

The Drive & Control Company

Rexroth
Bosch Group

Reversible A10VER Axial piston variable motor for hydrostatic fan drives

Series 52

Instruction manual
RE 91706-01-B/09.2015

Replaces: –.–
English



The information is provided solely for the purpose of product description. No statement about a specific characteristic or suitability for a certain application can be derived from this information. Information from the catalog does not represent assured properties. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

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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 German language.

Contents

1	About this documentation	5
1.1	Validity of the documentation	5
1.2	Required and supplementary documentation	5
1.3	Display of information	6
1.3.1	Safety instructions	6
1.3.2	Symbols	7
1.3.3	Designations	7
1.3.4	Abbreviations	7
2	Safety instructions	8
2.1	About this chapter	8
2.2	Intended use	8
2.3	Improper use	8
2.4	Personnel qualifications	9
2.5	General safety instructions	10
2.6	Product-specific safety instructions	11
2.7	Personal protective equipment	15
3	General instructions on damage to property and the product	16
4	Scope of delivery	19
5	About this product	20
5.1	Performance description	20
5.2	Product description	20
5.2.1	Layout of the axial piston unit	20
5.2.2	Functional description	21
5.3	Product identification	22
6	Transport and storage	23
6.1	Transporting the axial piston unit	23
6.1.1	Transporting by hand	23
6.1.2	Transporting with a lifting device	23
6.2	Storing the axial piston unit	25
7	Installation	27
7.1	Unpacking	27
7.2	Installation conditions	27
7.3	Installation position	28
7.3.1	Below-reservoir installation (standard)	28
7.3.2	Above-reservoir installation	29
7.4	Installing the axial piston unit	30
7.4.1	Preparation	30
7.4.2	Dimensions	30
7.4.3	General instructions	30
7.4.4	Installation with coupling	31
7.4.5	Installation on a gearbox	32
7.4.6	Installation with cardan shaft	32
7.4.7	Completing installation	32
7.4.8	Connecting the axial piston unit to hydraulic system	33
7.4.9	Electrically connecting the axial piston unit	37
7.5	Performing flushing cycle	38

8	Commissioning	39
8.1	Initial commissioning	39
8.1.1	Filling the axial piston unit	39
8.1.2	Testing the hydraulic fluid supply	40
8.1.3	Performing functional test	41
8.2	Running-in phase	41
8.3	Recommissioning after standstill	42
9	Operation	43
10	Maintenance and repair	44
10.1	Cleaning and care	44
10.2	Inspection	44
10.3	Maintenance	45
10.4	Repair	45
10.5	Spare parts	46
11	Removal and replacement	47
11.1	Required tools	47
11.2	Preparing for removal	47
11.3	Performing removal	47
11.4	Preparing the components for storage or later use	47
12	Disposal	48
13	Extension and conversion	49
14	Troubleshooting	50
14.1	How to proceed with troubleshooting	50
14.2	Malfunction table	51
15	Technical data	53
16	Alphabetical index	54

1 About this documentation

1.1 Validity of the documentation

This documentation is valid for the following products:

- Series 52 A10VER Axial piston variable motor (plug-in design, reversible)

This documentation is intended for machine/system manufacturers, assemblers and service engineers.

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 property and the product” on page 16 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

Title	Document number	Document type
 Order confirmation Contains the order-related technical data for your A10VER axial piston variable motor.	–	Order confirmation
 Installation drawing Contains the outer dimensions, all connections and the hydraulic circuit diagram for your A10VER axial piston variable motor.	Please request the installation drawing from your contact at Bosch Rexroth.	Installation drawing
 Axial Piston Plug-In Motor A10VER Contains the permissible technical data.	91706	Data sheet
 Project planning notes on the A10VER Contains additional information on project planning and commissioning.	90363	Manual
 Mineral oil-based hydraulic fluids and related hydrocarbons Describes the requirements for a mineral oil-based hydraulic fluid and related hydrocarbons for operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your hydraulic system.	90220	Data sheet
 Environmentally acceptable hydraulic fluids Describes the requirements on an environmentally friendly hydraulic fluid for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90221	Data sheet
 Fire-resistant, water-free hydraulic fluids (HFDR/HFDR) Describes the requirements on fire-resistant, water-free hydraulic fluids (HFDR/HFDR) for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90222	Data sheet

RE 91706-01-B/09.2015, A10VER Series 52, **Bosch Rexroth AG**

Table 1: Required and supplementary documentation

Title	Document number	Document type
 Information for the use of hydrostatic drives at low temperatures Contains additional information on the use of Rexroth axial piston units at low temperatures.	90300-03-B	Manual
 Storage and preservation of axial piston units Contains additional information on storage and preservation.	90312	Data sheet

1.3 Display of information

Standardized safety instructions, symbols, terms and abbreviations are used throughout this documentation so that you can 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 property and the product” on page 16 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:

 SIGNAL WORD
Type and source of danger Consequences of noncompliance ► Measures to prevent danger

- **Warning sign:** draws attention to the danger
- **Signal word:** identifies the degree of the danger
- **Type and source of danger:** indicates 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: Hazard classes as defined in ANSI Z535.6

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

1.3.2 Symbols

The following symbols indicate information that is not directly relevant to safety but increases understanding of the documentation.

Table 3: Meaning of the symbols

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

1.3.3 Designations

This documentation uses the following designations:

Table 4: Designations

Designation	Meaning
A10VER	Axial piston variable motor, plug-in version, reversible, open circuit for hydrostatic fan drives
Threaded plug	Metal screw, pressure-resistant
Protection plug	Made out of plastic, not pressure-resistant, only for transportation

The designation “axial piston unit” or “hydraulic motor” is used hereafter as a generic term for “A10VER plug-in axial piston motor”.

1.3.4 Abbreviations

This documentation uses the following abbreviations:

Table 5: Abbreviations

Abbreviation	Meaning
ATEX	EC directive on explosion protection (A tmosphère e xplosible)
DIN	Deutsches Institut für Normung (German Institute for Standardization)
EZ	Two point control electric
ISO	International Organization for Standardization
JIS	Japan Industrial Standard
RE	Rexroth document in the English language
VDI 2230	Directive for the systematic calculation of high duty bolted joints and joints with one cylindrical bolt from the VDI (Verein D eutscher I ngenieur e - 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 they are classified neither as complete nor as incomplete machines in the sense of the EC Machinery 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 machinery directive.

This product is intended for the following use:

The axial piston unit is designed solely as a hydraulic motor in hydrostatic fan drives in open circuit.

- ▶ Observe the technical data, the application and operating conditions and the performance limits as specified in data sheet 91706 and in the order confirmation. Information about approved hydraulic fluids can be found in data sheet 91706.

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 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 is not liable for damages resulting from improper use. The user bears all risks from improper use.

The following foreseeable forms of misuse shall also be considered to be improper (this list does not claim to be exhaustive):

- Use outside the operating parameters approved in the data sheet or in the order confirmation (unless specifically approved by the customer)
- Use of non-approved fluids, e.g., water or polyurethane components

- Changes to factory settings by unauthorized persons
- Use of add-ons (e.g., control unit, valves) not in combination with the specified Rexroth components
- Use of the axial piston unit under water at a depth of more than 10 meters without the necessary additional measures, e.g., pressure equalization. Units with electrical components (e.g., sensors) generally cannot come into contact with water.
- Use of the axial piston unit under a continuous pressure differential between case to ambient pressure greater than 2 bar, whereby the ambient pressure must always be lower than the case pressure. Short-term pressure peaks ($t < 0.1$ s) of up to 10 bar are permitted. Beyond this, the maximum case pressure specified on the data sheet cannot be exceeded.
- Use of 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
- Use of the axial piston unit in a corrosive atmosphere
- Use of the axial piston unit in aircraft or spacecraft

2.4 Personnel qualifications

The activities described in this documentation require basic mechanical, electrical and hydraulics expertise, as well as knowledge of the associated technical terms. For transporting and handling the product, additional knowledge is necessary with regard to working with lifting devices and their slings. In order to ensure safe use, these activities should only be performed by qualified personnel or an instructed person under the direction and supervision of qualified personnel.

Skilled persons are those who can recognize possible dangers 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 follow the rules relevant to their field and have the necessary hydraulics expertise.

Hydraulic expert knowledge includes:

- Reading and fully understanding hydraulic circuit diagrams
- Specifically, fully understanding the relationships with regard to safety devices
- Understanding how hydraulic components work and are put together



Bosch Rexroth offers training support for specialized fields. An overview of the training contents can be found online at: www.boschrexroth.de/training.

2.5 General safety instructions

- Observe the applicable accident prevention and environmental protection regulations.
- Observe the safety regulations and provisions 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.
- Persons who install, operate, remove or maintain Rexroth products may not be under the influence of alcohol, drugs or medication that may affect their reaction time.
- Only use genuine Rexroth accessories and spare parts to ensure there is no risk to personnel 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 relevant for safety, unexpected operating conditions may occur in the application, which could result in injury to personnel or damage to equipment. For this reason, only use the product in a safety-related application if this use is expressly specified and permitted in the product documentation, for example in explosion protection applications or in safety-related parts of a control system (functional safety).
- You may only commission the product if it has been determined that the end product (e.g., machinery or 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 or the fan wheel installed. Check whether or not your machine requires additional safety measures for your application. If necessary, make sure that these are properly implemented.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference. Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. Potential electromagnetic interference for persons (e.g. persons with a pacemaker) and other components must be tested by the machine manufacturer.

2.6 Product-specific safety instructions

The following safety instructions apply to chapters 6 to 14.

WARNING

Danger from excessively high pressure.

Risk of death or injury, or property damage.

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

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

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

Danger from suspended loads.

Risk of death or injury, or property damage.

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

- ▶ Make sure that the load bearing capacity of the lifting gear is sufficient to safely bear the weight of the axial piston unit.
- ▶ Never stand or put your hands under a suspended load.
- ▶ Make sure the unit remains stable during transport.
- ▶ Wear your personal protective equipment (e.g., safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Use suitable lifting gear for transportation.
- ▶ Observe the prescribed position of the lifting strap.
- ▶ Observe the national laws and regulations on work and health protection and transportation.

System/machine under pressure.

Risk of death or serious injury when working on unsecured machines/systems. Risk of property damage.

- ▶ Turn off the entire system and secure it against being restarted as specified by the machine/system manufacturer.
- ▶ Make sure that all relevant components in the hydraulic system are depressurized. Follow the machine/system manufacturer's specifications.
- ▶ Note that the hydraulic system may still be under pressure even after the pressure supply itself has been disconnected.
- ▶ Do not disconnect any line connections, ports and components as long as the hydraulic system is under pressure.

RE 91706-01-B/09.2015, A10VER Series 52, Bosch Rexroth AG

WARNING

Suction effect from running fan wheel.

Risk of death or injury. A running fan wheel produces a suction effect that can pose a risk of entanglement.

- ▶ Standing in the danger zone of the rotating fan wheel is prohibited.
Before entering the danger zone ensure the fan wheel has stopped, e.g., by disconnecting the drive source.

Unexpected fan speed control behavior.

Risk of injury from fan wheel activating on system start or after repair.

- ▶ When unpowered, the motor can reach maximum speed depending on the position of the drive unit (unpowered motor is swiveled out fully with pressure build-up).

Attention: Unplugging the electrical control (ED) of the drive unit and/or electrical control (EZ) of the hydraulic motor does not result in a safe off state, rather it causes the fan wheel to run at maximum speed.

- ▶ Check whether or not your machine requires additional safety measures for your application.

Fan wheel stationary while machine is running.

Risk of death or injury from sudden fan wheel movement.

- ▶ Never reach into the machine while it is running, e.g., to get the fan wheel to move.
- ▶ Use reversing to attempt to get the fan wheel to move again.
See also the required operating conditions and instructions on what to do as described in project planning and commissioning instructions 90363.
- ▶ Check whether or not your machine requires additional safety measures for your application.
We recommend programming the reversing function so it can only be started when the viscosity/operating temperature in the hydraulic circuit is high enough (testing during commissioning).

Bursting of hydraulic lines and/or damage to parts (e.g., shaft, fan blades).

Risk of death or injury, or property damage.

- ▶ Never unplug the solenoids while reversing operation is active.
- ▶ Never disconnect the power supply while reversing operation is active.

WARNING

Escaping oil mist.

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

- ▶ Depressurize the relevant machine/system part and repair the leak.
- ▶ Only perform welding work then 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 that any escaped 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 set up the relevant part of the machine/system so that it is free of electrical voltage before you install the product or when connecting and disconnecting connectors. Protect the machine/system against being re-energized.

Restriction of the control function.

Risk of injury or property damage.

Moving parts in control equipment (e.g., valve spools) can, under certain circumstances, get blocked in position as a result of contamination (e.g., impure hydraulic fluid, abrasion, or residual dirt from components). As a result, the flow of hydraulic fluid and the build-up of momentum in the axial piston unit can no longer meet the operator's specifications. Even the use of different filter cartridges (external or internal inlet filter) will not rule out a fault but merely reduce the risk.

- ▶ Check whether remedial measures for your application are needed on your machine in order to put the driven consumer in a safe state (e.g., safe stop).
- ▶ If necessary, make sure that these are properly implemented.

CAUTION

High noise levels during operation.

Risk of hearing damage or hearing loss.

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

- ▶ Always wear hearing protection when in the vicinity of the operating axial piston unit.

Hot surfaces on the axial piston unit.

Risk of burns.

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

Improper routing of cables and lines.

Risk of stumbling and property damage. Improper routing of cables and lines can cause a risk of tripping as well as damage to equipment and components, e.g., lines and plugs tearing.

- ▶ Always lay cables and lines in such a way that no one can trip over them, that they do not become kinked or twisted, do not rub on edges and do not run without adequate protection from sharp-edged ducts.

Contact with hydraulic fluid.

Inhalation may result in health hazards or adverse health effects, including eye injuries, skin irritation and poisoning.

- ▶ Avoid contact with hydraulic fluids.
- ▶ When working with hydraulic fluids, strictly observe the safety instructions provided by the lubricant manufacturer.
- ▶ Wear your personal protective equipment (e.g., safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Consult a doctor immediately if hydraulic fluid gets in your eyes or bloodstream, or is swallowed.

Escaping hydraulic fluid due to machine/system leakage.

Risk of burns and injury from escaping oil jet.

- ▶ Depressurize the relevant machine/system part and repair the leak.
- ▶ Never attempt to block or seal the leak or oil jet with a rag.

Danger from improper handling.

Risk of slipping. 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.

2.7 Personal protective equipment

Personal protective equipment is the responsibility of the user of the axial piston unit. Observe the safety regulations and provisions in your country.

All pieces of personal protective equipment must be intact.

3 General instructions on damage to property and the product

The following information applies to chapters 6 to 14.

NOTICE

Danger from improper handling.

Product can be damaged.

- ▶ Do not expose the product to excessive mechanical load.
- ▶ Never grab or climb onto the product.
- ▶ Do not place/lay 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 fittings.
- ▶ Do not strike fittings (e.g., sensors or valves).
- ▶ Do not strike sealing surfaces (e.g., working line ports).
- ▶ Leave the protective covers on the axial piston unit until you connect the lines.
- ▶ Disconnect all electrical connectors before electro-welding or painting.
- ▶ Make certain that the electronic components (e.g., sensors) do not become electrostatically charged (e.g., during painting operations).

Risk of property damage due to improper 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; if necessary, recommission. With above-reservoir installation, the housing area may drain via the drain line after longer periods of disuse (air enters via the shaft seal) or via the working line (gap leakage). This means the bearings are insufficiently lubricated when the system is turned on.

Mixing of 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 mixing of hydraulic fluids from different manufacturers or different types from the same manufacturer is generally not permitted.

NOTICE

Contamination of the hydraulic fluid.

The cleanliness of the hydraulic fluid has a considerable impact on the cleanliness and service life of the hydraulic system. Contamination of the hydraulic fluid can cause premature wear and malfunctions.

- ▶ Make sure that the working environment at the installation site is fully free of dust and foreign substances in order to prevent foreign particles, such as welding beads or metal cuttings, from getting into the hydraulic lines and causing product wear or malfunctions. The axial piston unit must be installed in clean condition.
- ▶ Use only clean connections, hydraulic lines and attachments (e.g., measuring equipment).
- ▶ No contaminants may enter the ports when they are sealed.
- ▶ Before commissioning, make sure that all hydraulic connections are tight and that all of the seals and plugs are installed correctly to ensure that they are leak proof and fluids and foreign particles are prevented from penetrating the product.
- ▶ Use a suitable filter system to filter hydraulic fluid during filling to minimize solid impurities and water in the hydraulic system.

Improper cleaning.

Product can be damaged.

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

Environmental pollution due to improper disposal.

Careless disposal of the axial piston unit and its fittings, the hydraulic fluid and the packaging material can result in environmental pollution.

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

Danger from chemical or corrosive 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. Hydraulic fluid can escape if leaks occur.

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

NOTICE

Escaping or spilling hydraulic fluid.

Risk of environmental pollution and contamination of groundwater.

- ▶ Always place a collecting pan under the axial piston unit when filling and draining the hydraulic fluid.
- ▶ Use an oil binding agent if hydraulic fluid is spilled.
- ▶ Observe the information in the safety data sheet for the hydraulic fluid and the specifications provided by the system manufacturer.

Danger from hot components.

Nearby products can be damaged. Components which heat up (e.g., solenoids) can cause damage to nearby products if they are too close.

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

The warranty only applies to the delivered configuration.

The warranty is void in case of improper installation, commissioning and operation, as well as improper use and/or improper handling. Warranty entitlement is also rendered void if service work is performed by anyone other than Bosch Rexroth Service or is not performed within the specified intervals.

4 Scope of delivery

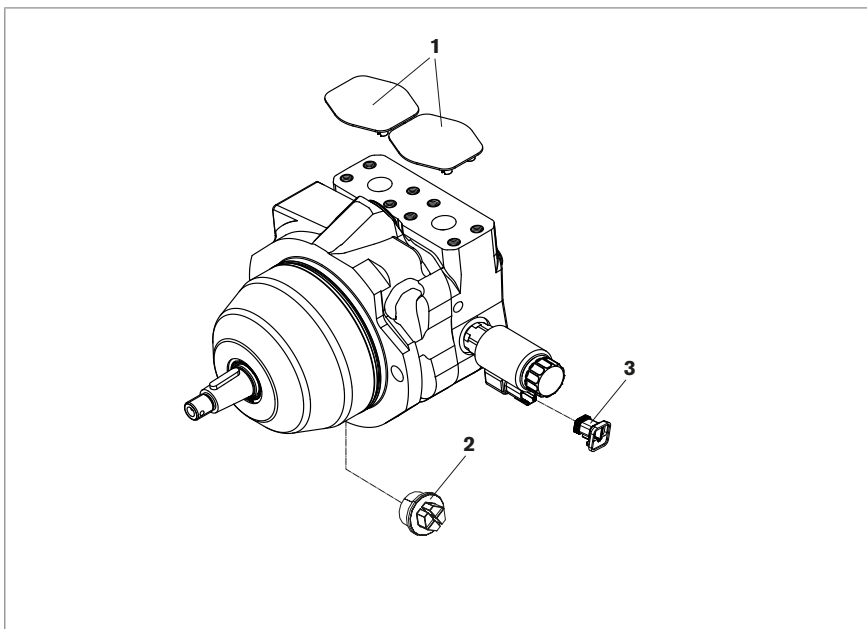


Fig. 1: Axial piston unit

The following is included in the scope of delivery:

- Axial piston unit as per order confirmation

The following parts are also assembled prior to delivery:

- Protective covers (1)
- Protective plug/threaded plug (2)
- Solenoid plug protective cover (3)

5 About this product

5.1 Performance description

The A10VER Axial piston variable motor converts hydrostatic flow into mechanical rotation, then controls/regulates this rotation. It is designed for mobile applications, specifically hydrostatic fan drives.

Refer to data sheet 91706 and the order confirmation for the technical data, operating conditions and operating limits of the axial piston unit.

5.2 Product description

The variable motor is available in the A10VER plug-in version. The A10VER is a variable motor with axial piston rotary group in swashplate design for hydrostatic drives in an open circuit. For axial piston units with swashplate design, the pistons (7) are arranged axially relative to the drive shaft (1). The pistons place a load on the swashplate (cradle) (9) and transfer the torque dependent on pressure and swivel angle via the cylinder to the drive shaft (6). The cylinder and drive shaft are interlocked. The control of the swashplate (cradle) can change the specific torque and displacement.

Open circuit In an open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is transported to the hydraulic motor. From the hydraulic motor, the hydraulic fluid flows directly back to the reservoir. The output speed of the hydraulic motor is changed by overcentering the cradle (9) to $-100\% V_{g \max}$, all without altering the pressure side.

5.2.1 Layout of the axial piston unit

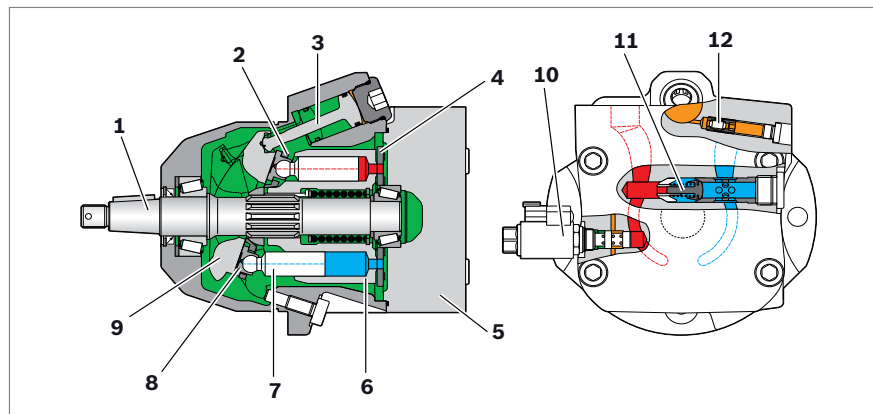


Fig. 2: Layout of the A10VER hydraulic motor

- | | | |
|---------------------|---------------|-----------------------|
| 1 Drive shaft | 5 Port plate | 9 Swashplate (cradle) |
| 2 Retainer plate | 6 Cylinder | 10 EZ control valve |
| 3 Stroking piston | 7 Piston | 11 Overrun valve |
| 4 Control plate | 8 Slipper pad | 12 Time-delay orifice |
| (distributor plate) | | |

5.2.2 Functional description

Motor function	A hydraulic motor converts hydrostatic energy into mechanical energy. Hydraulic fluid is directed via the port plate (5) and the control plate (distributor plate) (4) to the cylinder bores. The pistons (7) in the cylinder bores execute a stroke. The pressure on the piston makes it slide downwards onto the swashplate and takes the cylinder (6) with it. The cylinder rotates with the drive shaft (1) which causes it to generate an output torque. The output torque increases with the pressure difference between the high- and low-pressure sides and increasing displacement. The output speed is proportional to the inward flow and inversely proportional to the displacement of the hydraulic motor.
Control	The swivel angle of the swashplate (cradle) (9) is switchable from +100% to -100% (EZ two-point control). Control of the swivel angle of the swashplate changes the piston stroke and therefore the displacement. The neutral position also changes the hydraulic motor's direction of rotation when overcentering. The swivel angle is controlled electrically via the stroking piston (3). Increasing the swivel angle results in an increase in the displacement and specific torque; decreasing the swivel angle results in a corresponding decrease of these values. The output speed depends on the input flow and the displacement of the hydraulic motor or the electrical pressure control (ED) of the variable displacement pump.

5.3 Product identification

The axial piston unit can be identified from the name plate. The following example shows an A10VER name plate:

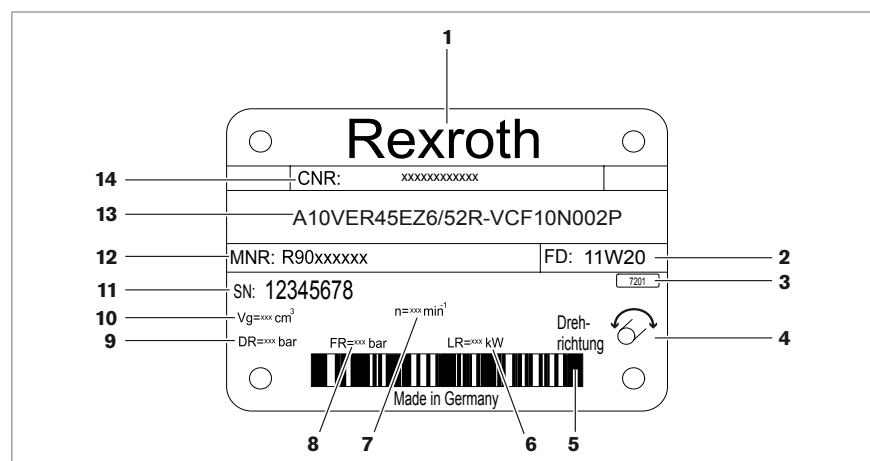


Fig. 3: Name plate A10VER

- | | |
|--|--|
| 1 Manufacturer | 8 Flow setting (optional) |
| 2 Manufacturing date | 9 Pressure control setting (optional) |
| 3 Internal plant designation | 10 Minimum displacement |
| 4 Direction of rotation (viewed on drive shaft) – shown here: clockwise | 11 Serial number |
| 5 Bar code | 12 Material number of the axial piston unit |
| 6 Power setting (optional) | 13 Type code |
| 7 Rotational speed | 14 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 25.



Information on unpacking can be found in Chapter 7.1 “Unpacking” on page 27.

6.1 Transporting the axial piston unit

The following transportation options are available depending on the weight and duration of transport:

- Transporting by hand
- Transporting with a lifting device (eye bolt or lifting strap)

Dimensions and weights

Table 6: Dimensions and weights

Size		30	37	45
Weight	kg	18	18	18
Width	mm	Dimensions vary by equipment. The values applicable for your axial piston unit can be found in the installation drawing (request if necessary).		
Height	mm			
Depth	mm			

Weight may vary by equipment.

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.

Health hazard from carrying axial piston units.

- ▶ Use suitable lifting, lowering and moving methods.
- ▶ Wear your personal protective equipment (e.g., safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Do not use sensitive attachments to transport the axial piston unit (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 a lifting device

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

Transport with eye bolt

The axial piston unit can be transported suspended from an eye bolt screwed into the drive shaft as long as only outward (pulling) axial forces are applied.

- ▶ For all female threads, use a stud end from the same system of units and of the correct size.
- ▶ To do this, screw an eye bolt completely into the female thread on the drive shaft. The thread size is stated in the installation drawing.

- Make sure that the eye bolt can bear the total weight of the axial piston unit plus 20%. You can hoist the axial piston unit as shown in Fig. 4 with the eye bolt screwed into the drive shaft.

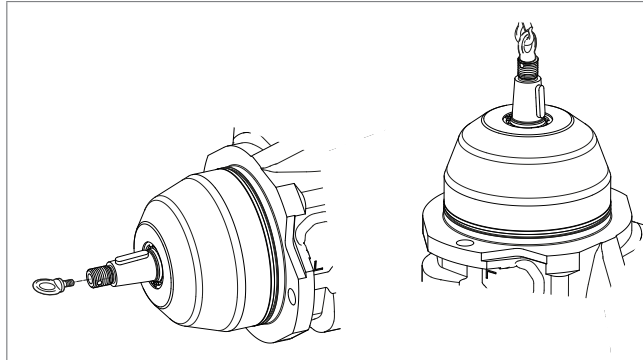


Fig. 4: Fixing the eye bolt

Transport with lifting strap

WARNING Danger from suspended loads.

During transport with a lifting device, the axial piston unit can slip out of the lifting strap and result in injury.

- Use the widest possible lifting strap.
- Make sure that the axial piston unit is securely fixed with the lifting strap.
- Only guide the axial piston unit by hand for fine positioning and to avoid oscillations.
- Never stand or put your hands under a suspended load.
- Place the lifting strap around the axial piston unit in such a way that it does not pass over attachments (e.g., valves, piping) and that the axial piston unit is not suspended from attachments (see Fig. 5).

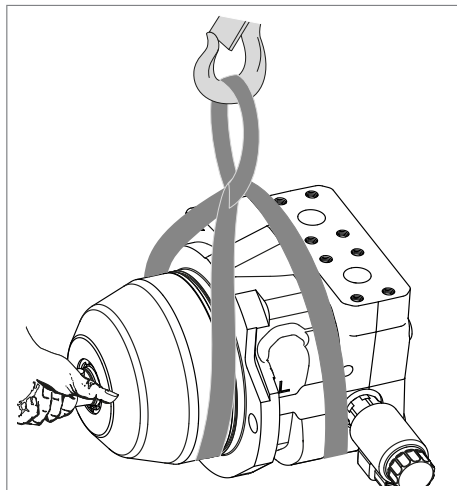


Fig. 5: Transport with lifting strap

6.2 Storing the axial piston unit

Requirements

- The storage areas must be free of 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 discharge) must not be operated in storage areas.
- The storage areas must be dry.
Recommended relative humidity $\leq 60\%$.
- Ideal storage temperature: 5 °C to 20 °C.
- Minimum storage temperature: -50 °C (exception: units with on-board electronics).
- Maximum storage temperature: 60 °C.
- Keep out of direct sunlight.
- Do not stack axial piston units and store them in a shock-proof manner.
- Do not store the axial piston unit on the drive shaft or attachments, 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 come with anti-corrosion 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, at a consistent temperature between 5 °C and 20 °C throughout. Undamaged and sealed corrosion protection film.	Maximum 12 months	Maximum 24 months



Warranty is void if the requirements and storage conditions are not observed or after expiration of the maximum storage time (see Table 7).

Procedure after expiration of the maximum storage time:

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



After expiration of the maximum storage time, we recommend that you have the axial piston unit inspected by your 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 manufacturer's plant for the axial piston unit, see Chapter 10.5 "Spare parts" on page 46.

After removal A dismantled axial piston unit must be stored with corrosion protection 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 Bosch Rexroth Service, see Chapter 10.5 "Spare parts" on page 46.

Bosch Rexroth recommends the following procedure:

1. Clean the axial piston unit, see Chapter 10.1 "Cleaning and care" on page 44.
2. Empty the axial piston unit.
3. For storage periods up to 12 months: Coat the inside of the axial piston unit with mineral oil and fill with approx. 100 ml mineral oil.
For storage periods up to 24 months: Fill the axial piston unit with VCI 329 corrosion protection (20 ml).
Filling is performed via drain port **L**, see Chapter 7.4 "Installing the axial piston unit", Fig. 10 on page 35.
4. Seal all ports so they are air proof.
5. Coat the unpainted areas of the axial piston unit with mineral oil or suitable, easily removable corrosion protection, e.g., acid-free grease.
6. Package the axial piston unit with desiccant in corrosion protection film so it is airtight.
7. Store the axial piston unit in a non-explosive area in a manner that is shock-proof, see "Requirements" on page 25 in this chapter.

7 Installation

The following documents must be on hand prior to installation:

- Installation drawing for axial piston unit (can be obtained from your contact at Bosch Rexroth)
- Hydraulic circuit diagram for the axial piston unit (in the installation drawing)
- Hydraulic circuit diagram 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 for the axial piston unit (contains the permissible technical data)
- Product-specific commissioning and project planning instructions

7.1 Unpacking

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

CAUTION. Danger from falling parts.

Improperly opening the packaging can result in parts falling out, which can be damaged or cause injury.

- ▶ Place the packaging on a level, 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 delivery” on page 19.
- ▶ Dispose of the packaging material according to the national regulations in 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.
- ▶ Observe the permissible radial forces on the drive shaft when transferring input/output drive with radial load (belt drives). If necessary, the belt pulley must be stored separately.
- ▶ Make sure that the axial piston unit is air bled and filled with hydraulic fluid during commissioning and operation. Do this also after relatively long periods of disuse, since the axial piston unit may drain through the hydraulic lines.
- ▶ The case drain fluid in the housing area must be directed to the reservoir via the highest drain port. Use the line size which is appropriate for the port.
- ▶ A check valve in the drain line is not permissible.
- ▶ To achieve favorable noise values, decouple all connecting lines from all vibration-capable components (e.g., reservoir) using elastic elements.

RE 91706-01-B/09.2015, A10VER Series 52, **Bosch Rexroth AG**

- ▶ Make certain that the drain line and return line flow into the reservoir below the minimum fluid level in all operating conditions. This prevents foaming.
- ▶ 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 clean condition. Contamination of the hydraulic fluid can considerably affect the function and service life of the axial piston unit and its suitability for use in explosive areas.
- ▶ Use lint-free cloths for cleaning.
- ▶ Use suitable mild cleaning agents 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 piping layout shown illustrates the basic layout.

7.3.1 Below-reservoir installation (standard)

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



Recommended installation position: 1.

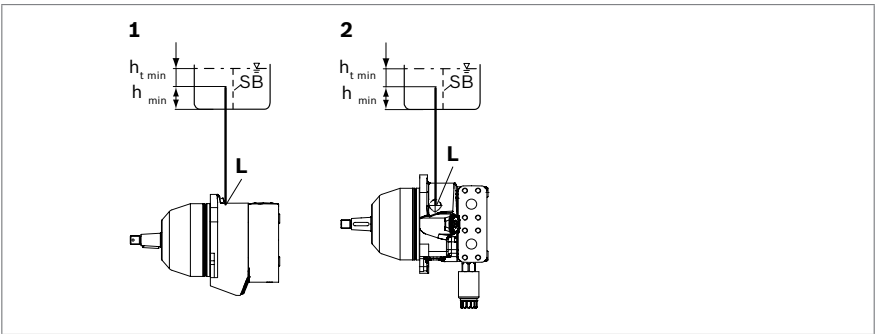


Fig. 6: Below-reservoir installation A10VER with installation position 1-2

L	Highest drain port	h_{min}	Minimum required distance to reservoir bottom (100 mm)
$h_{t min}$	Minimum required immersion depth (200 mm)		

Table 8: Below-reservoir installation

Installation position	Air bleeding	Filling
1 (drive shaft horizontal)	–	L
2 (drive shaft horizontal)	–	L

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.

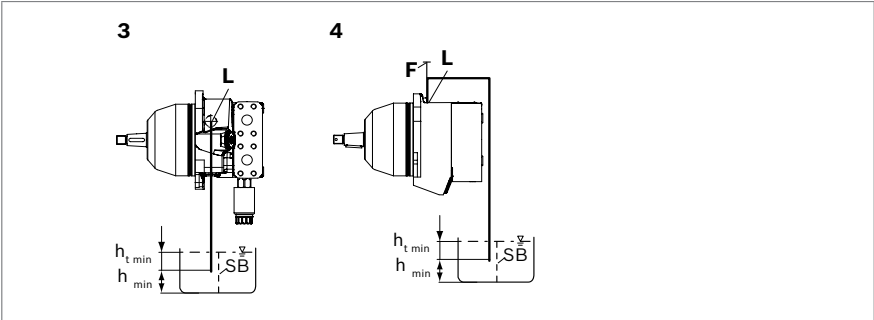


Fig. 7: Above-reservoir installation A10VER with installation position 3–4

- L

Highest drain port
- F

Filling/air bleeding
- $h_{t\ min}$

Minimum required immersion depth (200 mm)
- h_{min}

Minimum required distance to reservoir bottom (100 mm)



Port **F** is part of the external piping and must be provided by the customer to make filling and air bleeding easier.

Table 9: Above-reservoir installation

Installation position	Air bleeding	Filling
3 (drive shaft horizontal)	–	L
4 (drive shaft horizontal)	–	L

7.4 Installing the axial piston unit

7.4.1 Preparation

1. Check the specifications on the name plate of the axial piston unit to see if the axial piston unit is correct.
2. Compare the material number and designation (type 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 46.

3. Before installing, completely empty the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.
4. Check the permissible 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 intended motor function.

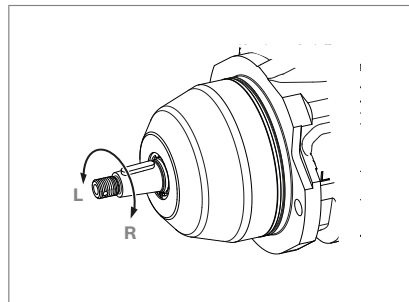


Fig. 8: Direction of rotation

- R** Clockwise (cooling operation; counter-clockwise: reversing operation)
L Counter-clockwise (upon request) (counter-clockwise: cooling operation; clockwise: reversing operation)



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 22.

7.4.2 Dimensions

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

7.4.3 General instructions

Follow these general instructions when installing 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 characteristic curves and changes in response time.
- If a shared drain line is used for several units, make sure that the respective case pressure is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating conditions, specifically on cold start. If this is not possible, separate drain lines may have to be laid.

The installation method for the axial piston unit depends on the connecting elements to the output side. The following descriptions explain the installation of the axial piston unit:

- with a coupling
- on a gearbox

7.4.4 Installation with coupling

How to install the axial piston unit with a coupling is described in 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 foreign particles from the installation location.
5. Install the coupling on the drive shaft of the machine/system in accordance with the specifications provided by the coupling manufacturer.



The axial piston unit must not be tightened 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 drive shaft of the machine/system so that there is no angular deviation.
8. Make certain that no impermissible axial and radial forces act on the drive shaft.
9. Details on the required tools and tightening torques for the mounting bolts are available from the machine/system manufacturer.

10. 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 be connected around the axial piston unit with a cardan shaft:

1. Position the axial piston unit close to the specified installation point. It should allow enough space for the cardan shaft to fit through on both sides.
2. Join the cardan shaft to the drive shaft of the machine/system.
3. Push the axial piston unit to the cardan shaft and join the cardan shaft to the output 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 torque 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 protective plugs.

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

- ▶ Before commissioning, remove all protection plugs and replace them with suitable, pressure-proof, metal threaded plugs or connect the appropriate lines.

2. Remove the transport protection.

The axial piston unit is delivered with protective covers (1) and protective plugs (2). They are not pressure-resistant and 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 Bosch Rexroth service partner or the service department of the manufacturer's plant for the axial piston unit.

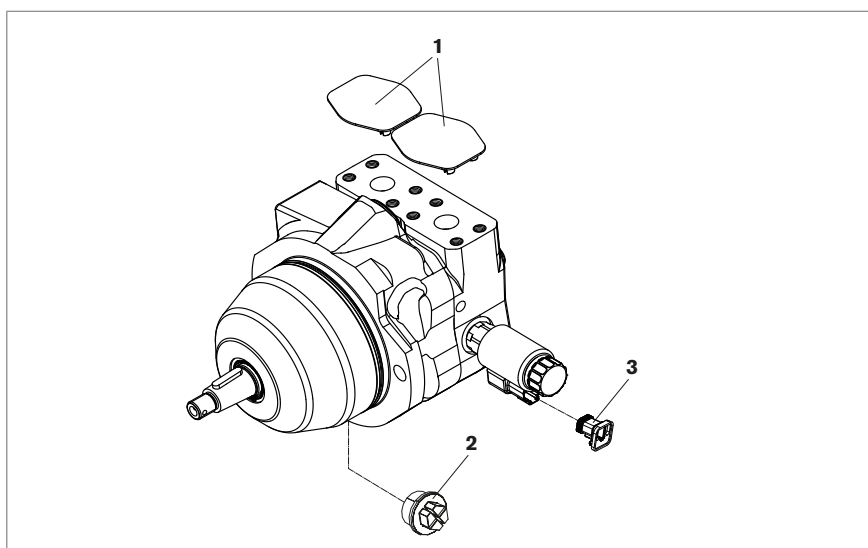


Fig. 9: Removing transport protection

- 1** Protective covers
- 2** Protection plugs/threaded plugs
- 3** Solenoid plug protective cover



Ports intended for connecting lines are covered by protective plugs or threaded plugs, which serve as transport protection. All ports required for functional operation must be connected (see Table 10 "A10VM/A10VER ports Series 52" on page 35). Failure to do so could lead to malfunctions or damage. 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 unintentional resetting by means of caps. Changing the adjusting screw will void the warranty. If you need to change settings, contact your Bosch Rexroth service partner (for address, see Chapter 10.5 "Spare parts" on page 46).

7.4.8 Connecting the axial piston unit to hydraulic system

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 circuit diagram of the machine/system manufacturer.

The ports and fastening threads 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 lines

Observe the following notes when routing the pressure and drain 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.
- Pressure line
 - For the pressure lines, use only pipes, hoses and connecting elements rated for the working pressure range specified in data sheet 91706 (see Table 10).
- Drain line
 - Always route the drain 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.
 - Under no operating circumstances may the case pressure exceed the maximum values specified for the axial piston unit in the data sheet.
 - The drain line joint in the reservoir must always be below the minimum fluid level (see Chapter 7.3 “Installation position” on page 28).
- If the axial piston unit is equipped with installed screw fittings, these must not be unscrewed. Screw the stud end of the fitting directly into the installed screw fitting.

Risk of confusion 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 – Japan Industrial Standard). Moreover, various kinds of seal are used.

The system of units, the kind of seal and the size of female thread and stud ends (e.g., threaded plug) must all match.

The limited ways of telling them apart visually poses a risk of confusing them.

WARNING. Leaky or bursting stud ends.

For fittings, if a stud end which is of a different measurement system, kind of seal and size with respect to the female thread is pressurized, the stud end may loosen itself or even be ejected from the hole in a projectile-like manner. This can result in serious injury and property damage. Hydraulic fluid can escape from this leakage point.

- ▶ Use the drawings (installation drawing) to determine the required stud end for each fitting.
- ▶ Make sure the right fittings, mounting bolts and threaded plugs are installed.
- ▶ For all female threads, use a stud end from the same system of units and of the correct size.

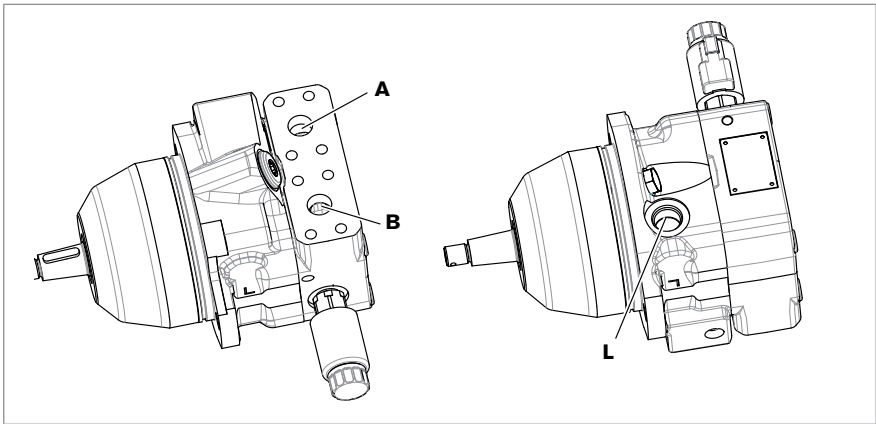


Fig. 10: Port overview A10VER, EZx control, SAE flange port (port plate 10)

Table 10: A10VM/A10VER ports Series 52

Ports ¹⁾		$p_{\max}$ [bar] ²⁾	Status
A	Working port (high-pressure series)	10	O
B	Working port (high-pressure series)	350	O
L	Drain port	2	O

¹⁾ The measuring system and thread size can be taken from the installation drawing.

²⁾ Depending on the application, short-term pressure peaks can occur. Keep this in mind when selecting measuring equipment and fittings.

O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Tightening torques

The following tightening torques apply:

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

Table 11: Tightening torques for 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 6149	M8 × 1	10 Nm	7 Nm	4 mm
	M10 × 1	30 Nm	15 Nm	5 mm
	M12 × 1.5	50 Nm	25 Nm	6 mm
	M14 × 1.5	80 Nm	45 Nm	6 mm
	M16 × 1.5	100 Nm	55 Nm	8 mm
	M18 × 1.5	140 Nm	70 Nm	8 mm
	M20 × 1.5	170 Nm	80 Nm	10 mm
	M22 × 1.5	210 Nm	100 Nm	10 mm
	M27 × 2	330 Nm	170 Nm	12 mm
	M30 × 2	420 Nm	215 Nm	17 mm
	M33 × 2	540 Nm	310 Nm	17 mm
	M42 × 2	720 Nm	330 Nm	22 mm
	M48 × 2	900 Nm	420 Nm	22 mm
DIN 3852	M8 × 1	10 Nm	7 Nm ¹⁾	3 mm
	M10 × 1	30 Nm	15 Nm ²⁾	5 mm
	M12 × 1.5	50 Nm	25 Nm ²⁾	6 mm
	M14 × 1.5	80 Nm	35 Nm ¹⁾	6 mm
	M16 × 1.5	100 Nm	50 Nm ¹⁾	8 mm
	M18 × 1.5	140 Nm	60 Nm ¹⁾	8 mm
	M22 × 1.5	210 Nm	80 Nm ¹⁾	10 mm
	M26 × 1.5	230 Nm	120 Nm ¹⁾	12 mm
	M27 × 2	330 Nm	135 Nm ¹⁾	12 mm
	M33 × 2	540 Nm	225 Nm ¹⁾	17 mm
	M42 × 2	720 Nm	360 Nm ¹⁾	22 mm
	M48 × 2	900 Nm	400 Nm ¹⁾	24 mm
ISO 11926	5/16-24 UNF-2B	10 Nm	7 Nm	1/8 in
	3/8-24 UNF-2B	20 Nm	10 Nm	5/32 in
	7/16-20 UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18 UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16 UNF-2B	160 Nm	70 Nm	5/16 in
	7/8-14 UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12 UN-2B	360 Nm	170 Nm	9/16 in
	1 5/16-12 UN-2B	540 Nm	270 Nm	5/8 in
	1 5/8-12 UN-2B	960 Nm	320 Nm	3/4 in
	1 7/8-12 UN-2B	1200 Nm	390 Nm	3/4 in

¹⁾ The tightening torques for the threaded plugs are valid for the condition "dry" and "lightly oiled".

²⁾ The tightening torques for the threaded plugs are valid for the condition "dry" – in the condition "lightly oiled", the tightening torques for M10 × 1 are reduced to 10 Nm and for M12 × 1.5 to 17 Nm.

- Procedure** To connect the axial piston unit to the hydraulic system:
1. Remove the protective plugs and threaded plugs at the ports at which the connections are to be made according to the hydraulic circuit diagram.
 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. (Observe Chapter 7.5 "Performing flushing cycle" on page 38 when you flush out the entire 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.



Relationship between direction of rotation and flow direction:
 Clockwise rotation: **B to A**

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).

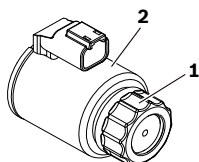
The machine/system manufacturer is responsible for the layout of the electric control. Electrically controlled axial piston units must be connected in accordance with the electrical circuit diagram for the machine/system. For axial piston units with electrical control and/or mounted sensors, please observe the specifications in data sheet 91706, such as:

- Permissible voltage range
- Permissible current
- Correct pin assignment
- Recommended electrical control units

Exact details on the connector, type of protection and matching mating connector can also be found in data sheet 91706. The mating connector is not included in scope of delivery.

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

Changing connector orientation



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

To do this, proceed as follows:

1. Loosen the mounting nut with rubber boot (1) on the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
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 the first 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 or risk of injury or serious injury!

- ▶ Pay attention to and eliminate potential sources of danger before operating the axial piston unit.
- ▶ Make sure no one is 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 an improperly installed product.

Risk of injury and property damage.

- ▶ Make sure that all electrical and hydraulic ports are connected or plugged.
- ▶ Only commission a completely installed, fully functioning 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, and specifically project planning and commissioning instructions 90363.

- ▶ Connect the gauge for the working pressure and case 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.



The axial piston unit should be filled with a filling unit (10 µm filter grade). The axial piston unit must not be operated while it is being filled by the filling unit.

Use only a hydraulic fluid that conforms to the following requirements:
You can find details of the minimum requirements on hydraulic fluids in Bosch Rexroth data sheets 90220, 90221 and 90222. The titles of the data sheets can be found in Table 1 "Required and supplementary documentation" on page 5. You can find details of permissible and optimal viscosity in data sheet 91706.

To ensure the functional reliability of the axial piston unit, cleanliness level 20/18/15 according to at least ISO 4406 is necessary for the hydraulic fluid. At very high hydraulic fluid temperatures (90 °C to maximum 110 °C, measured at port **L**), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary. For permissible temperatures, see data sheet 91706.

1. Place a collecting pan 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 28. The hydraulic lines of the system must also be filled.

NOTICE Risk of property damage due to improper lubrication.

Product can be damaged or destroyed.

- When using a shut-off valve in the drain line, make sure that the drive of the axial piston unit can only be started when the shut-off valves are open.

3. When using a shut-off valve in the drain line, only operate the axial piston unit when the shut-off valves are open.

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 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 50.

To test the hydraulic fluid supply:

1. Allow the axial piston unit to run at low speed and without load. Pay attention to leaks and noises.
2. Check the axial piston unit's drain line during the test. The drain fluid should not contain any bubbles.
3. Increase the load and check whether the working pressure rises as expected.
4. Perform a leak test to ensure that the hydraulic system is sealed and can withstand the maximum pressure.
5. At maximum working pressure, check the case pressure at port **L**. Refer to the data sheet 91706 for the permissible value.

8.1.3 Performing functional test

WARNING

Improperly 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 circuit diagram 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 drive motor, check in particular the specified pressures, e.g., working pressure and case pressure.
- ▶ Perform a leak test without and with load prior to normal operation.
- ▶ If necessary, disconnect the pressure gauge and plug the ports with the designated threaded plugs.

8.2 Running-in phase

NOTICE

Property damage from 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 leakage temperature.
- ▶ Reduce the loading (pressure, rotational speed) 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 sample 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, it is recommended to change the hydraulic fluid.

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 specified in the technical data. The machine/system manufacturer is responsible for the proper project planning of the hydraulic system and its control.

RE 91706-01-B/09.2015, A10VER Series 52, **Bosch Rexroth AG**

10 Maintenance and repair

NOTICE

Inspection and maintenance overdue!

Risk of property damage.

- Perform 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 due to mechanical forces.

The 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 cleaning agent to clean the axial piston unit. Never use solvents or corrosive cleaning agents.
- Remove major external contamination and keep sensitive and important components, such as solenoids, valves and sensors, clean.

10.2 Inspection

In order for the axial piston unit to be reliable and long-lasting, 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 performed	Interval
Hydraulic system	
Check level of hydraulic fluid in the reservoir.	Daily
Check the operating temperature under comparable load condition at the drain port and in the reservoir.	Weekly
Conduct analysis of hydraulic fluid: Viscosity, aging and contamination	Yearly or every 2000 operating hours (whichever occurs first)
Check filter. The change interval may vary depending on the degree of contamination of the hydraulic fluid. We recommend using a contamination indicator.	Yearly or every 1000 operating hours (whichever occurs first)

Task to be performed		Interval
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 fasteners for firm 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 properly.

The service life of the axial piston unit is heavily dependent on the quality of the hydraulic fluid. For this reason, we recommend changing the hydraulic fluid at least once per year or every 2,000 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 by the service life of the bearings used. The service life on the basis of the load cycle can be requested from the proper Bosch Rexroth service partner, see Chapter 10.5 "Spare parts" on page 46 for an address. Based on these details, a maintenance interval is to 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 cannot be assured and the warranty is void.

In the event of questions regarding repairs, contact your responsible Bosch Rexroth service partner or the service department of the manufacturer's plant for the axial piston unit, see Chapter 10.5 "Spare parts" on page 46.

10.5 Spare parts



CAUTION

Use of unsuitable spare parts.

Spare parts which do not comply with the requirements as laid down by Bosch Rexroth can cause injury and property damage.

- Use exclusively original spare parts from Rexroth to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit cannot be assured and the warranty is void.

The spare parts lists for axial piston units are order-specific. When ordering spare parts, quote 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 responsible Bosch Rexroth Service partner or the service department of the manufacturer's plant for the axial piston unit. Details for the manufacturer's plant can be found on the name plate of the axial piston unit.

Bosch Rexroth AG
An den Kelterwiesen 14
72160 Horb a.N., Germany
Hotline +49-9352-405-060
spares.horb@boschrexroth.de

Spare parts can be found online at www.boschrexroth.com/spc

If you have general questions, please contact svm.support@boschrexroth.de

For addresses in our sales and service network, please refer to www.boschrexroth.com/addresses

11 Removal and replacement

11.1 Required tools

Removal can be performed using 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 re-energized.

11.3 Performing removal

Proceed as follows to remove the axial piston unit:

1. Make sure you have the appropriate tools and wear personal protective equipment.
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 collecting pan under the axial piston unit to collect any hydraulic fluid that may leak.
5. Loosen the lines and collect the escaping hydraulic fluid in the collecting pan.
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 later use

- Proceed as described in Chapter 6.2 “Storing the axial piston unit” on page 25.

12 Disposal

Careless disposal of the axial piston unit, the hydraulic fluid and the packaging material can result in environmental pollution.

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 in your country. Also observe the applicable safety data sheet for the hydraulic fluid.
4. Disassemble the axial piston unit into its individual parts and properly recycle these parts.
5. Separate according to the following:
 - Castings
 - Steel
 - Aluminum
 - Non-ferrous metal
 - Electronic waste
 - Plastic
 - Seals

13 Extension and conversion

Do not modify the axial piston unit or its attachments. This also includes changing the wiring or software.

Changes to settings should only be made using the product-specific setting instructions.



The warranty by Bosch Rexroth only applies to the product as delivered. Any modification, extension or software customization voids the warranty.



The setting screws are protected against unintentional resetting by caps. Changing the adjusting screw will void the warranty. If you need to change settings, contact your Bosch Rexroth service partner (for the address, see Chapter 10.5 "Spare parts" on page 46).

14 Troubleshooting

Table 13 can help you with 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 with troubleshooting

- ▶ Perform troubleshooting if possible with reduced operating data (e.g., slowly swinging in or out and slow pressure increase).
- ▶ Proceed in a systematic and purposeful manner, even when pressed for time. Random and impetuous removal and readjustment of settings could make it impossible to determine the original cause of failure.
- ▶ First obtain a general overview of how your product functions in conjunction with the overall 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:
 - Were there any changes to the product's operating conditions or operating range?
 - 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, electronics, control) or to the product? If yes, which?
 - Has the hydraulic fluid been changed?
 - Has the product or machine been used as intended?
 - How did 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 you cannot rectify the fault, contact one of the contact addresses which can be found at:
www.boschrexroth.com/addresses.

14.2 Malfunction table

Table 13: Axial piston unit malfunction table

Fault	Possible cause	Remedy
Unusual noises	Insufficient air bleeding of the hydraulic system	Fill axial piston unit, suction line for the hydraulic pump and the reservoir Completely air bleed axial piston unit and hydraulic system Check correct installation position
	Output speed too high	Machine/system manufacturer: reduce output speed
	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 attachments, hydraulic lines or improper installation of the coupling	Mount attachments according to the information provided by the coupling or fitting manufacturer
	Mechanical damage to the axial piston unit (e.g., bearing damage).	Replace axial piston unit Contact Bosch Rexroth Service
Increased, unusual vibration	Bearings worn	Contact Bosch Rexroth Service
Reversing not possible	Hydraulic fluid too viscous	Check hydraulic fluid temperature on the high-pressure side
	Time-delay orifice clogged	Repeat reversing process (contact machine/system manufacturer or Bosch Rexroth Service)
	Defective solenoid, connector or lines	Make sure the solenoid/plug is properly connected. Make sure the electrical control functions properly.
No or insufficient pressure	Insufficient air bleeding of the hydraulic system	Fill axial piston unit, suction line for the hydraulic pump and the reservoir Check correct installation position
	Faulty mechanical output drive (e.g., defective coupling)	Contact machine/system manufacturer
	Drive power too low	Contact machine/system manufacturer
	Malfunction in the axial piston unit control device or controller	Contact Bosch Rexroth Service
	Control of the control device defective	Check control (contact machine/system manufacturer or Bosch Rexroth Service)
	Wear or mechanical damage to the axial piston unit	Replace axial piston unit Contact Bosch Rexroth Service
	Drive unit defective (e.g., hydraulic pump)	Contact machine/system manufacturer
Pressure/flow fluctuations or instabilities	Insufficient air bleeding of the hydraulic system	Fill axial piston unit, suction line for the hydraulic pump and the reservoir Completely air bleed axial piston unit and hydraulic system Check correct installation position
	Unstable control signal	Contact machine/system manufacturer or Bosch Rexroth Service
	Malfunction in the control devices or the controller.	Contact Bosch Rexroth Service

RE 91706-01-B/09.2015, A10VER Series 52, **Bosch Rexroth AG**

Table 13: Axial piston unit malfunction table

Fault	Possible cause	Remedy
Rotational speed or torque cannot be reached	Insufficient flow in hydraulic pump	Check function of the hydraulic pump
	Minimum or maximum displacement set incorrectly.	Contact Bosch Rexroth Service
	Control of the control device defective	Check control (machine/system manufacturer)
	Insufficient pilot pressure or control pressure	Check pilot pressure or control pressure
		Contact Bosch Rexroth Service
	Malfunction in the axial piston motor control device or controller	Contact Bosch Rexroth Service
	Hydraulic fluid not in optimum viscosity range	Machine/system manufacturer: check temperature range and use suitable hydraulic fluid
	Wear or mechanical damage to the axial piston motor	Replace axial piston unit
		Contact Bosch Rexroth Service
	Wear or mechanical damage to the hydraulic pump	Replace hydraulic pump
		Contact Bosch Rexroth Service
Wrong direction of rotation	Check function of the hydraulic pump	
	Machine/system manufacturer: check correct direction of rotation, see Chapter 7.4.1 "Preparation" on page 30	
Excessive temperature of hydraulic fluid and case	Excessive inlet temperature in the axial piston unit	Machine/system manufacturer: inspect system, e.g., malfunction in the cooler, insufficient hydraulic fluid in the reservoir
	Wrong setting or malfunction in the pressure relief and pressure control valves (e.g., high-pressure relief valve, pressure cut-off, pressure controller)	Optimize the adjustment of the pressure limitation and pressure control valves of the axial piston unit and the pressure safeguarding in the hydraulic system
		Contact Bosch Rexroth Service
		Contact machine/system manufacturer
	Output speed too high	Contact machine/system manufacturer
	Flushing flow of the flushing valve too low	Contact Bosch Rexroth Service
Axial piston unit worn	Replace axial piston unit, contact Bosch Rexroth Service	

16 Alphabetical index

► A		► I	
Abbreviations	7	Identification	22
Above-reservoir installation	29	Inspection	44
		Installation	27, 30
► B		– completing	32
Below-reservoir installation	28	– general instructions	30
		– on a gearbox	32
► C		– on gearbox	32
Care	44	– Preparation	30
Circuit		– with cardan shaft	32
– open	20	– with coupling	31
Cleaning	44	Installation conditions	27
Commissioning	39	Installation position	
– initial	39	– Above-reservoir installation	29
Connecting		– Below-reservoir installation	28
– electrical	37	Instructions	
– hydraulic	33	– general	30
Control	21	Intended use	8
Conversion	49		
Corrosion protection	25	► L	
Corrosion protection film	25	Layout	20
Cradle	20	Lifting device	23
Cylinder	20	Lifting strap	24
► D		► M	
Designations	7	Maintenance	44, 45
Dimensions	23, 30	Malfunction table	51
Direction of rotation	30	Motor function	21
Disposal	48		
Distributor plate	20	► N	
Drive shaft	20	Name plate	22
► E		► O	
Eye bolt	23	Operation	43
► F		► P	
Filling	39	Performance description	20
Flushing cycle	38	Piston	20
Functional description		Product description	20
– Control	21	Property damage	16
– Motor function	21		
Functional test	41		

► Q	
Qualifications	9
► R	
Recommissioning	
– after standstill	42
Removal	47
– performing	47
– preparing	47
Repair	45
Replacement	47
Required documentation	5
Retainer plate	20
Running-in phase	41
► S	
Safety instructions	8
– General	10
– Product-specific	11
– Signal word	6
Scope of delivery	19
Slipper pad	20
Solenoid position	
– changing	38
Spare parts	46
Storage	23
Storage time	25
Storing	25
Stroking piston	20
Symbols	7
► T	
Technical Data	53
Tightening torques	35
Tools	47
Transportation	23
– by hand	23
– with eye bolt	23
– with lifting strap	24
Transporting	23
Transport protection	33
Troubleshooting	50
► U	
Unpacking	27
► W	
Warranty	18, 49
Weight	23