe the information regarding "due diligence of the operating company and the operator" and "responsibility of the machine or system manufacturer" in the general operating instructions RE 90 300-B.
3 Product description

This chapter explains how to identify an axial piston variable displacement pump A4VG using the name plate. In addition, the basic function of the axial piston variable displacement pump A4VG is described.

In the general operating instructions RE 90 300-B you will find additional information on the supply volume, technical data and the conventional use of Rexroth axial piston units.

3.1 Identification of the axial piston unit

The axial piston unit can be identified with the name plate. The following example shows the name plate of an axial piston variable displacement pump A4VG, size 90:

The name plate contains the following information:

1. Manufacturer
2. Ordering code
3. Material number of the axial piston unit
4. Serial number
5. Production date
6. Speed
7. Internal plant designation
8. Direction of rotation (looking at the shaft; here: clockwise)
9. Specified area for test stamp
10. Power
3.2 Functional description

The A4VG is an axial piston variable displacement pump with swashplate design for hydrostatic drives in closed circuits. In this chapter, you will learn more about the method of operation, assembly and function of this variable displacement pump.

Details on the technical data of the axial piston variable displacement pump A4VG can be found in technical data sheet RE 92 003.

Basic method of operation of a variable displacement pump

This section describes the basic method of operation of an axial piston variable displacement pump for closed circuits.

Closed circuit
A hydraulic system is considered to be closed if the hydraulic fluid which flows back from the consumer is directed directly back to the pump. Here, there is a high-pressure side and a low-pressure side depending on the load direction (output torque on the consumer).

Assembly of the pump
The A4VG is an axial piston variable displacement pump with swashplate design for hydrostatic drives in closed circuits.

For axial piston pumps with swashplate design, the pistons are arranged axially relative to the drive shaft. The pistons are guided in the rotating cylinder and support themselves with the slipper pads on a slanted, non-rotating shim (swasher).

Division of forces (piston forces/torque) occurs via the slipper pad on the slanted plate. The change in the shim’s pitch results in a change in the stroke of the piston in each rotation, thereby changing the specific displacement.

Control and pressure valves are integrated. Auxiliary pumps can be mounted at the through drive of the pumps.
Design and method of operation of the axial piston variable displacement pump A4VG, sizes 71–180

The following figure illustrates the assembly and the components of an axial piston variable displacement pump A4VG, sizes 71–180:

**Pump function**

The drive shaft, which is driven by the engine, turns and engages the cylinder by means of gearing.

**NOTE**

In these operating instructions the term "engine" is used as a generic term for diesel, gasoline, gas and electric engines.

The cylinder turns with the drive shaft, turning with it the 9 pistons. The pistons are supported with slipper pads on the glide surface of the swasher and perform a stroke movement which is defined by the pitch of the swasher (swashplate). The slipper pads are held on and guided along the glide surface by a retaining plate.

During a rotation, each piston moves over the bottom and top dead centers back to its starting position. As it moves from dead center (here, the piston rotates around its axis) to dead center, the piston moves a full stroke. During this action, the fluid volume defined by the piston surface and the stroke is fed in or removed through the two control slits in the control plate.

On the intake stroke, fluid flows into the enlarging piston chamber – in a closed circuit this is supported by the return and boost pressures.

On the other side, during the pressure stroke the fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons.
Pressure cut-off

The operating pressure is limited by the pressure cut-off. The pressure cut-off is a pressure regulator which reduces the pump capacity once the set specified pressure value is reached so that the set pressure is maintained but not exceeded.

High-pressure protection

The peak pressures which occur during very rapid swiveling operation as well as the maximum pressure are safeguarded by the superordinate high-pressure relief valves. These valves open if the set value is exceeded, thereby depressurizing the low-pressure side. The fluid quantity remains constant in the closed circuit. The leakage at the pump and motor is replenished by the boost pump (auxiliary pump).

Auxiliary pump

The auxiliary pump supplies a sufficient volume of fluid (boost volume) from a small tank to the low-pressure side of the closed circuit via a check valve to replenish the internal leakage of the variable displacement pump and consumer. The auxiliary pump is an internal gear pump which is driven directly via the drive shaft.

Controls

General

For a variable displacement pump, the swivel angle of the swashplate is infinitely variable within certain limits. Changing the swivel angle of the swashplate results in a different piston stroke and, thus, a variable displacement.

The swivel angle of the swashplate is controlled hydraulically via the stroke piston. The swashplate/swisher is mounted for easy motion in roller bearings and the neutral position spring centered. Increasing the swivel angle increases the displacement; reducing the angle results in a corresponding reduction in displacement. If the swashplate is not swiveled out, the displacement is equal to zero.

NOTE

Additional information on the controls, such as the circuit diagram or characteristics, can be found in technical data sheet RE 92 003.
HW control unit

Depending on the swivel angle of the control lever and on the actuation direction (a or b), the stroke cylinder of the pump is supplied with control pressure via the HW control unit. Thus, the swashplate – and, therefore, the displacement – are infinitely adjustable. A different flow direction is associated with each direction of control lever actuation.
**HD control unit**

Depending on the pressure difference of the pilot pressure $p_{St}$ in the two control lines (port Y1 or Y2), the stroke cylinder of the pump is supplied with control pressure via the HD control unit. Thus, the swashplate – and, therefore, the displacement – are infinitely adjustable. A different flow direction is associated with each control line.
EP control unit

Depending on the preselected current I at the two proportional solenoids (a) or (b), the stroke cylinder of the pump is supplied with control pressure via the EP control unit. Thus, the swashplate – and, therefore, the displacement – are infinitely adjustable. A different flow direction is associated with each proportional solenoid.
DA control unit

Depending on the drive speed, the DA control valve generates a pilot pressure which charges the stroke cylinder of the pump with control pressure via a 4/3-directional valve, allowing the swashplate – and, therefore, the displacement – to be infinitely adjusted. Each flow direction is assigned an on/off solenoid (a or b) on the 4/3-directional valve.

You can find details on DA closed loop control in operating instructions "Hydrostatic drive with DA closed loop control" - RE 90 330-01-B and in RE 90 330-03-B (functional description and project planning note).
### 3.3 Bypass function of the high-pressure relief valves

For vehicles with hydrostatic drive, as long as there is no downstream mechanical interruption of the drive train (switch to idle/free running), the flow can be altered using a bypass function in order to tow the vehicle out of the immediate danger zone.

Turning the corresponding screw on the two high-pressure relief valves allows the hydraulic fluid to flow freely.

#### 3.3.1 Sizes 71, 90

**Activating the bypass function**

To activate the bypass function:

1. Switch off the internal combustion engine.
2. Remove the plastic protective cap (1) on the high-pressure relief valve with a suitable tool (e.g. gripper).
3. Loosen the one screw (2) by turning counter-clockwise two rotations with an Allen key (WAF 5).

**Note**

The plastic protective cap is destroyed when removing.

**Towing speed**

The maximum towing speed is dependent on the gear ratio in the vehicle and must be calculated by the vehicle manufacturer. The corresponding flow of $Q = 50$ l/min must not be exceeded.

**Towing distance**

The vehicle may only be towed out of the immediate danger zone.

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**WARNING**

Higher towing speeds and longer towing distances result in impermissible heat generation and insufficient lubrication. This damages the axial piston unit.

- Only tow the vehicle out of the immediate danger zone

**WARNING**

During and after towing, the axial piston unit is hot.

- Wear protective clothing.
### Deactivating the bypass function

To deactivate the bypass function:

1. Immediately following towing, switch off the bypass function.
2. Restore the function of the high-pressure relief valve. To do this, tighten the screw (2) with an Allen key (WAF 5) by turning clockwise with a torque of 10 ± 1 Nm.
3. Refit the screw (2) with a protective cap to prevent unauthorized changes to the position of the pressure-relief valve.

**WARNING**

While towing with the bypass function activated, the closed hydraulic circuit empties itself. This can result in unintended functions when restarting the travel drive.

- Start the travel drive only after completely filling and air bleeding the hydraulic circuit (see also "5.1 Filling the axial piston unit").

### Activating the bypass function

To activate the bypass function:

1. Switch off the internal combustion engine.
2. Loosen the screw (1) by turning counter-clockwise one rotation with a hex wrench (WAF 36).

**NOTE**

An optimal seal is not ensured if the high-pressure relief valve is loosened. If hydraulic fluid leaks from the high-pressure relief valve, clear away the fluid immediately and clean the valve.

### Towing speed

The maximum towing speed is dependent on the gear ratio in the vehicle and must be calculated by the vehicle manufacturer. The corresponding flow of \( Q = 100 \ l/min \) must not be exceeded.

### Towing distance

The vehicle may only be towed out of the immediate danger zone.

**WARNING**

Higher towing speeds and longer towing distances result in impermissible heat generation and insufficient lubrication. This damages the axial piston unit.

- Only tow the vehicle out of the immediate danger zone.

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**3.3.2 Sizes 125, 180**

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**WARNING**
During and after towing, the axial piston units are hot.
- Wear protective clothing.

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**Deactivating the bypass function**
To deactivate the bypass function:

1. Immediately following towing, switch off the bypass function.
2. Restore the function of the high-pressure relief valve. To do this, tighten the screw (1) with a hex wrench (WAF 36) by turning clockwise with a torque of 200 ± 10 Nm.

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**WARNING**
While towing with the bypass function activated, the closed hydraulic circuit empties itself. This can result in unintended functions when restarting the travel drive.
- Start the travel drive only after completely filling and air bleeding the hydraulic circuit (see also "5.1 Filling the axial piston unit").
4 Installation

This chapter describes the essential, generally valid steps for the installation of Rexroth axial piston units of type A4VG sizes 71–180. Read this chapter if you would like to install an axial piston unit in a stationary or mobile hydraulic system.

Note

Observe the fundamental safety instructions on page 7 of these operating instructions for all work performed during the installation of the axial piston unit.

The following warning notice applies to all variable displacement pumps with the control units HD and EP:

⚠️ CAUTION

The spring return in the control unit is not a security device.

The slide valve of the control unit can be blocked in an undefined position by internal contamination – e.g. impure hydraulic fluid, abrasion or residual contamination from system components. As a result, the variable displacement pump can no longer supply the flow specified by the operator.

- Install an appropriate emergency-off function to ensure that the driven consumer can be brought to a safe position (e.g. immediate stop).
- Maintain the specified cleanliness level 20/18/15 (< 90° C) or 19/17/14 (> 90° C) in accordance with ISO 4406.

Information on selecting the hydraulic fluid and design on the tanks, the filters and the heat exchanger as well as on the correct piping of the hydraulic system can be found in the appendix of the general operating instructions RE 90 300-B.

General installation instructions

You can find additional topics which should be observed during the installation of the A4VG axial piston variable displacement pump in the general operating instructions RE 90 300-B:

- Information on unpacking the axial piston unit
- Preparations for assembly
- Transporting to the installation location
- Information on disassembly and disposal of the axial piston unit

Specific installation instructions

This chapter supplements the installation instructions provided in the general operating instructions RE 90 300-B with information specific to the axial piston variable displacement pump A4VG:

- "4.1 Installation notes" on page 24 contains notes that must be observed during and after installation.
- "4.2 Assembling the axial piston unit" on page 27 explains how to install the axial piston unit via coupling, gear and cardan shaft.
- "4.3 Connecting lines" on page 28 provides information on how to correctly pipe the axial piston unit and connect the electric lines.
- "4.4 Connecting the electric open loop control" on page 30 provides information on how to correctly pipe the axial piston unit and connect the electric lines.
- Information on storing the axial piston unit can be found in "4.5 Preparing the axial piston unit for storage" on page 30.
4.1 Installation notes

This section supplements the general installation notes provided in the general operating instructions RE 90 300-B.

**Note**

Note that when the variable axial piston units are assembled in certain installation positions, the control or closed loop control may be affected. Because of gravity, dead weight and case internal pressure, minor characteristic displacements and changes in actuating time may occur.

**CAUTION**

Risk of damage to the axial piston unit

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

- During commissioning and operation, ensure that the axial piston unit is supplied with sufficient hydraulic fluid.
- Ensure that the entire hydraulic system is tight.
- Should unusual noises or vibrations develop, immediately switch off the machine or system and check whether the axial piston unit is filled with hydraulic fluid.

**General**

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This is also to be observed following a relatively long standstill as the system may empty via the hydraulic lines.

The leakage fluid in the case interior must be directed to the tank via the highest leakage fluid port. During operation and cold starting, the suction pressure at port S must not drop below the minimum permissible values (for values, see technical data sheet RE 92 003).

In all operating states, the suction line and leakage fluid line must flow into the tank below the minimum fluid level.
Installation position

Examples of permissible installation positions are shown below. The shown piping routes are only intended to serve as a reference point to illustrate the general routes. Additional installation positions are available upon request. Also observe the special notes for specific installation positions provided in "Filling the axial piston unit" on page 32.

Note

"Shaft upwards" installation position (positions 4 and 8)
- For the "shaft upwards" installation position, you will also need the additional R1 bleeding port in the flange area. This port is not included in the standard version and must be specified in plain text when ordering.

Below-tank installation

Below-tank installation is when the pump is installed below the minimum tank fluid level (next to, in or below the tank).

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleeding</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R</td>
<td>S + T₁ (L₂)</td>
</tr>
<tr>
<td>2</td>
<td>L₂</td>
<td>S + T₂ (L₂)</td>
</tr>
<tr>
<td>3</td>
<td>L₂</td>
<td>S + T₂ (L₂)</td>
</tr>
<tr>
<td>4</td>
<td>R₁ + L₂</td>
<td>S + T₂ (L₂)</td>
</tr>
</tbody>
</table>

Recommended installation positions: 1 and 2.
Above-tank installation

Above-tank installation is when the pump is installed above the minimum tank fluid level (next to, in or above the tank).

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleeding</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>R</td>
<td>T₁ + L₃</td>
</tr>
<tr>
<td>6</td>
<td>L₂</td>
<td>S (L₃ + T₂ (L₂))</td>
</tr>
<tr>
<td>7</td>
<td>L₂ + L₃</td>
<td>S (L₃ + T₂ (L₂))</td>
</tr>
<tr>
<td>8</td>
<td>R₁ + L₃</td>
<td>S (L₃ + T₂)</td>
</tr>
</tbody>
</table>

Note

Observe the maximum permissible suction height hₘₐₓ = 800 mm.
Recommendation for installation position 8 (shaft upwards): A check valve in the leakage fluid line (opening pressure 0.5 bar) can prevent draining of the case interior.

CAUTION

Risk of damage to the axial piston unit

An air pocket in the area near the bearings will damage the axial piston unit.

- With the "shaft upwards" installation position, it is especially important that the pump case be completely filled with hydraulic fluid during commissioning and during operation.
- With above-tank installation, the case interior may drain via the leakage fluid line after longer standstill periods (air enters via the shaft seal ring) or via the service line (gap leakage). The bearings are thus insufficiently lubricated when the pump is restarted. Therefore, check the hydraulic fluid level in the case interior regularly; if necessary, recommission.
- During commissioning and during operation, the suction line must be filled with hydraulic fluid.
4.2 Assembling the axial piston unit

Information on assembling the axial piston unit can be found in the "Installation" chapter of the general operating instructions RE 90 300-B.

**Note**

Observe the following note:

- To ensure that rotating components (coupling hub) and fixed components (case, retaining ring) do not touch one another, certain installation conditions must be taken into account depending on the size and the drive shaft. The exact values can be found in technical data sheet RE 92 003, section "Installation situation for coupling assembly".

**Transport protection**

The following diagram shows the protective covers and plastic plugs which you must remove from the axial piston variable displacement pump A4VG at the completion of assembly:

Example:
A4VG with HD control unit

4.3 Connecting lines

The machine or system manufacturer is responsible for dimensioning the lines.

The axial piston unit must be connected to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine or system manufacturer.

Observe the following safety instructions.

**CAUTION Risk of damage**

Hydraulic lines and hoses that are installed under tension generate additional mechanical forces during operation and thus reduce the service life of the axial piston unit and of the overall machine or system.

- Install all lines and hoses free of tension.

**CAUTION Risk of damage**

Generally, a minimum permissible suction pressure at port "S" is specified for axial piston pumps in all installation positions. If the pressure at port "S" drops below the specified values, damage may occur which may lead to destruction of the pump.

- Make certain that the required suction pressure is reached by using the appropriate piping (suction cross-section, pipe diameter, tank position) as well as appropriate viscosity.
Note

The service line ports and function ports are designed exclusively for connecting hydraulic lines.

Note

Observe the notes for routing the suction-, hydraulic- and leakage fluid lines provided in the general operating instructions RE 90 300-B.

**WARNING**

**Risk of wear and malfunctions**

The cleanliness of the hydraulic fluid affects the cleanliness and the service life of the hydraulic system. Contamination of the hydraulic fluid leads to wear and malfunctions. In particular, solid contaminants in the hydraulic lines such as welding beads and metal shavings may damage the axial piston unit.

- Absolute cleanliness is required. The axial piston unit must be installed in a clean condition. Contaminants in the hydraulic fluid could considerably impact the function and service life of the axial piston unit.
- Pay particular attention during installation to ensure that ports, hydraulic lines and attachment parts (e.g. testers) are clean. Thoroughly clean these items before opening ports. Make certain that no contaminants enter the system when closing the ports.
- Use suitable liquid cleaning agents to remove lubricants and other difficult-to-remove contaminants. Cleaning agent must not penetrate the hydraulic system.
- Do not use any cotton waste or fibrous cloths for cleaning.
- Do not use hemp or mastic as sealant.

**Procedure**

To connect the axial piston unit to the hydraulic system:

1. Remove the transport protection (if not already removed).
2. Clean the lines.
3. Connect the lines according to the hydraulic circuit diagram.
4. Make sure that
   - the fixing elements at fittings and flanges are tightened correctly (observe the tightening torque of the manufacturer!). Mark all checked fittings using e.g. a permanent marker.
   - the pipes and hose lines and every combination of connecting piece, coupling or connecting point with hoses or pipes has been inspected by a technically qualified person for safe working condition.

For the relationship between direction of rotation, control and flow direction, refer to technical data sheet RE 92 003.
### Connection overview:

![Connection Diagram](image)

#### View:
Port plate (Rear side)

#### Connection Designation

<table>
<thead>
<tr>
<th>Connection</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line ports</td>
</tr>
<tr>
<td>T₁ / T₂</td>
<td>Leakage fluid and filling/drain ports</td>
</tr>
<tr>
<td>S</td>
<td>Suction port for boost fluids</td>
</tr>
<tr>
<td>X₁ / X₂</td>
<td>Control pressure</td>
</tr>
<tr>
<td>Fₐ</td>
<td>Filter output</td>
</tr>
<tr>
<td>Fₑ</td>
<td>Filter input</td>
</tr>
<tr>
<td>F₁ₐ</td>
<td>Filter output (mountable filter)</td>
</tr>
<tr>
<td>Pₛ</td>
<td>Control pressure supply</td>
</tr>
<tr>
<td>Fₛ</td>
<td>Connection of filter to suction line (cold start)</td>
</tr>
<tr>
<td>Mₐ / Mₐ</td>
<td>Measurement point, service line ports A, B</td>
</tr>
<tr>
<td>R</td>
<td>Air bleeding</td>
</tr>
<tr>
<td>G</td>
<td>Pressure port for auxiliary circuits</td>
</tr>
<tr>
<td>Mₕ</td>
<td>Port for balanced high pressure</td>
</tr>
<tr>
<td>Y₁ / Y₂</td>
<td>Pilot pressure ports (HD control only)</td>
</tr>
</tbody>
</table>

### Note

For the sizes of the flange connections and threaded connections, please refer to technical data sheet RE 92 003.
All ports must be connected to either pipes or hoses according to the installation drawing and machine or system circuit diagram or the ports plugged using suitable locking screws.

The following **tightening torques** apply:

- **Internal threads of the axial piston unit**: The maximum permissible tightening torques $M_{G \text{ max}}$ are the maximum values of the internal threads and must not be exceeded. Refer to the following table for values.

- **Fittings**: Observe the manufacturer's instruction regarding tightening torques of the used fittings.

- **Fixing screws**: For fixing screws according to DIN 13/ISO 68, we recommend checking the tightening torque in individual cases as per VDI 2230

- **Locking screws**: For the locking screws supplied with the axial piston unit, the required tightening torques of locking screws $M_V$ apply. Refer to the following table for values.

<table>
<thead>
<tr>
<th>Threaded size (DIN 3852)</th>
<th>Max. permissible tightening torque of the internal thread $M_{G \text{ max}}$</th>
<th>Required tightening torque of the locking screws $M_V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10x1</td>
<td>30 Nm</td>
<td>12 Nm</td>
</tr>
<tr>
<td>M12x1.5</td>
<td>50 Nm</td>
<td>25 Nm</td>
</tr>
<tr>
<td>M14x1.5</td>
<td>80 Nm</td>
<td>35 Nm</td>
</tr>
<tr>
<td>M16x1.5</td>
<td>100 Nm</td>
<td>50 Nm</td>
</tr>
<tr>
<td>M18x1.5</td>
<td>140 Nm</td>
<td>60 Nm</td>
</tr>
<tr>
<td>M22x1.5</td>
<td>210 Nm</td>
<td>80 Nm</td>
</tr>
<tr>
<td>M26x1.5</td>
<td>230 Nm</td>
<td>120 Nm</td>
</tr>
<tr>
<td>M27x2</td>
<td>330 Nm</td>
<td>135 Nm</td>
</tr>
<tr>
<td>M33x2</td>
<td>540 Nm</td>
<td>225 Nm</td>
</tr>
<tr>
<td>M42x2</td>
<td>720 Nm</td>
<td>360 Nm</td>
</tr>
</tbody>
</table>
4.4 Connecting the electric controller

The machine or system manufacturer is responsible for dimensioning the electrical control.

For electrically controlled axial piston units (EP and DA), the electric open loop control must be connected according to the electric circuit diagram of the machine or system manufacturer.

**Note**

To prevent malfunctions or incorrect flow directions, make certain that all connections are correct.

**Changing the solenoid position**

If necessary, you can change the position of the connector by turning the solenoid.

![Solenoid diagram]

To do this, proceed as follows:

1. Loosen the fixing nut (a) of the solenoid.
2. Turn the solenoid (b) to the desired position.
3. Retighten the fixing nut (tightening torque of the fixing nut: 5+1 Nm, WAF26, 12-sided DIN 3124).

For further details and technical data, e.g. regarding the selection of a suitable mating connector, please refer to technical data sheet RE 92 003.

4.5 Preparing the axial piston unit for storage

When preparing the axial piston unit for storage, please proceed as described in the general operating instructions RE 90 300-B.

For internal preservation of the axial piston unit, use corrosion protection VCI 329. The required quantity is 10 ml for sizes 71, 90 and 20 ml for sizes 125, 180.

Fill via leakage fluid port T₁ or T₂.
5 Commissioning

The information in this chapter supplements the "Commissioning" chapter in the general operating instructions RE 90 300-B with information specific to the axial piston variable displacement pump A4VG.

Note: The axial piston unit is, within the meaning of Machine Directive 98/37/EC, a component which is intended for installation in a machine or system. Commissioning is prohibited until it is determined that the machine or system in which this product is installed complies with the regulations of the EC directives and all other relevant guidelines.

Observe the following safety instructions when commissioning:

<table>
<thead>
<tr>
<th>! DANGER!</th>
<th>Danger to life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working in the danger zone of a machine or system poses a danger to life and limb.</td>
<td></td>
</tr>
<tr>
<td>• Eliminate all potential sources of danger on the machine or system.</td>
<td></td>
</tr>
<tr>
<td>• Nobody may stand in the danger zone of the machine or system.</td>
<td></td>
</tr>
<tr>
<td>• The emergency-stop button for the machine or system must be within reach.</td>
<td></td>
</tr>
<tr>
<td>• Always follow the instructions of the machine or system manufacturer during commissioning.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>! WARNING</th>
<th>Risk of damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination of the hydraulic fluid results in wear and malfunctions. In particular, solid contaminants in the hydraulic lines such as welding beads and metal shavings may damage the axial piston unit.</td>
<td></td>
</tr>
<tr>
<td>• Ensure utmost cleanliness during commissioning.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>! CAUTION</th>
<th>Risk of damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commissioning or restarting without or with insufficient hydraulic fluid in the case interior will lead to damage or immediate destruction of the rotary group.</td>
<td></td>
</tr>
<tr>
<td>• When commissioning or restarting a machine or system, make certain that the entire case interior of the axial piston unit is filled with hydraulic fluid and that it remains filled during operation.</td>
<td></td>
</tr>
</tbody>
</table>
5.1 Filling the axial piston unit

For information on the possible installation positions, refer to "Installation notes" starting on page 24.

During commissioning, proceed as follows:

1 Fill and air bleed the axial piston unit via the appropriate ports, see information starting on page 25.

**CAUTION**

Risk of damage to the axial piston unit

An air pocket in the area near the bearings will damage the axial piston unit.

- With the "shaft upwards" installation position, it is especially important that the pump case is completely filled with hydraulic fluid during commissioning and during operation.
- With above-tank installation, the case interior may drain via the leakage fluid line after longer standstill periods (air enters via the shaft seal ring) or via the service line (gap leakage). The bearings are thus insufficiently lubricated when the pump is restarted. Therefore, check the hydraulic fluid level in the case interior regularly; if necessary, recommission.
- The suction line must be filled with hydraulic fluid.

2 Operate the pump at a lower speed (starter speed for internal combustion engines or inching operation for electric engines) until the pump system is completely filled. To inspect, drain the hydraulic fluid at port G via a mini-measurement line into a tank and wait until the fluid drains without bubbles.

3 Use the appropriate port to air bleed (see description beginning on page 25).

4 Make certain that all ports are either connected with pipes or plugged according to the general circuit diagram.
5.2 Testing the hydraulic fluid supply

The axial piston unit must always have a sufficient supply of hydraulic fluid. For this reason, the supply of hydraulic fluid must be ensured at the start of the commissioning process.

When you test the hydraulic fluid supply, constantly monitor the noise development and check the hydraulic fluid level in the tank. If the axial piston unit becomes louder (cavitation) or the leakage fluid is discharged with bubbles, this is an indication that the axial piston unit is not being sufficiently supplied with hydraulic fluid.

For information on troubleshooting, see page 35.

An overview of all connections can be found in section "Connecting lines" on page 28.

Dangers posed by faulty commissioning

Faulty commissioning may cause the drive to behave unexpectedly.

- Make certain that the vehicle cannot drive away!
- Make certain that no persons are present in the danger zone of the machine!

To test the hydraulic fluid supply:

1. Allow the engine to run at the slowest speed.
   The axial piston unit must be operated without load.
   Pay attention to leakage and noise.

2. Check the suction pressure at port S of the axial piston pump.
   For the permissible values, refer to technical data sheet RE 92 003.

3. Check whether the boost pressure is present at gauge port G on the pump.

4. If no boost pressure is present, check whether the suction line is leaky.

5. Start the engine as normal and check the boost pressure at port G of the pump.
   The pressure value here must not be less than 15 bar and should stabilize after a short time.
   The suction pressure at port Fₙ of the pump must not drop below the pressure value specified in the technical data sheet.
   The leakage fluid pressure at port R, T₁ or T₂ of the pump must not exceed the pressure value specified in the technical data sheet.
6 Troubleshooting

The following table will assist you in fault diagnosis. The table does not claim to be complete. It supplements the fault table provided in the general operating instructions RE 90 300-B with typical faults which can occur with the axial piston variable displacement pump A4VG. For this reason, also observe the table in the “Troubleshooting” chapter of the general operating instructions RE 90 300-B.

In practical use, problems and causes which are not listed here could also occur.

### Noise development

<table>
<thead>
<tr>
<th>Possible cause of fault</th>
<th>Test point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed too high</td>
<td>Engine speed</td>
</tr>
<tr>
<td>Suction line not air tight</td>
<td>–</td>
</tr>
<tr>
<td>Suction line cross-section not sufficient</td>
<td>–</td>
</tr>
<tr>
<td>Air in the hydraulic fluid</td>
<td>–</td>
</tr>
<tr>
<td>Boost pressure valve</td>
<td>G</td>
</tr>
<tr>
<td>High-pressure relief valves</td>
<td>MA / MB</td>
</tr>
<tr>
<td>Mechanical pump damages</td>
<td>–</td>
</tr>
<tr>
<td>Fan</td>
<td>–</td>
</tr>
<tr>
<td>Coupling defective</td>
<td>–</td>
</tr>
</tbody>
</table>

### Vehicle/system starts prematurely

<table>
<thead>
<tr>
<th>Possible cause of fault</th>
<th>Test point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical neutral position not set correctly</td>
<td>MA / MB</td>
</tr>
<tr>
<td>Hydraulic neutral position not set correctly</td>
<td>X1 / X2</td>
</tr>
<tr>
<td>Control signal on control unit not correct</td>
<td>X1 / X2</td>
</tr>
<tr>
<td>Start of control of the DA control valve (optional)</td>
<td>X1 / X2</td>
</tr>
<tr>
<td>not set correctly</td>
<td></td>
</tr>
</tbody>
</table>

### Operational data not achieved

<table>
<thead>
<tr>
<th>Possible cause of fault</th>
<th>Test point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boost pressure too low</td>
<td>G</td>
</tr>
<tr>
<td>Engine speed too low</td>
<td>Engine speed</td>
</tr>
<tr>
<td>Filter soiled</td>
<td>Filter</td>
</tr>
<tr>
<td>Auxiliary pump worn (defective)</td>
<td>Auxiliary pump</td>
</tr>
<tr>
<td>Rotary group worn</td>
<td>Rotary group</td>
</tr>
<tr>
<td>Boost pressure OK</td>
<td>G</td>
</tr>
<tr>
<td>Control (control unit) defective</td>
<td>X1 / X2</td>
</tr>
<tr>
<td>Pressure cut-off set too low</td>
<td>MA / MB</td>
</tr>
<tr>
<td>High-pressure relief valves set too low</td>
<td>MA / MB</td>
</tr>
</tbody>
</table>
### Engine overloaded

<table>
<thead>
<tr>
<th>Possible cause of fault</th>
<th>Test point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement hydraulics</td>
<td>$X_1 / X_2$</td>
</tr>
<tr>
<td>Control unit</td>
<td>$M_A / M_B$</td>
</tr>
<tr>
<td>Pressure cut-off set too high</td>
<td>$M_A / M_B$</td>
</tr>
<tr>
<td>High-pressure relief valves set too high (for DA control)</td>
<td></td>
</tr>
</tbody>
</table>

### Temperature too high

<table>
<thead>
<tr>
<th>Possible cause of fault</th>
<th>Test point</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-pressure relief valves set too low</td>
<td>$M_A / M_B$</td>
</tr>
<tr>
<td>Pump worn</td>
<td>$G$</td>
</tr>
<tr>
<td>Cooler soiled / fan defective</td>
<td>Cooler / fan</td>
</tr>
<tr>
<td>Hydraulic fluid level in tank too low</td>
<td>Tank</td>
</tr>
</tbody>
</table>

**NOTE**

Information about **maintenance**, **inspection** and **repair** of Rexroth axial piston units can be found in the "Servicing" chapter of the general operating instructions RE 90 300-B.
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