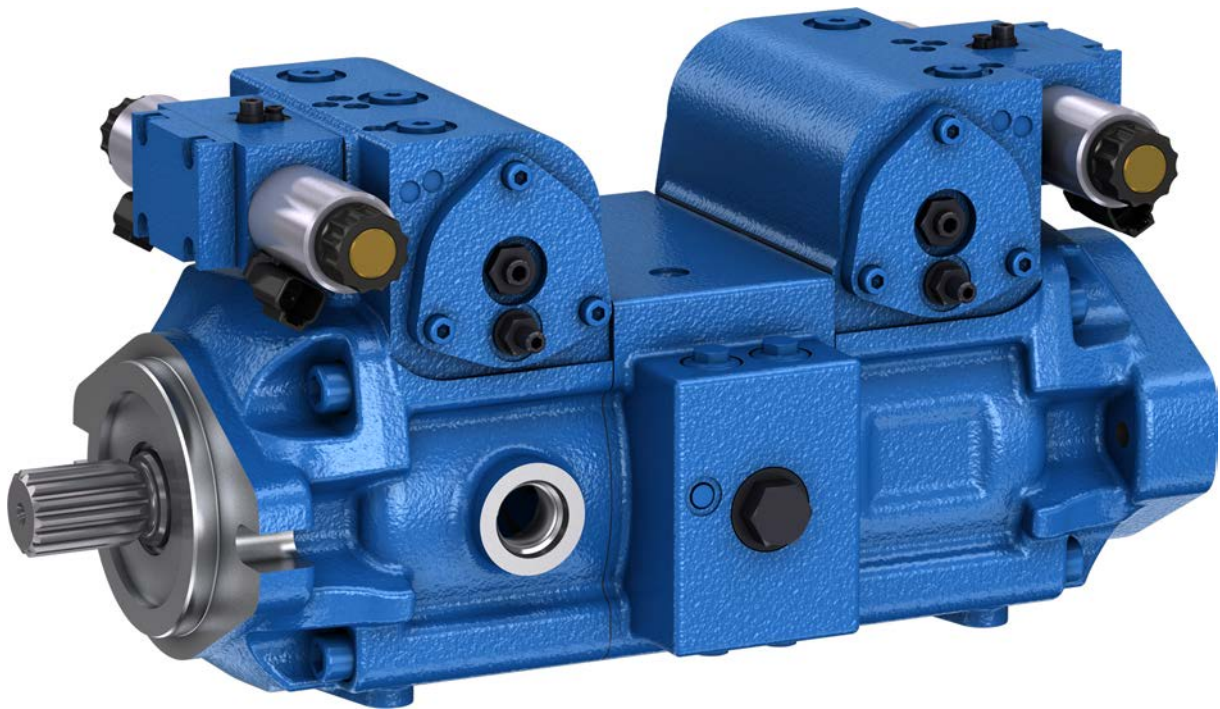


# Axial Piston Variable Double Pump A21VG

Series 10

**Instruction manual**  
**RE 93223-01-B/09.2020**

Replaces: -:-  
English



The data specified above serve to describe the product. Should information be provided on use, these are only examples of applications and suggestions. Information from the catalog are not assured properties. The information given does not release the user from the obligation of own judgment and verification. Our products are subject to a natural wear and aging process.

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The cover shows an example application. The product delivered may differ from the image on the cover.

The original instruction manual was created in the English language.

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# 1 About this documentation

## 1.1 Validity of the documentation

This documentation applies to the following products:


- Axial piston variable double pump A21VG series 10

This documentation is intended for machine/system manufacturers, fitters and service technicians.






This documentation contains important information on the safe and appropriate transport, installation, commissioning, operation, maintenance, removal and simple troubleshooting of the axial piston unit.

- ▶ Read this documentation completely and in particular the chapter 2 “Safety instructions” on page 8 and chapter 3 “General instructions on damage to equipment and the product” on page 14 before you start work with the axial piston unit.

## 1.2 Required and supplementary documentation

- ▶ Only commission the axial piston unit if the documentation marked with the book symbol  is available to you and you have understood and observed it.

**Table 1: Required and supplementary documentation**

	<b>Title</b>	<b>Document number</b>	<b>Document type</b>
	<b>Order confirmation</b> Contains the order-related technical data of your A21VG axial piston variable double pump.	–	Order confirmation
	<b>Installation drawing</b> Contains the outer dimensions, all ports and the hydraulic schematic for your axial piston variable double pump A21VG.	Please request the installation drawing via your contact person at Bosch Rexroth.	Installation drawing
	<b>Axial piston variable double pump A21VG</b> Contains the permissible technical data, ports, main dimensions and circuit diagrams.	93223	Data sheet
	<b>Mineral-oil based hydraulic fluids and related hydrocarbons</b> Describes the requirements on a mineral-oil based hydraulic fluid and related hydrocarbons for the operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your hydraulic system.	90220	Data sheet
	<b>Environmentally acceptable hydraulic fluids</b> Describes the requirements on an environmentally acceptable hydraulic fluid for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90221	Data sheet
	<b>Fire-resistant, water-free hydraulic fluids (HFDR/HFDR)</b> Describes the requirements on fire-resistant, water-free hydraulic fluids for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90222	Data sheet
	<b>Notes on the use of hydrostatic drives at low temperatures</b> Contains additional information on the use of Rexroth axial piston units at low temperatures.	90300-03-B	Manual
	<b>Storage and preservation of axial piston units</b> Contains additional information on storage and preservation.	90312	Data sheet

### 1.3 Display of information

Standardized safety instructions, symbols, terms and abbreviations are used so that you can use this documentation to work quickly and safely with your product. To give you a better understanding they are explained in the sections below.

#### 1.3.1 Safety instructions

This documentation includes safety instructions in chapter 2.6 “Product-specific safety instructions” on page 11 and in chapter 3 “General instructions on damage to equipment and the product” on page 14 and before a sequence of actions or an instruction for action involving a risk of personal injury or damage to equipment.




The described danger prevention measures must be observed.

Safety instructions are set out as follows:

 <b>SIGNAL WORD</b>
<p><b>Type and source of danger!</b></p> <p>Consequences in case of noncompliance</p> <ul style="list-style-type: none"> <li>▶ Measure for danger prevention</li> <li>▶ &lt;List&gt;</li> </ul>

- **Warning sign:** draws attention to the danger
- **Signal word:** identifies the degree of the danger
- **Type and source of danger:** identifies the type and source of the danger
- **Consequences:** describes what occurs if the safety instructions are not complied with
- **Precautions:** states how the danger can be avoided


**Table 2: Danger classes in accordance with ANSI Z535.6-2006**

Warning sign, signal word	Meaning
 <b>DANGER</b>	Identifies a dangerous situation that will result in death or serious injuries if it is not avoided.
 <b>WARNING</b>	Identifies a dangerous situation that may result in death or serious injuries if it is not avoided.
 <b>CAUTION</b>	Identifies a dangerous situation that may result in minor to moderate injuries if it is not avoided.
<b>NOTICE</b>	Damage to equipment: the product or the environment may be damaged.

#### 1.3.2 Symbols

The following symbols mark notes that are not safety-relevant but which increase the understanding of the documentation.

**Table 3: Meaning of the symbols**

Symbol	Meaning
	If this information is disregarded, the product can not be used and/or operated to the optimum extent.
▶	Single, independent step
1.	Numbered instruction: The numbers specify that the steps are completed one after the other.
2.	
3.	

### 1.3.3 Designations

This documentation uses the following designations:

**Table 4: Designations**

Designation	Meaning
A21VG	Axial piston variable double pump, closed circuit
Threaded plug	Metal screw, pressure-resistant
Protection plug	Made out of plastic, not pressure-resistant, only for transportation

As umbrella term for “A21VG axial piston variable double pump” the designation “axial piston unit” will be used in the following.

### 1.3.4 Abbreviations

This documentation uses the following abbreviations:

**Table 5: Abbreviations**

Abbreviation	Meaning
ATEX	EU directive for explosion protection ( <b>A</b> tmosphère <b>e</b> xplosible)
DIN	<b>D</b> eutsche <b>I</b> ndustrie <b>N</b> orm (German Institute for Standardization)
EP	Proportional control electric
ET	Electric control, direct controlled
HT	Hydraulic control, direct controlled
HW	Proportional control, hydraulic, mechanical servo
ISO	<b>I</b> nternational <b>O</b> rganization for <b>S</b> tandardization
JIS	<b>J</b> apan <b>I</b> ndustrial <b>S</b> tandard
RE	<b>R</b> exroth document in the <b>E</b> nglish language
VDI 2230	Directive for the systematic calculation of high duty bolted joints and joints with one cylindrical bolt from the VDI ( <b>V</b> erein <b>D</b> eutscher <b>I</b> ngenieur <b>e</b> – Association of German Engineers)

## 2 Safety instructions

### 2.1 About this chapter

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

- ▶ Read this documentation completely and thoroughly before working with the axial piston unit.
- ▶ Keep this documentation in a location where it is accessible to all users at all times.
- ▶ Always include the required documentation when you pass the axial piston unit on to third parties.

### 2.2 Intended use

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

The product is intended for the following use:

The axial piston unit is only approved as a pump for hydrostatic drives in closed circuit.

- ▶ Observe the technical data, application and operating conditions and performance limits as specified in data sheet 93223 and in the order confirmation. Information about approved hydraulic fluids can be found in data sheet 93223.

The axial piston unit is only intended for professional use and not for private use. Intended use includes having read and understood the complete documentation, especially the chapter 2 “Safety instructions” on page 8.

### 2.3 Improper use

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

Similarly, the following foreseeable faulty usages are also considered to be improper:

- Use outside the operating parameters approved in the data sheet or in the order confirmation (unless customer-specific approval has been granted)
- Use for non-approved fluids, e.g. water or polyurethane components
- Modification of factory settings by non-authorized persons



- Use of add-on parts (e.g. control unit, valves) that are not specified Rexroth components
- Using the axial piston unit under water at a depth of more than 10 meters without necessary additional measures, e.g. pressure equalization
- Using the axial piston unit when the exterior pressure is greater than the interior pressure (case pressure)
- Using the axial piston unit in explosive environments unless the component or machine/system has been certified as compliant with the ATEX directive 94/9/EC
- Using the axial piston unit in an aggressive atmosphere
- Using the axial piston unit in aircraft or space craft

## 2.4 Personnel qualifications

The activities described in this documentation require basic mechanical, electrical and hydraulic knowledge, as well as knowledge of the associated technical terms. For transporting and handling the product, additional knowledge is necessary with regard to working with a lifting device and the corresponding attachment equipment. In order to ensure safe use, these activities may therefore only be carried out by appropriate qualified personnel or an instructed person under the direction and supervision of qualified personnel. Qualified personnel are those who can recognize possible hazards and institute the appropriate safety measures due to their professional training, knowledge, and experience, as well as their understanding of the relevant regulations pertaining to the work to be done. Qualified personnel must observe the rules relevant to the subject area and have the necessary hydraulic knowledge.

Hydraulic knowledge means, for instance:

- reading and fully understanding hydraulic plans,
- fully understanding in particular the interrelationships regarding safety devices, and
- having knowledge on the function and assembly of hydraulic components.



Bosch Rexroth offers training support for special fields. You can find an overview of the training contents on the internet at:  
<http://www.boschrexroth.com/didactic>.

## 2.5 General safety instructions

- Observe applicable accident prevention and environmental protection regulations.
- Observe the safety regulations of the country in which the product is used/operated.
- Use Rexroth products only when they are in good working order.
- Observe all notices on the product.
- Do not install, operate, remove or maintain Rexroth products if under the influence of alcohol, drugs or medication that may affect your reaction time.
- Only use genuine Rexroth accessories and spare parts to ensure there is no hazard to persons from unsuitable spare parts.
- Observe the technical data and ambient conditions specified in the product documentation.

- If unsuitable products are installed or used in applications that are of relevance to safety, unexpected operating conditions may occur in the application, which could result in personal injury or property damage. For this reason, only use the product in safety-relevant applications if this use is expressly indicated and approved in the product documentation, e.g. in explosion protection areas or in safety-related parts of a control system (functional safety).
- Only commission the product if it has been determined that the end product (e.g. machinery/system) in which the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards for the application.
- Use tools appropriate for the work being performed and wear appropriate protective clothing to prevent punctures and cuts (e.g. when removing protective covers, disassembly).
- There is a risk of entanglement when operating the axial piston unit with a bare shaft end. Check whether or not your machine requires additional safety measures for your application. If necessary, make sure these are appropriately implemented.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Potential electromagnetic interference (EMI) exists if the solenoid is energized with a modulated direct current (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.

## 2.6 Product-specific safety instructions

The following safety instructions apply for chapters 6 to 14.

### **WARNING**

#### **Danger from excessive pressure!**

Danger to life, risk of injury or property damage!

Improperly changing the factory pressure settings can result in a pressure increase beyond the maximum permissible pressure.

Operating the unit above the maximum permissible pressure can cause components to burst and hydraulic fluid to escape under high pressure.

- ▶ Changes to the factory settings may only be made by Bosch Rexroth specialists.
- ▶ In addition, a pressure relief valve is required in the hydraulic system as back-up. If the axial piston unit is equipped with a pressure cut-off and/or pressure controller, this is not an adequate safeguard against pressure overload.

#### **Danger due to suspended loads!**

Danger to life, risk of injury or property damage!

Improper transportation may cause the axial piston unit to fall down and lead to injury, e.g. crushing or fracture, or damage to the product.

- ▶ Make sure that the load bearing capacity of the lifting device is sufficient to safely bear the weight of the axial piston unit.
- ▶ Never step or grip under suspended loads.
- ▶ Ensure a stable transport position.
- ▶ Use your personal protective equipment (e.g. safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Use suitable lifting devices for transport.
- ▶ Observe the prescribed position of the lifting strap.
- ▶ Observe the national laws and specifications of occupational safety and health and transport.

#### **System/machine under pressure!**

Risk of death or serious injury when working on unsecured machines/systems!

Property damage!

- ▶ Switch off the entire system and secure it against reactivation according to the parameters provided by the machine/system manufacturer.
- ▶ Ensure that all relevant components of the hydraulic system are depressurized. For this purpose, observe the parameters indicated by the machine/system manufacturer.
- ▶ Please note that the hydraulic system might still be pressurized even after separation from the actual pressure supply.
- ▶ Do not disconnect any line connections, ports and components as long as the hydraulic system is under pressure.

## **WARNING**

### **Escaping hydraulic fluid mist!**

Risk of explosion and fire hazard, health hazard, risk of environmental pollution!

- ▶ Depressurize the relevant machine/system component and repair the leak.
- ▶ Only perform welding work when the machine/system is depressurized.
- ▶ Keep open flames and ignition sources away from the axial piston unit.
- ▶ If axial piston units are located in the vicinity of ignition sources or powerful thermal radiators, a shield must be erected to ensure any escaping hydraulic fluid cannot be ignited, and to protect hose lines from premature aging.

### **Electrical voltage!**

Risk of injury from electric shock or risk of property damage!

- ▶ Always disconnect the voltage supply to the relevant machine/system part before installing the product and/or connecting or disconnecting the connector. Protect the machine/system against being re-energized.

### **Danger from unexpected machine movement!**

Danger to life or risk of injury! Unintentional or careless actuation of the manual override of the solenoids can cause unexpected machine movements.

- ▶ Use the manual override only for functional testing or in the event of technical malfunctions.
- ▶ Using the manual override on a permanent basis (e.g. by wedging, blocking) is not permitted.
- ▶ The use of the manual override is only permitted with limited technical data (e.g.  $0.25 \times$  maximum data).
- ▶ Check whether or not your machine requires additional safety measures for your application to avoid unintentional actuation. If necessary, make sure these are appropriately implemented.
- ▶ Wear suitable protective clothing.

### **Limitation of the closed loop control and/or open loop control function!**

Risk of injury or property damage!

Under certain circumstances, moving parts in control equipment

(e.g., valve spools) can get stuck in an undefined position due to contamination (e.g., impure hydraulic fluid, abrasion or residual dirt from components).

As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk.

- ▶ Check whether your application requires remedial measures on your machine in order to bring the driven consumer to a safe position (e.g. safe stop).
- ▶ If necessary, make sure these are appropriately implemented.

## CAUTION

### **High noise development during operation!**

Danger of hearing damage, hearing loss!

The noise emission of axial piston units depends on rotational speed, working pressure and installation conditions, among other factors. The sound pressure level may rise above 70 dB (A) in certain application conditions.

- ▶ Always wear hearing protection near a running axial piston unit.

### **Hot surfaces on axial piston unit!**

Risk of burning!

- ▶ Allow the axial piston unit to cool down sufficiently before touching it.
- ▶ Protect yourself with heat-resistant protective clothing, e.g. gloves.

### **Inappropriate routing of cables and lines!**

Risk of stumbling and property damage! Improper routing of cables and lines can cause a risk of stumbling as well as damage to equipment and components, e.g. due to lines and connectors being torn off.

- ▶ Always install cables and lines in a way that nobody can fall over them, that they are not bend or twisted, do not chafe on edges and are not guided through ducts with sharp edges without sufficient protection.

### **Contact with hydraulic fluid!**

Danger to health / damage to health, e.g. eye injury, skin damage, toxication in the event of inhalation!

- ▶ Avoid any contact with hydraulic fluids.
- ▶ When handling hydraulic fluids, the safety instructions of the lubricant manufacturer need to be observed at all times.
- ▶ Use your personal protective equipment (e.g. safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Immediately seek medical attention, however, if hydraulic fluid gets into your eyes or blood circuit or if you swallow it accidentally.

### **Escaping hydraulic fluid through leaking machine/system components!**

Risk of burning and risk of injury due to escaping hydraulic fluid jet!

- ▶ Depressurize the relevant machine/system component and repair the leak.
- ▶ Never attempt to block or seal the leak or hydraulic fluid jet with a cloth.

### **Danger from improper handling!**

Slip hazard! Risk of slipping on wet surfaces when climbing on the axial piston unit.

- ▶ Never grab or climb onto the axial piston unit.
- ▶ Check how to safely get on top of the machine/system.

## **2.7 Personal protection equipment**

The personal protection equipment is the responsibility of the user of the axial piston unit. Observe the safety regulations and provisions of your country. All components of the personal protection equipment must be intact.

### 3 General instructions on damage to equipment and the product

The following instructions apply for chapters 6 to 14.

#### NOTICE

##### **Danger from improper handling!**

Product can be damaged!

- ▶ Do not subject the product to improper mechanical loads.
- ▶ Never use the product as handle or step.
- ▶ Do not put/place any objects on the product.
- ▶ Do not strike the drive shaft of the axial piston unit.
- ▶ Do not set/place the axial piston unit on the drive shaft or assembled parts.
- ▶ Do not strike assembled parts (e.g. sensors or valves).
- ▶ Do not hit sealing surfaces (e.g. on the work connections).
- ▶ Leave the protective covers on the axial piston unit until you connect the lines.
- ▶ Disconnect all electrical connectors before arc welding and painting operations.
- ▶ Ensure that the electronic components (e.g. sensors) are not electro-statically charged (e.g. during painting operations).

##### **Risk of property damage due to inadequate lubrication!**

Product can be damaged or destroyed!

- ▶ Never operate the axial piston unit with insufficient hydraulic fluid. Specifically, make sure that the rotary group has sufficient lubrication.
- ▶ When commissioning a machine/system, make sure that the housing area and the working lines of the axial piston unit are filled with hydraulic fluid and remain filled during operation.
- ▶ Check the hydraulic fluid level in the housing area regularly and recommission, if necessary. For above-reservoir installation, the housing area may drain out through the drain line after prolonged standstill periods (air enters through the shaft seal) or through the working line (gap leakage). This means the bearings are insufficiently lubricated when the system is turned on.
- ▶ Make sure the suction line is always filled with hydraulic fluid during commissioning and operation.

##### **Mixing hydraulic fluids!**

Product can be damaged!

- ▶ Before installation, remove all fluids from the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.
- ▶ Any mixture of hydraulic fluids of different manufacturers and/or different types of the same manufacturer is generally not permissible.

## NOTICE

### **Contamination of hydraulic fluid!**

The cleanliness of the hydraulic fluid impacts the service life of the axial piston unit. Contamination of the hydraulic fluid may lead to premature wear and malfunctions!

- ▶ Always ensure a work environment in the assembly location that is free from dust and foreign particles to prevent foreign particles, e.g. welding beads or metal cuttings, from entering the hydraulic lines and lead to wear and malfunctions in the product. The axial piston unit should be clean when installed.
- ▶ Only use clean ports, hydraulic lines and assembled parts (e.g. measuring devices).
- ▶ When plugging the ports, no contamination may ingress.
- ▶ Before commissioning, ensure that all hydraulic connections are tight and that all seals and plugs of the plug-in connection are correctly installed and undamaged to prevent fluids and foreign particles from entering the product.
- ▶ Filter the hydraulic fluid when filling the system with a suitable filter system to minimize the solid particle contamination and water in the hydraulic system and to achieve the required cleanliness level.

### **Improper cleaning**

Product can be damaged!

- ▶ Plug all openings with appropriate protective covers in order to prevent cleaning agents from entering the hydraulic system.
- ▶ Never use solvents or aggressive cleaning agents. Use only water and, if necessary, a mild cleaning agent to clean the axial piston unit.
- ▶ Do not point a high-pressure cleaner at sensitive components, e.g. shaft seal, electrical connections and components.
- ▶ Use fiber-free cleaning cloths for cleaning.

### **Environmental pollution due to incorrect disposal!**

Careless disposal of the axial piston unit and its assembled parts, the hydraulic fluid and the packaging material can cause environmental pollution!

- ▶ Dispose of the axial piston unit, hydraulic fluid and packaging in accordance with the regulations in your country.
- ▶ Dispose of the hydraulic fluid in accordance with the applicable safety data sheet of the hydraulic fluid.

### **Danger due to chemical or aggressive environmental conditions!**

Product can be damaged! If the axial piston unit is exposed to chemical or corrosive environmental conditions, such as sea water, fertilizer or road salt, it can result in corrosion or, in extreme cases, malfunction. Leaks may lead to a leakage of hydraulic fluid.

- ▶ Take appropriate measures to protect the axial piston unit from chemical or corrosive environmental conditions.

## NOTICE

### **Leakage or spilling of hydraulic fluid!**

Environmental pollution and contamination of the ground water!

- ▶ Always place a drip tray under the axial piston unit when adding and draining the hydraulic fluid.
- ▶ Use a suitable binding agent if hydraulic fluid is spilled.
- ▶ Observe the safety data sheet for the hydraulic fluid and the specifications provided by the system manufacturer.

### **Danger due to heat development in components!**

Adjacent products may be damaged! Due to a heat development in components (e.g. solenoids), adjacent products may be damaged during assembly if no sufficient safety distance is complied with.

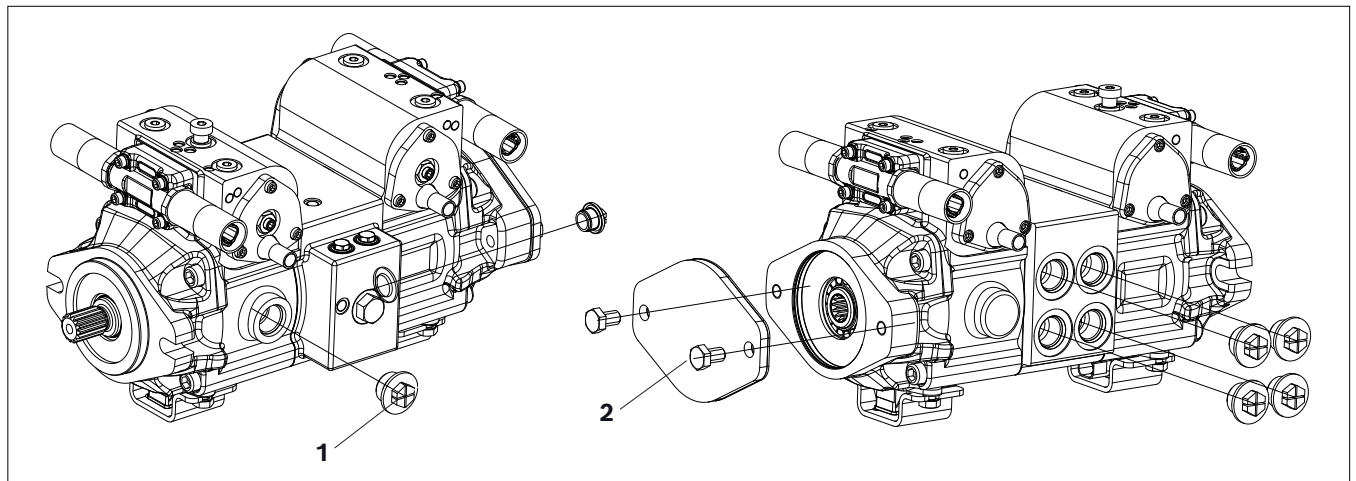
- ▶ When installing the axial piston unit, check the safety distances to nearby products to ensure that they are not damaged.

The warranty applies only to the delivered configuration.

The entitlement to warranty cover will be rendered void if the product is incorrectly installed, commissioned or operated, or if it is used or handled improperly.



## 4 Scope of supply



**Fig. 1: Axial piston unit**

Included in the scope of supply are:

- Axial piston unit as per order confirmation

The following parts are also installed on delivery:

- Protection plug/threaded plug (**1**)
- For version with through drive, metallic protection cover and mounting bolts (**2**)

## 5 Product description

### 5.1 Performance description

The axial piston variable double pump generates, controls and regulates a hydraulic-fluid flow. It is designed for mobile applications such as construction machinery.

Refer to data sheet 93223 and the order confirmation for the technical data, operating conditions and operating limits of the axial piston unit.

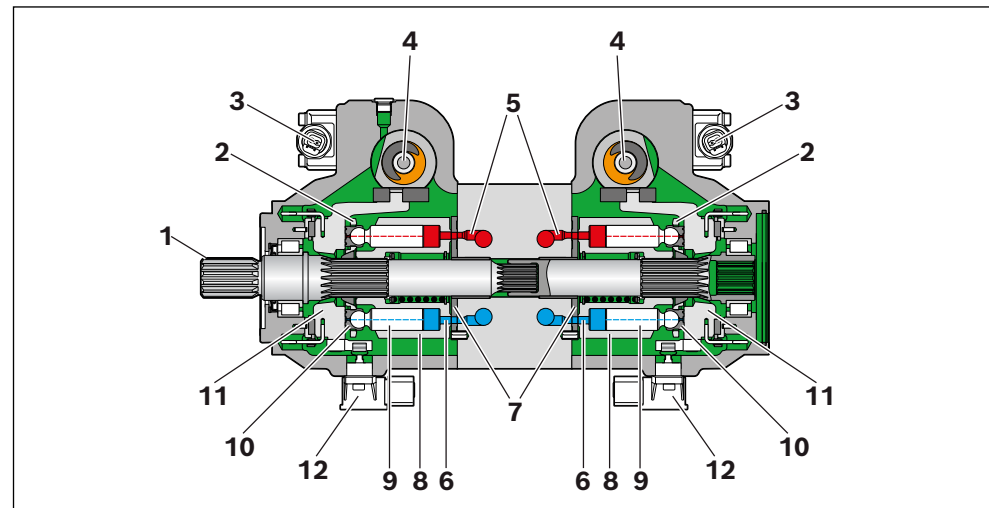
### 5.2 Product description

The A21VG is a variable double pump with two axial piston rotary groups in swashplate design for hydrostatic drives in closed circuits. The two flows are proportional to the drive speed and the displacement. The flow can be steplessly changed by controlling the cradle (11). Both circuits can be adjusted independent of one another. For axial piston units with swashplate design, the pistons are arranged axially with respect to the drive shaft.

**Closed circuit** In the closed circuit, the hydraulic fluid flows from the hydraulic pump to the consumer (e.g. the hydraulic motor) and from there directly back to the hydraulic pump.

There is a high-pressure side and a low-pressure side which alternate depending on which side is under load.

#### 5.2.1 Assembly of the axial piston unit



**Fig. 2: Assembly of the A21VG**

- |   |                             |                                   |
|---|-----------------------------|-----------------------------------|
| <b>1</b> Drive shaft                                  | <b>4</b> Stroking piston    | <b>9</b> Piston                   |
| <b>2</b> Retainer plate                               | <b>5</b> High-pressure side | <b>10</b> Slipper pad             |
| <b>3</b> Controller (using the ET as an example here) | <b>6</b> Low-pressure side  | <b>11</b> Cradle                  |
|   | <b>7</b> Control plate      | <b>12</b> Angle Sensor (optional) |
|   | <b>8</b> Cylinder           |                                   |

### 5.2.2 Functional description

**Pump** Torque and rotational speed are applied to the drive shaft (1) by an diesel engine. The drive shaft is connected by splines to the cylinder (8) to set this in motion. With every revolution, the pistons (9) in the cylinder bores execute one stroke whose magnitude depends on the setting of the cradle (11). The pistons hold the slipper pads (10) onto the glide surface of the cradle with the retainer plate (2) and guide them along. The swashplate setting during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position. Here, hydraulic fluid is fed in and drained out through the two control slots in the control plate (7) according to the stroke displacement. On the high-pressure side (5) the hydraulic fluid is pushed out of the cylinder chamber and into the hydraulic system by the pistons. At the same time, hydraulic fluid flows into the growing piston chamber on the low-pressure side (6). In a closed circuit, supported by the return and boost pressure.

**High-pressure safeguarding** The four high-pressure relief valves protect the hydrostatic transmission (pump and engine) against overloading. They limit the maximum pressure in the relevant high-pressure line and at the same time act as boost valves. High-pressure relief valves are not working valves and are only suitable for pressure spikes or high rates of pressure change.

**Version without boost pump** In order to replenish internal leakage in the variable double pump and consumers, port **G** must be connected to an external source of boost pressure. The boost pressure-relief valve is integrated.

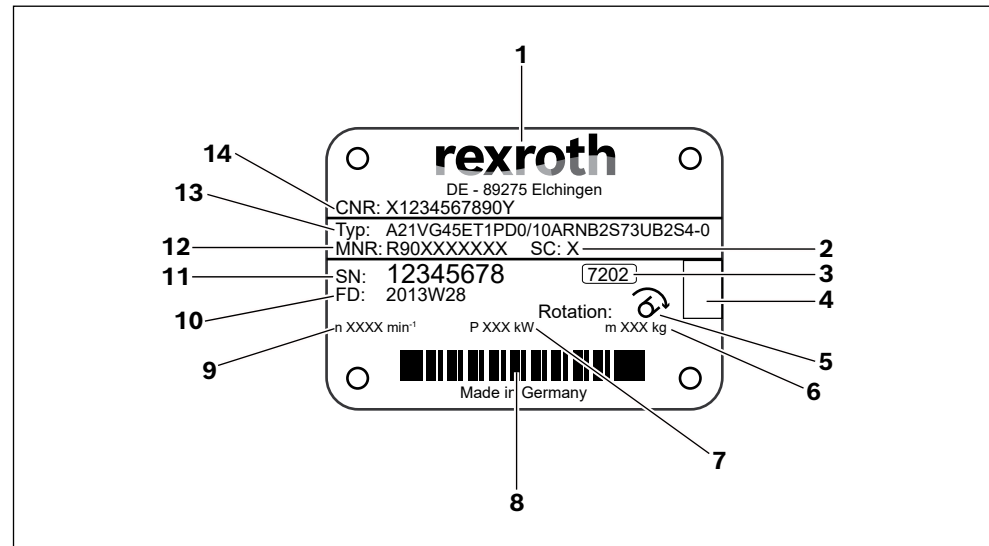
**Control** The swivel angle of the cradle (11) is steplessly varied. Controlling the swivel angle of the swashplate changes the piston stroke and therefore the displacement. Adjusting the swashplate through the neutral position will change the direction of flow (making reversing operation possible). The swivel angle is controlled hydraulically by means of the stroking piston. The cradle is mounted in swivel bearings for easy motion and the neutral position is spring-centered. Increasing the swivel angle increases the displacement; reducing the angle results in a corresponding reduction in displacement.



Various control devices are available depending on requirements. Information about this can be found in data sheet 93223.

### 5.3 Product identification

The axial piston unit can be identified from the name plate. The following example shows an A21VG name plate:



**Fig. 3: Name plate A21VG**

- |  |  |
|--|--|
| <b>1</b> Manufacturer  | <b>8</b> Bar code                                  |
| <b>2</b> Sample category (optional)                                      | <b>9</b> Rotational speed                          |
| <b>3</b> Internal plant designation                                      | <b>10</b> Manufacturing date                       |
| <b>4</b> Specified area for inspection stamp                             | <b>11</b> Serial number                            |
| <b>5</b> Direction of rotation (viewed on drive shaft) – here: clockwise | <b>12</b> Material number of the axial piston unit |
| <b>6</b> Weight (optional)   | <b>13</b> Ordering code                            |
| <b>7</b> Power   | <b>14</b> Customer material number                 |

## 6 Transport and storage

- ▶ Always observe the required ambient conditions for transport and storage, see chapter 6.2 “Storing the axial piston unit” on page 23.



Notes on unpacking can be found in chapter 7.1 “Unpacking” on page 25.

### 6.1 Transporting the axial piston unit

The transportation options below exist depending on the weight and duration of the transport:

- Transport by hand (chapter not relevant for this axial piston unit)
- Transporting with lifting device (eye bolt or lifting strap)

#### Dimensions and weights

**Table 6: Dimensions and weights**

Size		35	45
Weight	kg	56 <sup>1)</sup>	56 <sup>1)</sup>
Width	mm	The dimensions vary with the unit type. The values applicable for your axial piston unit can be found in the installation drawing (request if necessary).	
Height	mm		
Depth	mm		

<sup>1)</sup> With HT control

The weight specifications may vary depending on the unit type.

#### 6.1.1 Transporting by hand

Axial piston units with a weight of up to 15 kg can be transported manually for a short time if necessary.

#### **CAUTION!** Danger from heavy loads!

There is a danger of health damage when carrying axial piston units.

- ▶ Use suitable lifting, placement and relocation equipment.
- ▶ Use your personal protection equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- ▶ Do not transport the axial piston unit at sensitive attachment parts (e.g. sensors or valves).
- ▶ Carefully place the axial piston unit on the seating to prevent it from being damaged.

#### 6.1.2 Transporting with lifting device

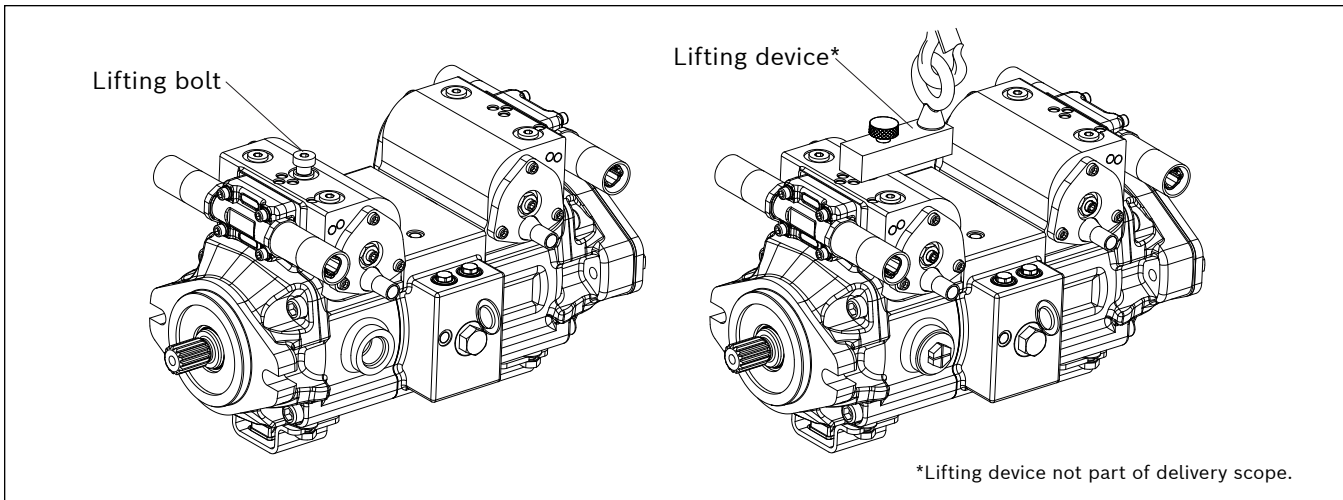
For transporting, the axial piston unit can be connected to a lifting device via a lifting bolt or a lifting strap.

#### Transport with lifting bolt

The axial piston unit can be transported suspended from the lifting bolt which comes installed in R port as standard option on all units (**except** for units with HW controllers).

- ▶ **WARNING:** Lifting device should have a locking mechanism to ensure that device locks around the lifting bolt so that the unit cannot slide out of lifting device.
- ▶ **WARNING:** When lifting the unit from the lifting bolt, the axial piston unit can rotate or tilt. Careful handling must be maintained to prevent injury
- ▶ Only guide the axial piston unit by hand for fine positioning and to avoid oscillations
- ▶ When installing the unit into the primary drive assembly, carefully guide the unit so that the drive shaft is axially aligned to the mating component and is not tilted at an angle.
- ▶ The lifting device must be capable of handling the total weight of the unit plus 20%.

You can hoist the axial piston unit as shown in Fig. 4 with the lifting device attached to the lifting bolt.



**Fig. 4: Attaching and lifting with lifting device**

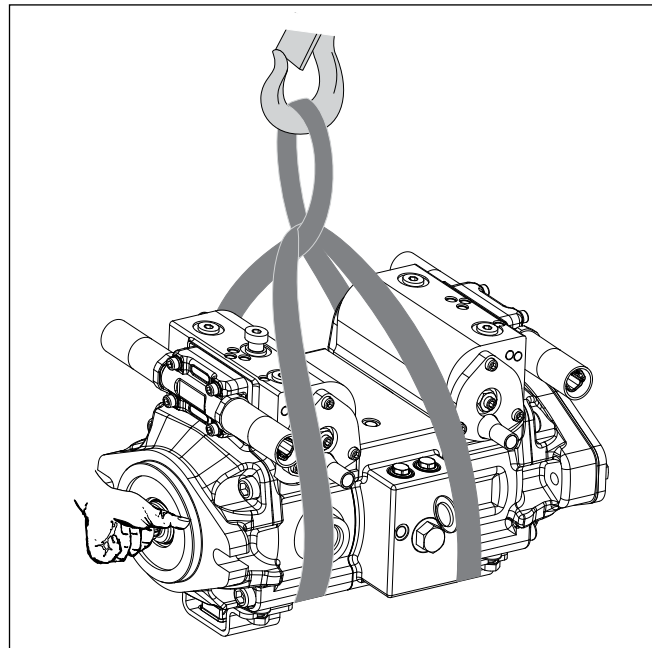
**Transport with lifting strap**

**WARNING!** Danger from suspended loads!

During transport with a lifting strap, the axial piston unit can fall out of the lifting strap and cause injuries.

- ▶ Use the widest possible lifting strap.
- ▶ Make sure that the axial piston unit is securely fixated with the lifting strap.
- ▶ Only guide the axial piston unit by hand for fine positioning and to avoid oscillations.
- ▶ Never stand under or put you hands under suspended loads.

Place the lifting strap around the axial piston unit in such a way that it neither passes over the attachment parts (e.g. valves) nor that the axial piston unit is hung from attachment parts (see Fig. 5).



**Fig. 5: Transport with lifting strap**

## 6.2 Storing the axial piston unit

### Requirement

- The storage areas must be free from corrosive materials and gases.
  - To prevent damage to the seals, ozone-forming equipment (e.g. mercury-vapor lamps, high voltage equipment, electric motors, sources of electrical sparks or electrical discharges) must not be operated in storage areas.
  - The storage areas must be dry.
  - Ideal storage temperature: +5 °C to +20 °C.
  - Minimum storage temperature: –50 °C (exception: units with on-board-electronics).
  - Maximum storage temperature: +60 °C.
  - Avoid high light irradiation (e.g. bright windows or direct fluorescent lighting).
  - Do not stack axial piston units and store them shock-proof.
  - Do not store the axial piston unit on the drive shaft or fitting, e.g. sensors or valves.
  - For further storage conditions, see Table 7.
- Check the axial piston unit monthly to ensure proper storage.

### After delivery

The axial piston units are provided ex-works with corrosion protection packaging (corrosion protection film).

Table 7 lists the maximum permissible storage times for an originally packed axial piston unit as per data sheet 90312.

**Table 7: Storage time with factory corrosion protection**

Storage conditions	Standard corrosion protection	Long-term corrosion protection
Closed, dry room, uniform temperature between +5 °C and +20 °C. Undamaged and closed corrosion protection film.	Maximum 12 months	Maximum 24 months



Entitlement to warranty will be rendered void if the requirements and storage conditions are not adhered to or after expiration of the maximum storage time (see Table 7).

Procedure after expiry of the maximum storage time:

1. Check the entire axial piston unit for damage and corrosion prior to installation.
2. Check the axial piston unit for proper function and leaks during a test run.
3. If the storage time exceeds 24 months, the shaft seal ring must be replaced.



After expiry of the maximum storage time, we recommend that you have the axial piston unit inspected by your responsible Bosch Rexroth Service partner.

In the event of questions regarding repair and spare parts, contact your responsible Bosch Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit, see chapter 10.5 "Spare parts" on page 45.

**After removal** If a removed axial piston unit is to be stored, it must be preserved against corrosion for the duration of storage.



The following instructions only refer to axial piston units which are operated with a mineral-oil based hydraulic fluid. Other hydraulic fluids require preservation methods that are specifically designed for them. In such cases, consult with Bosch Rexroth Service, see chapter 10.5 “Spare parts” on page 45.

Bosch Rexroth recommends the following procedure:

1. Clean the axial piston unit, see chapter 10.1 “Cleaning and care” on page 43.
2. Empty the axial piston unit.
3. For storage time up to 12 months: Moisten the inside of the axial piston unit with mineral oil and fill with approx. 100 ml mineral oil.  
For storage time up to 24 months: Fill the axial piston unit with corrosion protection medium VCI 329 (20 ml).  
Filling is performed via the reservoir port **T**, see chapter 7.4 “Installing the axial piston unit”, Fig. 10 on page 36.
4. Seal all ports airproof.
5. Moisten the unpainted surfaces of the axial piston unit with mineral oil or a suitable, easily removed corrosion protection agent, e.g. acid-free grease.
6. Package the axial piston unit airproof together with desiccant in corrosion protection film.
7. Store the axial piston unit so that it is protected against jolts, see “Requirement” on page 23 in this chapter.



## 7 Installation

Prior to installation, the following documents must be ready at hand:

- Installation drawing for axial piston unit (can be obtained from your responsible contact person at Bosch Rexroth)
- Hydraulic schematic for the axial piston unit (in the installation drawing)
- Hydraulic schematic for the machine/system (available from the machine/system manufacturer)
- Order confirmation (contains the order-related technical data for your axial piston unit)
- Data sheet of the axial piston unit (contains the permissible values of technical data)

### 7.1 Unpacking

The axial piston unit is delivered in a corrosion protection film made of polyethylene material (PE).

**CAUTION!** Danger from parts falling out!

If the packaging is not opened correctly, parts may fall out and damage the parts or even cause injuries!

- ▶ Place the packaging on a flat and solid surface.
- ▶ Only open the packaging from the top.
- ▶ Remove the packaging from the axial piston unit.
- ▶ Check the axial piston unit for transport damage and completeness, see chapter 4 “Scope of supply” on page 17.
- ▶ Dispose of the packaging according to the environmental regulations of your country.

### 7.2 Installation conditions

The installation location and position of the axial piston unit essentially determine the procedures during installation and commissioning (such as when filling and air bleeding the axial piston unit).

- ▶ Fix the axial piston unit so that the expected forces and torques can be transferred without any danger. The machine/system manufacturer is responsible for dimensioning the fasteners.



The variable double pump A21VG is permissible without additional supports, providing a maximum dynamic mass acceleration of 10 g (= 98.1 m/s<sup>2</sup>) is not exceeded. If an additional pump is to be fitted to the A21VG, the mounting flange must be calculated for the permissible moment of inertia.

- ▶ Observe the permissible radial forces on the drive shaft when transferring output drive with radial force loading (belt drives). If necessary, the belt pulley must be separately mounted.
- ▶ Make sure that the axial piston unit is air bled and filled with hydraulic fluid during commissioning and operation. This is also to be observed following relatively long standstill periods as the axial piston unit may empty via the hydraulic lines.

- ▶ The case drain fluid in the housing must be directed to the reservoir via the highest case drain port. Use the line size which is appropriate for the port.
- ▶ Avoid using a check valve in the reservoir line.
- ▶ To achieve favorable noise values, decouple all connecting lines from all vibration-capable components (e.g. reservoir) using elastic elements.
- ▶ Make sure that the suction, reservoir and return lines lead into the reservoir below the minimum fluid level in all operating conditions. This will prevent air from being drawn in and foam from being formed.



The suction conditions improve with below-reservoir installation.

- ▶ Make sure that the working environment at the installation site is fully free of dust and foreign substances. The axial piston unit must be installed in a clean condition. Dirt contamination in the hydraulic fluid can seriously impair the function and service life of the axial piston unit.
- ▶ Use lint-free cloths for cleaning.
- ▶ Use suitable mild detergents to remove lubricants and other difficult-to-remove contamination. Cleaning agents must not enter the hydraulic system.

### 7.3 Installation position

The following installation positions are permissible. The shown piping layout illustrates the basic layout.



If it is not possible to fill the stroking chambers via **X<sub>1</sub>** to **X<sub>2</sub>** in the final installation position, this must be done prior to installation.



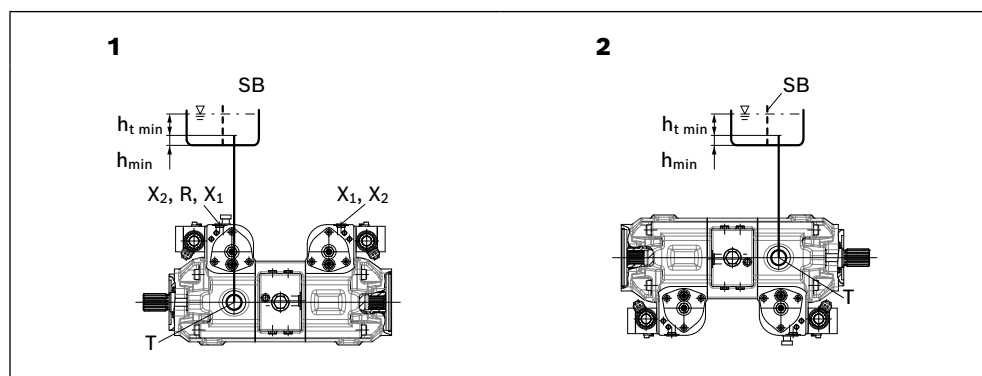
In order to prevent unexpected activation behavior and damage, the stroking chambers must be air bled via ports **X<sub>1</sub>**, **X<sub>2</sub>**, according to their installation position.

#### 7.3.1 Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Recommended installation position: 1 and 2 (without boost pump)



**Fig. 6: Below-reservoir installation A21VG without boost pump, installation position 1-2**

<b>R</b>	Air bleed port	<b>h<sub>t min</sub></b>	Minimum required immersion depth (200 mm)
<b>T</b>	Reservoir port (case drain)	<b>h<sub>min</sub></b>	Minimum required spacing to reservoir bottom (100 mm)
<b>SB</b>	Baffle (baffle plate)		

**Table 8: Below-reservoir installation**

Installation position	Air bleeding the housing	Air bleed Stroking chamber	Filling
1 (drive shaft, horizontal)	R*	X <sub>1</sub> , X <sub>2</sub>	T + X <sub>1</sub> + X <sub>2</sub>
2 (drive shaft, horizontal)	–	–	T

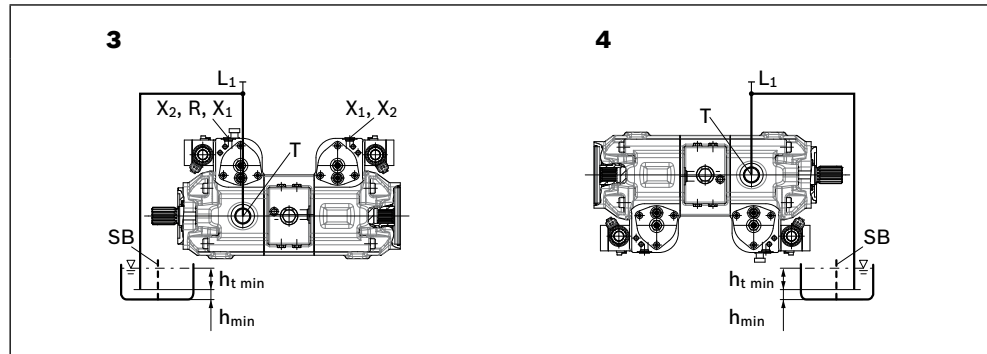
\*If R port is inaccessible, for installation position 1, the X<sub>1</sub> and X<sub>2</sub> ports can be opened to bleed the air when the unit is not in use. Does not apply to HT units.

### 7.3.2 Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.



Observe the maximum permissible suction height  $h_{s \max} = 800 \text{ mm}$ .  
The permissible suction height  $h_s$  is derived from the total pressure loss.



**Fig. 7: Above-reservoir installation A21VG without boost pump, installation position 3-4**

- |                      |                             |                          |   |
|----------------------|-----------------------------|--------------------------|---|
| <b>L<sub>1</sub></b> | Filling / air bleed         | <b>h<sub>t min</sub></b> | Minimum required immersion depth (200 mm)             |
| <b>R</b>             | Air bleed port              | <b>h<sub>min</sub></b>   | Minimum required spacing to reservoir bottom (100 mm) |
| <b>T</b>             | Reservoir port (case drain) | <b>h<sub>s max</sub></b> | Maximum permissible suction height (800 mm)           |
| <b>SB</b>            | Baffle (baffle plate)       |                          |   |

**Table 9: Above-reservoir installation**

Installation position	Air bleeding the housing	Air bleed Stroking chamber	Filling
3 (drive shaft, horizontal)	R*	X <sub>1</sub> , X <sub>2</sub>	L <sub>1</sub> + X <sub>1</sub> + X <sub>2</sub>
4 (drive shaft, horizontal)	L <sub>1</sub>	–	L <sub>1</sub>

\*If R port is inaccessible, for installation position 1, the X<sub>1</sub> and X<sub>2</sub> ports can be opened to bleed the air when the unit is not in use. Does not apply to HT units.

## 7.4 Installing the axial piston unit

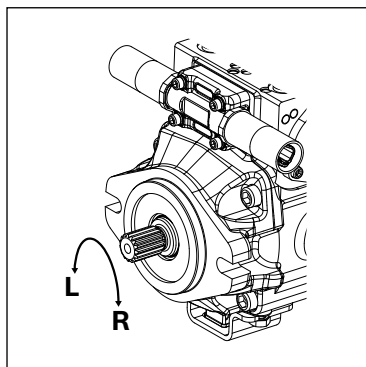
### 7.4.1 Preparation

1. Compare the material number and designation (ordering code) with the details in the order confirmation.



If the material number for the axial piston unit does not correspond to the one in the order confirmation, contact Bosch Rexroth Service for clarification, see chapter 10.5 “Spare parts” on page 45.

2. Before installing, completely empty the axial piston unit to prevent any mixing with the hydraulic fluid used in the machine/system.



**Fig. 8: Direction of rotation**

- L** Counter-clockwise  
**R** Clockwise

3. Check the direction of rotation of the axial piston unit (on the name plate) and make sure that this corresponds to the direction of rotation of the output/drive shaft of the machine/system.



The direction of rotation as specified on the name plate determines the direction of rotation of the axial piston unit as viewed on the drive shaft, see chapter 5.3 “Product identification” on page 20.

### 7.4.2 Dimensions

The installation drawing contains the dimensions for all connections and ports on the axial piston unit. Also observe the instructions provided by the manufacturers of the other hydraulic components when selecting the required tools.

### 7.4.3 General instructions

Please keep in mind the following general instructions for installation of the axial piston unit:

- Note that you can expect certain installation positions to affect the control device. Gravity, dead weight and case pressure can cause minor shifts in control characteristics and changes in response time.

- Torsional vibrations and speed variations may cause leakages on the shaft seal and increased rotary angle accelerations of the rotary group of the axial piston unit. At risk are diesel drives with a small number of cylinders and low flywheel mass and toothed belt or V-belt drives. Belts can lose a large part of its tension after just a short time.

An automatic clamping device can lessen the speed variations and vibrations and thus avoid consequential damage.

– Always use an automatic clamping device when using toothed belts or V-belts to transfer the input or output drive.

- On the input or output drive of an axial piston unit, a cardan shaft may cause vibrations and impermissible rotary angle accelerations. Depending on the frequency and temperature, they may result in leakage on the shaft seal and damage to the rotary group.
- For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of differential pressures at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

How to install the axial piston unit depends on the connecting elements to the drive side. The following descriptions explain the installation of the axial piston unit:

- with a coupling
- on a gearbox

#### 7.4.4 Installation with coupling

The method for installing the axial piston unit with a coupling is described below:

**NOTICE!** Danger from improper handling!

Product can be damaged!

- ▶ Do not install the coupling hub onto the drive shaft of the axial piston unit by striking it.

1. Install the specified coupling half onto the drive shaft of the axial piston unit according to the instructions of the coupling manufacturer.



The drive shaft of the axial piston unit is equipped with a female thread. Use this female thread to pull the coupling element onto the drive shaft. The size of the female thread can be seen in the installation drawing.

2. Clamp the coupling hub onto the drive shaft or ensure permanent lubrication of the drive shaft. This prevents the formation of frictional corrosion and the associated wear.
3. Transport the axial piston unit to the installation location.
4. Remove dirt and contaminants from the installation location.
5. Install the coupling on the output shaft of the diesel engine in accordance with the specifications provided by the coupling manufacturer.



The axial piston unit may not be bolted down until the coupling has been correctly installed.

6. Fix the axial piston unit at the installation location.
7. Align the drive shaft of the axial piston unit and the output shaft of the diesel engine so that there is no angular deviation.
8. Make sure that no impermissible axial and radial forces act on the drive shaft.
9. For bell housing installation, check the coupling axial play through the bell window according to the manufacturer's instructions.
10. Details on the required tools and tightening torques for the mounting bolts are available from the machine/system manufacturer.
11. When using flexible couplings, check that the drive is free of resonance after completing the installation.

#### 7.4.5 Installation on a gearbox

The installation layout for the axial piston unit on a gearbox is described below.

After installing on a gearbox, the axial piston unit is covered and is difficult to access:

- ▶ Therefore, before installing, make sure that the spigot diameter centers the axial piston unit (observe tolerances) and that no impermissible axial or radial forces act on the drive shaft of the axial piston unit (installation length).
- ▶ Protect the drive shaft against frictional corrosion by providing permanent lubrication.
- ▶ Fix the axial piston unit at the installation location.

**For attachment via gear wheel or helically-toothed shaft**

No gearing forces higher than the permissible axial and radial forces are to act on the shaft, if necessary the gear wheel must be supported separately at the gearbox output.

**7.4.6 Installation with cardan shaft**

To connect the axial piston unit to the diesel engine via a cardan shaft:

1. Position the axial piston unit close to the specified installation location.  
It should allow enough space for the cardan shaft to fit through on both sides.
2. Position the cardan shaft on the output shaft of the diesel engine.
3. Push the axial piston unit to the cardan shaft and join the cardan shaft to the drive shaft of the axial piston unit.
4. Bring the axial piston unit to the installation position and secure. If necessary, details on the required tools and tightening torques for the mounting bolts can be obtained from the system manufacturer.

**7.4.7 Completing installation**

1. Remove any mounted transport screws.

**CAUTION!** Operation with protection plug!

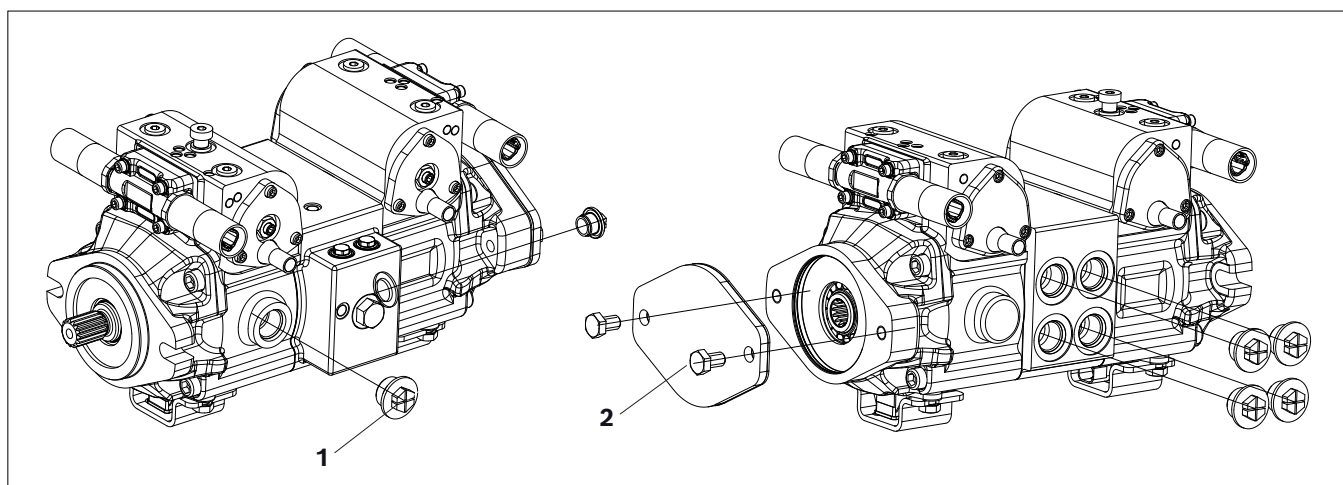
Operating the axial piston unit with protection plugs may result in injuries or damage to the axial piston unit.

- ▶ Before commissioning, remove all protection plugs and replace them with suitable, pressure-proof, metal threaded plugs.

2. Remove the transport protection.

The axial piston unit is delivered with protection plugs **(1)** and protection covers **(2)**. They are not pressure-resistant, therefore they have to be removed prior to connection. Use a suitable tool for this to prevent damage to the sealing and functional surfaces. If sealing or functional surfaces are damaged, contact your responsible Bosch Rexroth Service partner or the service department of the manufacturer's plant for the axial piston unit.





**Fig. 9: Removing transport protection**

- 1** Protection plug/threaded plug      **2** Protection cover



Ports intended for connecting lines are covered by protection plugs or threaded plugs, which serve as transport protection. All ports required for functional operation must be connected (see Table 10 “Ports A21VG series 10 1”) on page 36). If this requirement is disregarded, malfunction or damage may result. If a port is not connected, it must be plugged with a threaded plug because protection plugs are not pressure-resistant.



The setting screws are protected against unauthorized resetting by means of protection caps. Removing the protection caps will void the warranty. If you need to change settings, contact your responsible Bosch Rexroth Service partner (for address, see chapter 10.5 “Spare parts” on page 45).

- 3.** For versions with through drive, install the auxiliary pump according to the pump manufacturer’s instructions.

### 7.4.8 Hydraulically connecting the axial piston unit

## NOTICE

### Insufficient suction pressure!

Generally, a minimum permissible suction pressure at port “S” is specified for axial piston pumps with boost pump in all installation positions. If the pressure at port “S” drops below the specified values, damage may occur which may lead to the axial piston pump being damaged beyond repair!

- ▶ Make sure that the necessary suction pressure is not undercut. This is influenced by:
  - the piping (e.g. suction cross-section, pipe diameter, length of suction line)
  - the position of the reservoir
  - the viscosity of the hydraulic fluid
  - if fitted, a filter cartridge or check valve in the suction line (regularly check the level of soiling of the filter cartridge)

The machine/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 schematic of the machine/system manufacturer. The ports and fastening thread are designed for the maximum pressure specified in the data sheet. The machine/system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.



Connect only hydraulic lines that are appropriate for the axial piston unit port (pressure level, size, system of units).

### Notes on routing the lines

Observe the following notes when routing the suction, pressure and reservoir lines.

- Lines and hoses must be installed without pre-charge pressure, so that no further mechanical forces are applied during operation that will reduce the service life of the axial piston unit and, if applicable, the entire machine/system.
- Use suitable seals as sealing material.
- Suction line (pipe or hose)
  - The suction line should be as short and straight as possible.
  - Measure the line cross section of the suction line so that the pressure at the suction port does not drop below the minimum permissible pressure. Make sure that the maximum suction pressure is not exceeded (e.g. when pre-filling).
  - Make sure the connections and connecting elements are air-tight.
  - The hose must be pressure-resistant, also for external air pressure.
- Pressure line
  - For the pressure lines, use only pipes, hoses and connecting elements rated for the operating pressure range specified in data sheet 93223 (see Table 10).

- Drain line
  - Always route the reservoir lines so that the case is constantly filled with hydraulic fluid and to ensure that no air gets through the shaft seal even during extended standstill periods.
  - The case pressure must not exceed the limit values listed for the axial piston unit in the data sheet under any operating conditions.
  - The reservoir line joint in the reservoir must always be below the minimum fluid level under all conditions (see chapter 7.3 “Installation position” on page 27).
- If the axial piston unit is equipped with installed screw fittings, these must not be unscrewed. Screw the threaded plug of the fitting directly into the installed screw fitting.

**Risk of mix-ups with threaded connections**

Axial piston units are employed in regions using the metric measuring system, in regions using the Anglo-American (imperial) measuring system and in regions using the Japanese measuring system (JIS – **J**apan **I**ndustrial **S**tandard). Moreover, various kinds of seal are used. The system of units, the kind of seal, and the size of female thread and threaded plugs (e.g. locking screw) must all match. Due to the limited options for visually detecting differences, there is a risk of mix-ups.

**WARNING!** Leaky or popped-out threaded plugs!

If a threaded plug which is of a different measurement system, kind of seal and size with respect to the female thread is pressurized, the threaded plug may loosen itself or even be ejected from the hole in a projectile-like manner. This can result in serious injury and damage to equipment. Hydraulic fluid can be discharged from this leakage point.

- ▶ Use the drawings (installation drawing) to determine the required threaded plug for each fitting.
- ▶ Make certain that there are no mix-ups when installing fittings, mounting bolts and threaded plugs.
- ▶ For all female threads, use a threaded plug from the same system of units and of the correct size.

## Port overview

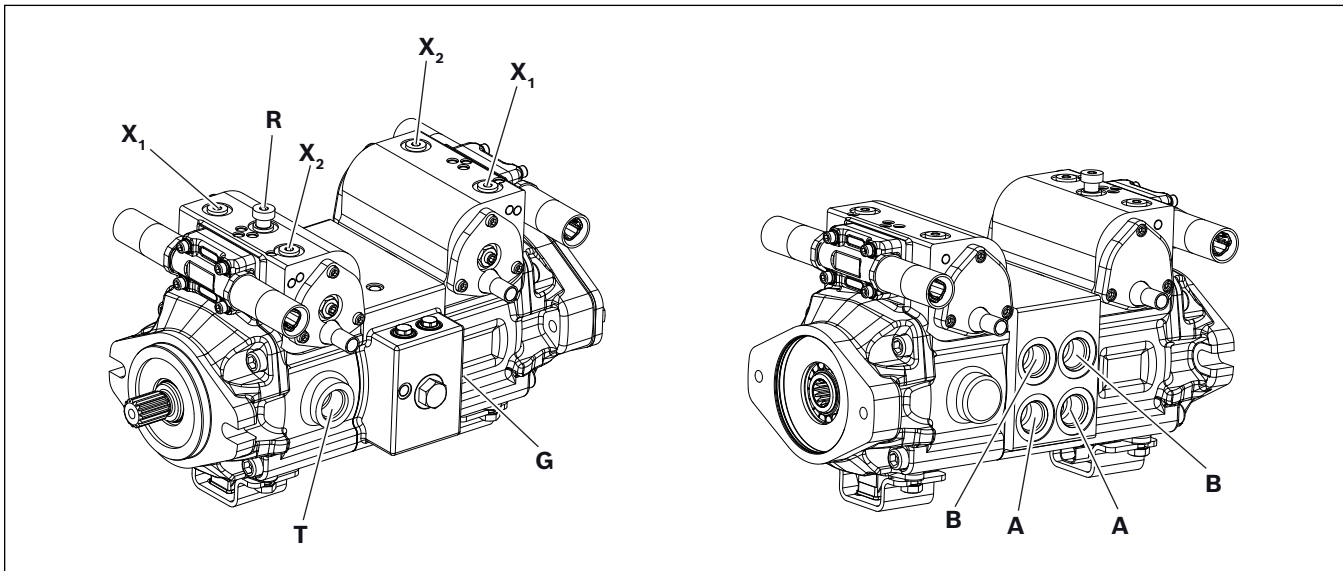


Fig. 10: Port overview A21VG, EP control with boost pump

Table 10: Ports A21VG series 10<sup>1)</sup>

Ports		Standard <sup>2)</sup>	Size [in] <sup>3)</sup>	p <sub>max abs</sub> [bar] <sup>4)</sup>	State <sup>5)</sup>
A, B	Working port	ISO 11926	1 1/16-12 UN-2B; 20 deep	450	O
T	Drain port	ISO 11926	1 1/16-12 UN-2B; 20 deep	3	O
R	Air bleed on pump 1	ISO 11926	9/16-18 UNF-2B; 13 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, only HP, HW, EP, ET)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (HT)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	O
Y	Pilot pressure, outlet (only for DA control valve)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	O
G	Boost pressure, inlet	ISO 11926	3/4-16 UNF-2B; 15 deep	30	O
Y <sub>BR</sub>	Brake release pressure	ISO 11926	9/16-18 UNF-2B; 13 deep	30	X
P <sub>S</sub>	Pilot pressure supply (filtered internally)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	X
G <sub>1</sub>	Boost pressure, inlet (only for DA control valve)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	X

<sup>1)</sup> Thread according to ASME B1.1

<sup>2)</sup> The spot face can be deeper than specified in the appropriate standard.

<sup>3)</sup> For notes on tightening torques, see instruction manual

<sup>4)</sup> Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

<sup>5)</sup> O = Must be connected (plugged on delivery)  
X = Plugged (normal operation)



Port **G** (or **G<sub>1</sub>** on the version with DA control valve) must be charged with boost pressure by the customer.

**Tightening torques**

The following tightening torques apply:

- Female threads hole of the axial piston unit:  
The maximum permissible tightening torques  $M_{G \max}$  are maximum values of the for the female threads and must not be exceeded. Values, see Table 11.
- Fittings:  
Observe the manufacturer's instruction regarding tightening torques for the used fittings.
- Mounting bolts:  
For mounting bolts with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases as per VDI 2230.
- Threaded plugs:  
For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs  $M_V$  apply. Values, see Table 11.

**Table 11: Tightening torques of the female threads and threaded plugs**

Ports Standard	Thread size	Maximum permissible tightening torque of the female threads $M_{G \max}$	Required tightening torque of the threaded plugs $M_V$	WAF hexagon socket of the threaded plugs
ISO 11926	5/16-24 UNF-2B	10 Nm	7 Nm	1/8 in
	3/8-24 UNF-2B	20 Nm	10 Nm	5/32 in
	7/16-20 UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18 UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16 UNF-2B	160 Nm	70 Nm	5/16 in
	7/8-14 UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12 UN-2B	360 Nm	170 Nm	9/16 in
	1 5/16-12 UN-2B	540 Nm	270 Nm	5/8 in
	1 5/8-12 UN-2B	960 Nm	320 Nm	3/4 in
	1 7/8-12 UN-2B	1200 Nm	390 Nm	3/4 in

**Procedure**

To connect the axial piston unit to the hydraulic system:

1. Remove the protection plugs and threaded plugs at the ports at which the connections are to be made according to the hydraulic schematic.
2. Make sure that the sealing surfaces of the hydraulic ports and functional surfaces are not damaged.
3. Use only clean hydraulic lines or flush them before installation. (Note chapter 7.5 "Performing flushing cycle" on page 38 when you flush out the complete system.)
4. Connect the lines in accordance with the installation drawing and the machine or system schematic. Check whether all ports are connected or plugged with threaded plugs.
5. Tighten the fittings correctly (note tightening torques). Mark all correctly tightened fittings, e.g. with a permanent marker.
6. Check all pipes and hose lines and every combination of connecting pieces, couplings or connecting points with hoses or pipes to ensure they are in condition for safe working.



For relationship between direction of rotation and flow direction, please refer to data sheet 93223.

### 7.4.9 Electrically connecting the axial piston unit

## NOTICE

### Short circuit in event of penetrating hydraulic fluid!

Fluid can penetrate the product and cause a short circuit!

- ▶ Do not install axial piston units with electric components (e.g. electric controls, sensors) in a reservoir below the fluid level (inside-reservoir installation).

The machine/system manufacturer is responsible for the layout of the electric control.

Electrically controlled axial piston units must be connected in accordance with the electrical circuit diagram for the machine/system.

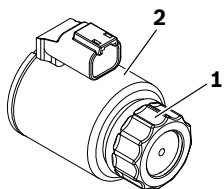
For axial piston units with electrical control and/or mounted sensors, please comply with the details given in data sheet 93223, e.g.:

- the permissible voltage range
- the permissible current
- correct pin assignment
- the recommended electrical control units

Exact details on the connector, type of protection and matching mating connector can also be found in data sheet 93223. The mating connector is not included in the scope of supply.

1. Switch off power supply to the relevant system component.
2. Electrically connect the axial piston unit (12 or 24V). Before connecting, check that the connector including all seals are intact.

### Changing connector orientation



If necessary, you can change the connector orientation by turning the solenoid housing. This is dependent on the connector version.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counterclockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the mounting nut. Tightening torque of the mounting nut: 5+1 Nm.

### 7.5 Performing flushing cycle

In order to remove foreign particles from the system, Bosch Rexroth recommends a flushing cycle for the entire system before initial commissioning. To avoid internal contamination, the axial piston unit must not be included in the flushing cycle.



The flushing cycle must be performed with an additional flushing unit. Follow the instructions of the flushing unit's manufacturer for the exact procedure during the flushing cycle.

## 8 Commissioning

### **WARNING**

#### **Danger while working in the danger zone of a machine/system!**

Danger to life, risk of injury or serious injuries!

- ▶ Pay attention to and rectify potential danger sources before operating the axial piston unit.
- ▶ Nobody may stand in the danger zone of the machine/system.
- ▶ The emergency stop button for the machine/system must be within the operator's reach.
- ▶ Always follow the instructions of the machine/system manufacturer during commissioning.

### **CAUTION**

#### **Commissioning of an incorrectly installed product!**

Risk of injury and damage to equipment!

- ▶ Make sure that all electrical and hydraulic ports are connected or plugged.
- ▶ Only commission a completely installed fault-free product with original accessories from Bosch Rexroth.

### 8.1 Initial commissioning



During all work for commissioning the axial piston unit, observe the general safety instructions and intended use detailed in chapter 2 “Safety instructions” on page 8.

- ▶ Connect the gauge for the operating pressure, case pressure and suction pressure to the specified measuring points on the axial piston unit or in the hydraulic system, to check the technical data at first operation.
- ▶ During the commissioning process, monitor the temperature of the hydraulic fluid in the reservoir to ensure that it lies within the permissible viscosity limits.

#### 8.1.1 Filling the axial piston unit

Professional filling and air bleeding is necessary to prevent damage to the axial piston unit and to maintain correct function.



Usually, the cleanliness level of commercial hydraulic fluids is insufficient for our components. These hydraulic fluids must be filtered during filling using an appropriate filter system to minimize solid particle contamination and water in the system.

Use only a hydraulic fluid that corresponds to the following requirements: You can find details on the minimum requirements for hydraulic fluids in Bosch Rexroth data sheets 90220, 90221, 90222, and 90223. The titles

of the data sheets can be found in Table 1 „Required and supplementary documentation“ on page 5.

Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to data sheet 90235. For hydraulic fluids which have been positively evaluated in the Fluid Rating, please refer to data sheet 90245 „Bosch Rexroth fluid rating list for Rexroth hydraulic components (pumps and motors)“. The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range ( $\nu_{opt}$ ; see selection diagram in the data sheet 93223).

To ensure the functional reliability of the axial piston unit, cleanliness level 20/18/15 according to at least ISO 4406 is required for the hydraulic fluid. At a hydraulic fluid viscosity of less than 10 mm<sup>2</sup>/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required. You can find details on the permissible and optimal viscosities and admissible temperatures in data sheet 93223.

**Procedure** Proceed as follows to fill the axial piston unit:

1. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may leak.

**NOTICE!** Contaminated hydraulic fluid!

The cleanliness levels of hydraulic fluids on delivery do not normally conform to the requirements for our components.

- ▶ Use a suitable filter system to filter hydraulic fluids during filling to minimize solid impurities and water in the hydraulic system.

2. Fill and air bleed the axial piston unit via the appropriate ports, see chapter 7.3 “Installation position” on page 27. The hydraulic lines of the system must also be filled.

**NOTICE!** Damage to equipment due to improper lubrication!

Product can be damaged or destroyed!

- ▶ When using a shut-off valve in the suction line, make sure that the input of the axial piston unit can only be started when the shut-off valves are open.
- ▶ Dimension a shut-off valve in the suction line so that no inadmissible pressure drop occurs in the suction area when the shut-off valve is open.

3. When using a shut-off valve in the suction line, only operate the axial piston unit when the shut-off valves are open.
4. Test the direction of rotation of the diesel engine. To do this, rotate the diesel engine briefly at the lowest rotational speed (inching). Make sure that the direction of rotation of the axial piston unit agrees with the details of the name plate, see chapter 5.3 “Product identification”, Fig. 3: Name plate A21VG on page 20.
5. Operate the axial piston pump at a lower speed (starter speed for internal combustion engines or inching operation for electric motors) until the hydraulic



system is completely filled and air bled. To inspect, drain the hydraulic fluid at the reservoir port and wait until it drains without bubbles.

### 8.1.2 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 reservoir. If the axial piston unit becomes louder (cavitation) or the case drain 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 chapter 14 “Troubleshooting” on page 48.

To test the hydraulic fluid supply:

1. Allow the diesel engine to run at the lowest speed. The axial piston unit must be operated without load. Pay attention to leakage and noise.
2. Check the axial piston unit's reservoir line during the test. The case drain fluid should not contain any bubbles.
3. Increase the load and check whether the operating pressure rises as expected.
4. Carry out a leak test to ensure that the hydraulic system is sealed and can withstand the maximum pressure.
5. Check the suction pressure at port “**S**” of the axial piston pump at nominal speed and maximum swivel angle (only on the version with boost pump). Refer to data sheet 93223 for the permissible value.
6. At maximum pressure, check the case drain pressure at port **T**. Refer to data sheet 93223 for the permissible value.

### 8.1.3 Performing functional test

## **WARNING**

#### **Incorrectly connected axial piston unit!**

Mixing up the ports will lead to malfunctions (e.g. lift instead of lower) and thus to corresponding danger to persons and equipment!

- ▶ Before the functional test, check whether the piping specified in the hydraulic schematic has been installed.

Once you have tested the hydraulic fluid supply, you must perform a functional test on the machine/system. The functional test should be performed according to the instructions of the machine/system manufacturer. The axial piston unit is checked for functional capability before delivery according to the technical data. During commissioning, it must be ensured that the axial piston unit was installed properly in the machine/system.

- ▶ After starting the diesel engine, check in particular the specified pressures, e.g. system pressure, boost pressure and case pressure.
- ▶ If necessary, remove the pressure gauge and plug the ports with threaded plugs.

## 8.2 Running-in phase

### NOTICE

#### **Damage to equipment by insufficient viscosity!**

An increased hydraulic fluid temperature may reduce the viscosity values by too much and damage the product!

- ▶ Monitor the operating temperature during the running-in phase, e.g. by measuring the case drain temperature.
- ▶ Reduce the loading (pressure, rpm) of the axial piston unit if impermissible operating temperatures and/or viscosities occur.
- ▶ Operating temperatures that are too high indicate faults that have to be analyzed and cleared.

The bearings and sliding surfaces are subject to a running-in phase. The increased friction at the start of the running-in phase results in increased heat development which decreases with increasing operating hours. The volumetric and mechanical-hydraulic efficiency increases as well through the conclusion of the running-in phase of approx. 10 operating hours.

To ensure that contamination in the hydraulic system does not damage the axial piston unit, Bosch Rexroth recommends the following procedure after the running-in phase:

- ▶ After the running-in phase, have a hydraulic fluid specimen analyzed for the required cleanliness level.
- ▶ Change the hydraulic fluid if the required cleanliness level is not reached. If a laboratory test is not carried out after the running-in phase, Bosch Rexroth recommends the hydraulic fluid be changed.

## 8.3 Recommissioning after standstill

Depending on the installation conditions and ambient conditions, changes may occur in the hydraulic system which make recommissioning necessary.

Among others, the following criteria may make recommissioning necessary:

- Air and/or water in the hydraulic system
  - Old hydraulic fluid
  - Other contamination
- ▶ Before recommissioning, proceed as described in chapter 8.1 “Initial commissioning” on page 39.

## 9 Operation

The product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Use the product only within the performance range provided in the technical data. The machine/system manufacturer is responsible for the proper project planning of the hydraulic system and its control.

## 10 Maintenance and repair

### NOTICE

#### **Inspection and maintenance work carried out too late!**

Damage to equipment!

- ▶ Carry out the specified inspection and maintenance work at the intervals described in this manual.

### 10.1 Cleaning and care

### NOTICE

#### **Damage to seals and electrical system by mechanical effects!**

The water jet of a high-pressure cleaner may damage the seals and electrical system of the axial piston unit!

- ▶ Do not point the high-pressure cleaner at sensitive components, e.g. shaft seal, electrical connections and components.

For cleaning and care of the axial piston unit, observe the following:

- ▶ Check whether all seals and fittings on the connections are securely seated to ensure that no moisture can penetrate into the axial piston unit during cleaning.
- ▶ Use only water and, if necessary, a mild detergent to clean the axial piston unit. Never use solvents or aggressive detergents.
- ▶ Remove external coarse dirt and keep sensitive and important components, such as solenoids, valves and sensors, clean.

## 10.2 Inspection

In order to enable long and reliable operation of the axial piston unit, Bosch Rexroth recommends testing the hydraulic system and axial piston unit on a regular basis, and documenting and archiving the following operating conditions:

**Table 12: Inspection schedule**

Task to be carried out	Interval	
Hydraulic system	Check level of hydraulic fluid in the reservoir.	Daily
	Check the operating temperature at a comparable load condition at the reservoir port and in the reservoir.	Weekly
	Conduct analysis of hydraulic fluid: viscosity, aging and dirt contamination	Yearly or every 2000 operating hours (whichever occurs first)
Axial piston unit	Check axial piston unit for leakage. Early detection of hydraulic fluid loss can help to find faults on the machine/system and to rectify them. For this reason, Bosch Rexroth recommends that the axial piston unit and system are always kept in a clean condition.	Daily
	Check axial piston unit for unusual noise development.	Daily
	Check fastener elements for tight seating. All fasteners have to be checked when the hydraulic system is switched off, depressurized and cooled down.	Monthly

## 10.3 Maintenance

The axial piston unit is low-maintenance when used as intended. The service life of the axial piston unit is heavily dependent on the quality of the hydraulic fluid. This is why we recommend changing the hydraulic fluid at least once per year or every 2000 operating hours (whichever occurs first), or having it analyzed by the hydraulic fluid manufacturer or a laboratory to determine its suitability for further use.

The service life of the axial piston unit is limited to the service life of the bearings used. You can ask your local contact person about service life based on load cycle. You can find their contact information at [www.boschrexroth-us.com/contactus](http://www.boschrexroth-us.com/contactus)

Based on these details, a maintenance interval should be determined by the system manufacturer for the replacement of the bearings and included in the maintenance schedule of the hydraulic system

## 10.4 Repair

Bosch Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Repairs on the axial piston unit and its fittings may only be performed by service centers certified by Bosch Rexroth.

- ▶ Use exclusively original spare parts from Rexroth to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit can not be assured and you lose your entitlement under warranty.

In the event of questions regarding repairs, contact your responsible Bosch Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit, see chapter 10.5 "Spare parts" on page 45.

## 10.5 Spare parts



### **Use of unsuitable spare parts!**

Spare parts that do not meet the technical requirements specified by Bosch Rexroth may cause personal injury or property damage!

- ▶ Only use Rexroth original spare parts to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit can not be assured and you lose your entitlement under warranty.

The spare parts lists for axial piston units are order-specific. When ordering spare parts, specify the material and serial number of the axial piston unit as well as the material numbers of the spare parts. Address all questions regarding spare parts to your proper Bosch Rexroth Service partner or the service department of the plant that manufactured the axial piston unit.

Details for the manufacturer's plant can be found on the name plate of the axial piston unit.

Bosch Rexroth Corporation  
 8 Southchase Court  
 Fountain Inn, SC 29644-9018  
 Telephone (864) 967-2777  
 Facsimile (864) 962-5338

Spare parts can be found online at [www.boschrexroth-us.com/eshop](http://www.boschrexroth-us.com/eshop)

For general inquiries, please contact your local contact person. You can find their contact information at

[www.boschrexroth-us.com/contactus](http://www.boschrexroth-us.com/contactus)

# 11 Removal and replacement

## 11.1 Required tools

Removal can be performed with standard tools. No special tools are necessary.

## 11.2 Preparing for removal

1. Decommission the entire system as described in the instruction manual for the machine or system.
  - Relieve pressure in the hydraulic system according to the instructions of the machine or system manufacturer.
  - Make sure that the relevant system components are not under pressure or voltage.
2. Protect the complete system against being energized.

## 11.3 Removal of the axial piston unit

Proceed as follows to remove the axial piston unit:

1. Check whether the hydraulic system is depressurized.
2. Allow the axial piston unit to cool down until it can be removed without danger.
3. For below-reservoir installation, before removing the axial piston unit from the complete system, seal the connection to the reservoir or drain the reservoir.
4. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may escape.
5. Loosen the lines and collect the escaping hydraulic fluid in the drip tray.
6. Remove the axial piston unit. Use a suitable lifting device.
7. Completely empty the axial piston unit.
8. Plug all openings.

## 11.4 Preparing the components for storage or further use

- ▶ Proceed as described in chapter 6.2 “Storing the axial piston unit” on page 23.

## 12 Disposal

Careless disposal of the axial piston unit, the hydraulic fluid and the packaging material could lead to pollution of the environment.

Observe the following points when disposing of the axial piston unit:

1. Completely empty the axial piston unit.
2. Dispose of the axial piston unit and packaging material in accordance with the national regulations in your country.
3. Dispose of the hydraulic fluid according to the national regulations of your country. Also observe the applicable safety data sheet for the hydraulic fluid.
4. Remove the axial piston unit into its individual parts and properly recycle these parts.
5. Separate according to, for instance:
  - Castings
  - Steel
  - Aluminum
  - Non-ferrous metal
  - Electronic waste
  - Plastic
  - Seals

## 13 Extension and conversion

Do not modify the axial piston unit and/or its assembled parts.  
Changes to settings on the customer side should only be made using the product-specific setting instructions.



The warranty from Bosch Rexroth only applies to the product as delivered.  
The warranty will be voided if the unit is modified or extended.



Adjusting the setting screws will render the warranty void. If you need to change the settings, please contact your local contact person; you can find their contact information at  
[www.boschrexroth.com/addresses](http://www.boschrexroth.com/addresses)

# 14 Troubleshooting

Table 13 is intended to support troubleshooting. This table is not exhaustive. Issues may occur in practice that are not listed here. Only authorized personnel may perform troubleshooting inside a safety area designated by the machine manufacturer.

## 14.1 How to proceed for troubleshooting

- ▶ Perform troubleshooting if possible with reduced operating data (e.g. slowly swinging in or out and slow pressure increase).
- ▶ Use a systematic and targeted approach, even when pressed for time. Random, indiscriminate removal and changing of settings could make it impossible to determine the original cause of the fault.
- ▶ First get a general idea of how your product works in conjunction with the entire system.
- ▶ Try to find out whether or not the product was working properly in conjunction with the entire system before the fault occurred.
- ▶ Try to determine any changes to the entire system in which the product is installed:
  - Have there been any changes to the application conditions or operating range of the product?
  - Has maintenance work recently been carried out? Is there an inspection or maintenance log?
  - Have any changes (e.g. upgrades) or repairs been made to the overall system (machine/system, electrics, control) or to the product? If yes: What changes?
  - Has the hydraulic fluid been changed?
  - Has the product or machine been used as intended?
  - How does the malfunction appear?
- ▶ Try to get a clear idea of the cause of the fault. Directly ask the (machine) operator.
- ▶ Document the work carried out.
- ▶ If the fault cannot be corrected, please refer to one of the contact addresses at: [www.boschrexroth-us.com/contactus](http://www.boschrexroth-us.com/contactus).



## 14.2 Malfunction table

**Table 13: Axial piston unit malfunction table**

Malfunction	Possible cause	Remedy
Unusual noises	Drive speed too high.	Machine/system manufacturer.
	Wrong direction of rotation.	Ensure correct direction of rotation.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line (only relevant for the version with boost pump).	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Improper mounting of the axial piston unit.	Check the mounting of the axial piston unit according to the specifications of the machine/system manufacturer. Observe tightening torques.
	Improper mounting of the attachment parts, e.g. coupling and hydraulic lines.	Fix attachment parts according to the information provided by the coupling or fitting manufacturer.
	Pressure-relief valves on axial piston unit.	Air bleed the axial piston unit Check viscosity of the hydraulic fluid Contact Bosch Rexroth Service.
	Pressure-relief valve of the axial piston unit (boost pressure, high pressure).	Air bleed the axial piston unit Check viscosity of the hydraulic fluid Contact Bosch Rexroth Service.
Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact Bosch Rexroth Service.	
No or insufficient flow	Faulty mechanical drive (e.g. defective coupling).	Machine/system manufacturer.
	Drive speed too low.	Machine/system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line (only relevant for the version with boost pump).	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine/system manufacturer).
	External control of the control device defective.	Check external control (machine/system manufacturer).
	Insufficient pilot pressure or control pressure.	Check pilot pressure or control pressure, contact Bosch Rexroth Service.
	Malfunction of the control device or controller of the axial piston unit.	Contact Bosch Rexroth Service.
Wear of axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.	
Mechanical damage to the axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.	

**Table 13: Axial piston unit malfunction table**

<b>Malfunction</b>	<b>Possible cause</b>	<b>Remedy</b>	
No or insufficient pressure	Faulty mechanical drive (e.g. defective coupling).	Machine/system manufacturer.	
	Drive power too low.	Machine/system manufacturer.	
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line (only relevant for the version with boost pump).		Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
			Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
			Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine/system manufacturer).	
	External control of the control device defective.	Check external control (machine/system manufacturer).	
	Insufficient pilot pressure or control pressure.	Check pilot pressure or control pressure, contact Bosch Rexroth Service.	
	Malfunction of the control device or controller of the axial piston unit.	Contact Bosch Rexroth Service.	
	Wear of axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.	
Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact Bosch Rexroth Service.		
Output unit defective (e.g. hydraulic motor or cylinder).	Machine/system manufacturer.		
Pressure/flow fluctuations	Axial piston unit not or insufficiently air bled.	Completely air bleed axial piston unit.	
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line (only relevant for the version with boost pump).	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).	
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.	
	Remove contaminants from the suction line.		
Excessive hydraulic fluid temperature and case temperature	Excessive inlet temperature at the axial piston unit.	Machine or system manufacturer: inspect system, e.g malfunction of the cooler, insufficient hydraulic fluid in the reservoir.	
	Malfunction of the pressure control valves (e.g. high-pressure relief valve, pressure controller).	Contact Bosch Rexroth Service.	
	Wear of axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.	
Instability/vibrations	Setpoint value not stable.	Machine/system manufacturer.	
	Resonance in the reservoir line.	Machine/system manufacturer.	
	Malfunction of the control devices or the controller.	Contact Bosch Rexroth Service.	

## 15 Technical data

The permissible values of the technical data of your axial piston unit can be found in data sheet 93223.

The data sheet can be found in the online product catalog at [www.boschrexroth.com/p-A21VG](http://www.boschrexroth.com/p-A21VG)

The order-related technical data of your axial piston unit can be found in the order confirmation.



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