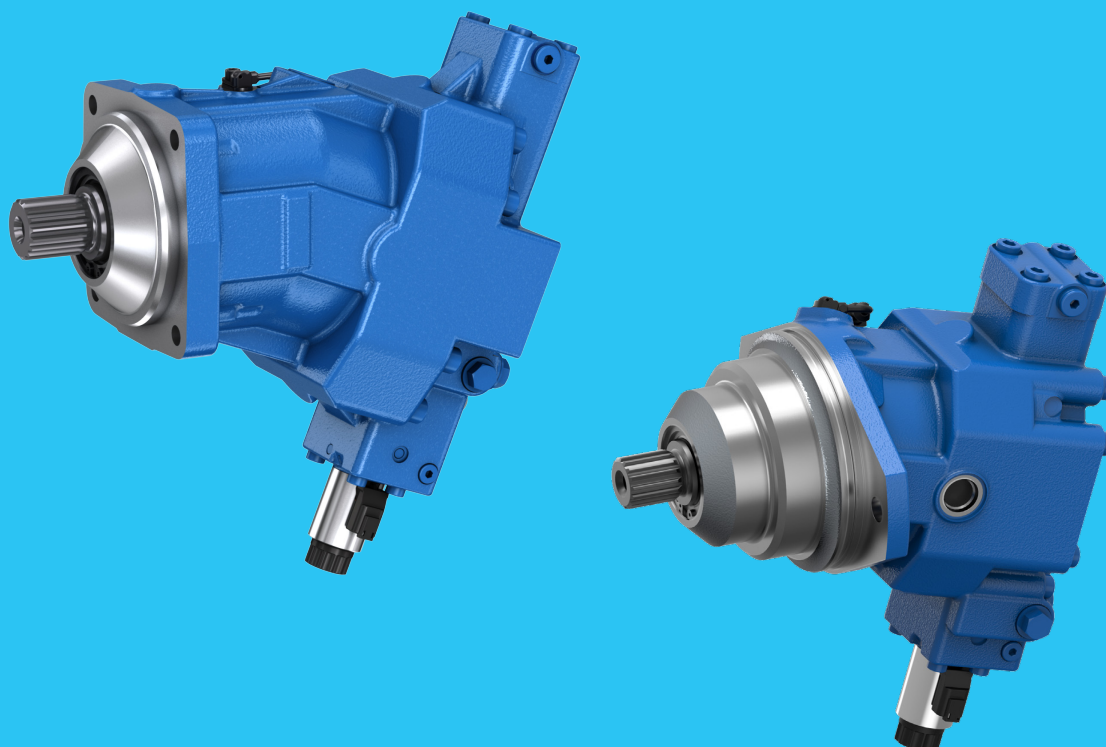


Axial piston variable motor

A36VM series 10
A36VM/A36VE series 50



RE 91650-01-B/2023-11-15, Replaces: 2021-07-19, EN

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The data specified within only serve to describe the product. As our products are constantly being further developed, no statements concerning a certain condition or suitability for a certain application can be derived from our information. 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.

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

The original instruction manual was created in German.

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1 About this documentation

1.1 Validity of the documentation

This documentation applies to the following products:

- Axial piston variable motor A36VM series 10
- Axial piston variable motor A36VM/A36VE series 50

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

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

- Read this documentation completely, in particular chapter 2 "Safety instructions" on page 8 and chapter 3 "General instructions on property damage and product damage" on page 15 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 axial piston variable motor A36VM and A36VE.	–	Order confirmation
 Installation drawing Contains the outer dimensions, all connections and the hydraulic circuit diagram for your axial piston variable motor A36VM and A36VE.	Please request the installation drawing from your contact at Bosch Rexroth.	Installation drawing
 Axial piston variable motor A36VM series 10 Contains the permissible technical data, ports, main dimensions and circuit diagrams of standard versions.	91650	Data sheet
 Axial piston variable motor A36VM/A36VE series 50 Contains the permissible technical data, ports, main dimensions and circuit diagrams of standard versions.	91655	Data sheet
 Hydraulic fluids based on mineral oils and related hydrocarbons Describes the requirements for mineral oil-based hydraulic fluids and related hydrocarbons for operation with Rexroth hydraulic components and provides support for selection of suitable hydraulic fluids for the hydraulic system.	90220	Data sheet
 Environmentally acceptable hydraulic fluids Describes the requirements for environmentally acceptable hydraulic fluids on mineral oil basis and related hydrocarbons for operation with Rexroth hydraulic components, and provides support for selection of suitable hydraulic fluids for the hydraulic system.	90221	Data sheet
 Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors) Contains the hydraulic fluids positively evaluated by Bosch Rexroth.	90245	Data sheet
Information on the application of hydrostatic drives at low temperatures Contains additional information on the application 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 Representation of information

Uniform safety instructions, symbols, terms and abbreviations are used throughout this documentation to ensure safe and proper use of the product. For clarification, they are explained in the sections below.

1.3.1 Safety instructions




This documentation contains safety instructions in chapter 2.6 "Product-specific safety instructions" on page 11 and in chapter 3 "General instructions on property damage and product damage" on page 15, as well as before a sequence of actions or an instruction for action involving a risk of personal injury and property damage. Always follow the measures for danger prevention associated with the use of this product.

Safety instructions are set out as follows:

 SIGNAL WORD
Type and source of danger! Consequences of non-compliance ► Danger prevention measures

- **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 the consequences of non-compliance
- **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 injury if it is not avoided.
 WARNING	Identifies a dangerous situation that may result in death or serious injury if it is not avoided.
 CAUTION	Identifies a dangerous situation that may result in minor to moderate injury if it is not avoided.
NOTICE	Property damage: The product or surrounding area may be damaged.

1.3.2 Symbols

The following symbols indicate notices that are not safety-relevant but increase understanding of the documentation.

Table 3: Meaning of symbols

Symbol	Meaning
	If this information is disregarded, the product cannot be used and/or operated to its full extent.
	Single, independent action
1.	Numbered instruction:
2.	The numbers indicate that the actions must be completed in order.
3.	

1.3.3 Designations

This documentation uses the following designations:

Table 4: Designations

Designation	Meaning
A36VM	Axial piston variable motor in standard version, closed circuit
A36VE	Axial piston variable motor in plug-in version, closed circuit
Threaded plug	Metal screw, pressure-resistant
Protective plug	Made out of plastic, not pressure-resistant, only for transportation

As a general term for the "axial piston variable motor A36VM" or "axial piston plug-in motor A36VE", 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
ANSI	American N ational S tandards I nstitute is an organization that coordinates the development of voluntary standards in the United States
ATEX	EC directive on explosion protection (A tmosphere e xplosible)
DIN	D eutsches I nstitut für N ormung (German Institute for Standardization)
EP	P roportional control, e lectric
HA	A utomatic control, h igh pressure-related
ISO	I nternational O rganization for S tandardization
JIS	J apan I ndustrial S tandard
RE	R exroth document in the E nglish language
VDI 2230	Guideline for the systematic calculation of heavy-duty threaded connections and cylindrical screw joints from the VDI (V erein D eutscher I ngenieure - Association of German Engineers)

2 Safety instructions

2.1 About this chapter

The axial piston unit has been manufactured to generally accepted engineering standards. There is still, however, a risk of personal injury or property damage if this chapter and the safety instructions in this documentation are not observed.

- ▶ 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 partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC. The component is exclusively intended to form partly completed machinery or complete machinery together with other components. The component should 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 only approved as a hydraulic motor in hydrostatic drive systems in a closed circuit.

- ▶ Observe the technical data, the application and operating conditions and the performance limits as specified in the data sheet 91650 and 91655 and in the order confirmation. Information about approved hydraulic fluids can be found in data sheet 91650 and 91655.

The axial piston unit is only intended for commercial use and not for private use. Intended use includes having fully read and understood this documentation, especially chapter 2 "Safety instructions" on page 8.

2.3 Improper use

Any use other than that described as intended use is considered improper.

Bosch Rexroth AG is not liable for damage resulting from improper use.

The user is solely responsible for any risks arising from improper use.

The following foreseeable forms of faulty usage are also considered improper (this list is not exhaustive):

- Use outside the operating parameters approved in the data sheet and 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 assembled parts (e.g. control unit, valves) not in combination with the specified Rexroth components

- Use of the axial piston unit with assembled parts 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) must not come into contact with water, depending on the IP protection class. Observe the IP protection class in the data sheet 91650 and 91655.
- Use of the axial piston unit under a continuous pressure differential between housing and ambient pressure greater than 2 bar, with the case pressure always greater than the external pressure on the shaft seal ring (ambient pressure). Short-term ($t < 0.1$ s) max. 1000 case pressure peaks up to 10 bar are permitted. Beyond this, the maximum permissible case pressure specified in the data sheet must not be exceeded.
- Application of the axial piston unit in explosive environments unless the component or machine/system has been certified as compliant with the ATEX Directive 2014/34/EU
- 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 a basic understanding of mechanics, electricity and hydraulics, as well as familiarity with associated technical terms. For transporting and handling the product, knowledge regarding the use of lifting devices and lifting accessories is required. In order to ensure safe use, these activities should only be performed by skilled personnel or an instructed person under the direction and supervision of skilled personnel.

Skilled personnel refers to persons who possess the professional training, knowledge and experience, as well as the understanding of the regulations relevant to the work to be done that are necessary to recognize possible dangers and take the appropriate safety measures. Skilled personnel must follow the rules relevant to their field and have the necessary hydraulic expert knowledge.

Hydraulic expert knowledge includes:

- Being able to read and fully understand hydraulic circuit diagrams
- In particular, fully understanding the relationships with regard to safety devices
- Knowledge regarding the function and interaction of hydraulic components



Bosch Rexroth offers you measures supporting training in specific areas.

You can find an overview of the training contents on the Internet at:

www.boschrexroth.com/training.

2.5 General safety instructions

- Observe the country-specific 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 assemble, 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 safety-relevant applications, 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 to chapters 6 to 14.

WARNING

Danger due to excessive pressure!

Risk of death or injury, or property damage!

Improperly changing the factory pressure settings can result in a pressure increase beyond the permissible maximum 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.
- ▶ A pressure relief must be provided in the hydraulic system. In this connection, observe the technical limits of the pressure relief valve.

Danger due to suspended loads!

Risk of death or 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 regulations on occupational health and safety, and transportation.

System/machine under pressure!

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

Property damage!

- ▶ Switch off the relevant machine/system part and secure it against reactivation according to the parameters 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 or 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.

Escaping hydraulic fluid due to leakage of machine/system components!

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

In case of leakage at the axial piston unit, high-pressure fluid jets may escape.

- ▶ 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.

Hydraulic fluid will explode when making contact with water!

Explosion and fire hazard!

- ▶ Do not bring hot hydraulic fluids in contact with water.

Electrical voltage!

Danger to life or risk of injury due to electric shock or 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.

Overloading of the axial piston motor!

Risk of injury or property damage!

When using the axial piston motor in winch drives it may, when extremely overloaded (e.g., if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), cause the rotary group to be damaged and, in the worst case, the axial piston motor may burst.

- ▶ Ensure that the technical limit values are not exceeded in any operating conditions.
- ▶ Check whether any additional measures are needed for your machine/system (up to an encapsulation) in order to avoid any hazard to persons. If necessary, make sure that these are properly implemented.
- ▶ For safety reasons, axial piston variable motors with beginning of control at $V_{g \min}$ (e.g. HA) are not permissible for winch drives (e.g. anchor winches).

WARNING

Restriction of 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.

Limitation of load-holding function in lifting winches!

Risk of injury or property damage!

Moving parts in high-pressure relief valves may in certain circumstances become stuck in an undefined position due to contamination (e.g. impure hydraulic fluid). This can result in restriction or loss of load-holding functions in lifting winches.

- ▶ Check whether the application on your machine requires additional safety measures in order to keep the load in a safe position.
- ▶ If necessary, make sure these are appropriately implemented.

CAUTION

High noise development during operation!

Risk of hearing damage or 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 getting burnt!

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

Improper cable and line routing!

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 lay cables and lines so no one can trip over them, they do not become kinked or twisted, do not rub on edges and do not run through sharp-edged ducts without adequate protection.

Contact with hydraulic fluid!

Risk of adverse health effects, e.g. eye injury, skin irritation, toxication from 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.

Danger from improper handling!

Risk of slipping and property damage! Risk of slipping when climbing on the axial piston unit. Parts and components may be damaged.

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

2.7 Personal protective equipment

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

All pieces of personal protective equipment must be intact.

3 General instructions on property damage and product damage

The following information applies to 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, solenoids 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.
- ▶ Make sure the electronic components (e.g. sensors) do not build up electrostatic charges (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.
- ▶ For above-reservoir installation, the housing area may drain out through the drain line after prolonged standstill periods or through the working line (gap leakage). This means the bearings are insufficiently lubricated when the system is turned on.

Mixing hydraulic fluids!

Product can be damaged!

- ▶ 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 considerably 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 must be clean when installed.
- ▶ Only use clean ports, hydraulic lines and assembled parts (e.g. measuring devices).
- ▶ When plugging the ports, no contamination must ingress.
- ▶ Before commissioning, ensure that all hydraulic connections are tight and that all seals 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 axial piston unit.
- ▶ 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 improper 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 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. Leaks may lead to 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!

Risk of environmental pollution and contamination of ground water!

- ▶ Always place a drip tray under the axial piston unit when filling and draining hydraulic fluid.
- ▶ Use a suitable binding agent to collect any leaked hydraulic fluid.
- ▶ Observe the parameters in the safety data sheet for the hydraulic fluid and the specifications provided by the machine/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 during installation.

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

The warranty only applies to the machine configuration as delivered.

The warranty will be voided if the product is incorrectly installed, commissioned or operated, or if it is used or handled improperly.

4 Scope of delivery

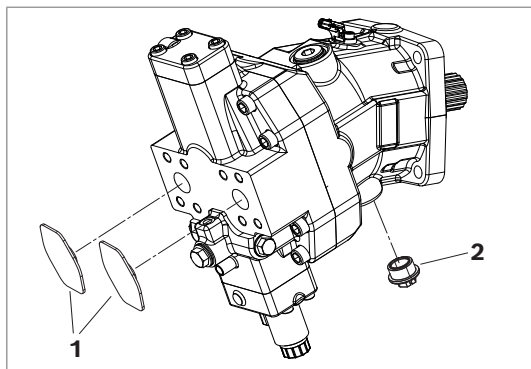


Fig. 1: Axial piston unit

Included in the scope of delivery:

- Axial piston unit as per order confirmation

The following parts come assembled on the unit:

- Protective covers (1)
- Protective plug/threaded plugs (2)

5 About this product

5.1 Performance description

The axial piston variable motor converts hydrostatic flow into mechanical rotation and controls or regulates this action. It is designed for mobile and stationary applications.

Refer to the data sheet 91650 and 91655 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 as a standard version A36VM (Series 10 and 50) and as a plug-in version A36VE (series 50).

The A36VM/A36VE is a variable motor with bent-axis design for hydrostatic drives in closed circuits.

For axial piston units with bent-axis design, the pistons (2) are arranged at an angle to the drive shaft (1). The pistons rest directly on the drive shaft where they generate torque depending on the pressure and swivel angle.

The specific torque and displacement can be continuously changed by controlling the bent axis.

Closed circuit

In the closed circuit, the hydraulic fluid flows from the hydraulic pump to the hydraulic motor, then back to the hydraulic pump. The output direction of rotation of the hydraulic motor is changed, e.g., by reversing the flow direction in the hydraulic pump.

5.2.1 Axial piston unit layout

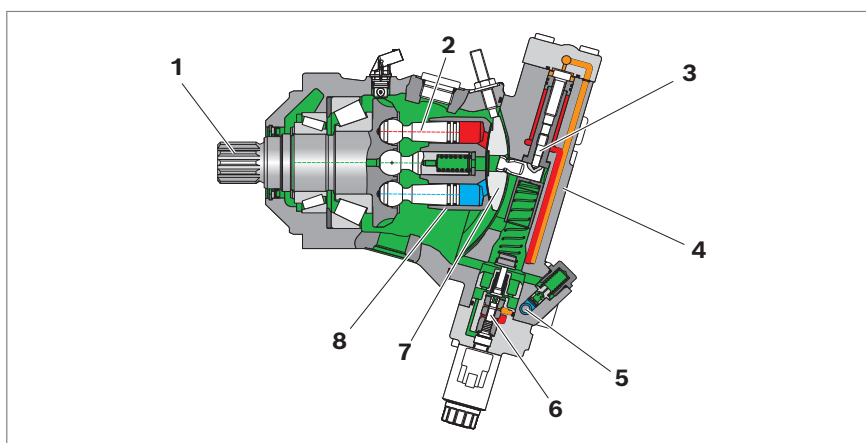


Fig. 2: Layout of A36M series 50 (size 60) with axial tapered piston rotary group

- | | | |
|-------------------|-------------------------------------|-----------------|
| 1 Drive shaft | 4 Port plate | 6 Control spool |
| 2 Piston | 5 Flushing and boost-pressure valve | 7 Lens plate |
| 3 Stroking piston | | 8 Cylinder |

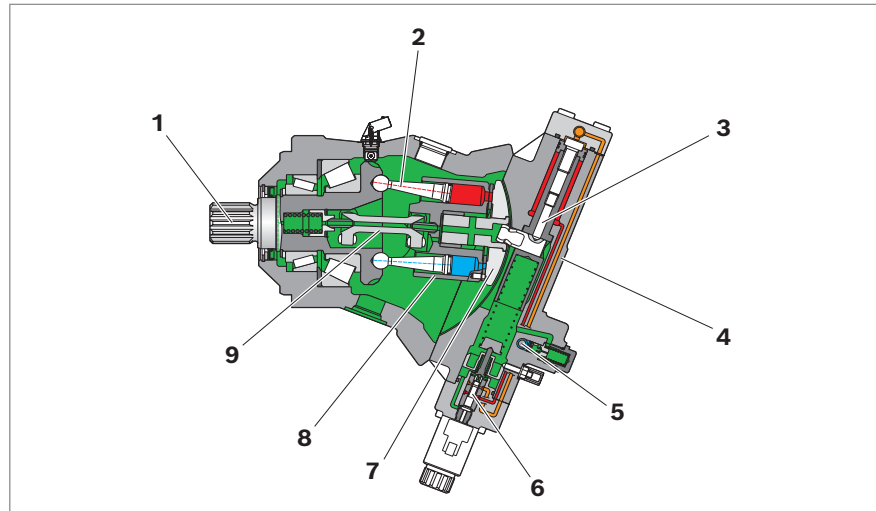


Fig. 3: Layout of the A36M series 10 (size 125 and 255) with double tripod joint

- | | | |
|-------------------|--|-----------------------|
| 1 Drive shaft | 5 Flushing and
boost-pressure valve | 8 Cylinder |
| 2 Piston | 6 Control spool | 9 Double tripod joint |
| 3 Stroking piston | 7 Lens plate | |
| 4 Port 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 (4) and the lens plate (7) to the cylinder bores. The pistons (2) in the cylinder bores execute a stroke that is converted into rotation on the drive shaft flange. During this, the pistons generate output torque on the drive shaft while the cylinder (8) is carried by the double tripod joint (9) (series 10) or the tapered pistons (series 50). 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.

Flushing and boost-pressure valve

The flushing and boost-pressure valve (5) is used to remove heat from the hydraulic circuit. In an open circuit, it is used exclusively for flushing the housing. In a closed circuit, it ensures a minimum boost pressure level in addition to flushing the housing. Hydraulic fluid is directed from the respective low-pressure side into the motor housing. This is then fed into the reservoir, together with the leakage. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.

Control The swivel angle of the bent-axis rotary group is infinitely variable. Adjusting the swivel angle changes the piston stroke and, with it, the displacement. The swivel angle is controlled hydraulically by the stroking piston (3). Here, the cylinder (8) is swiveled including the pistons (2) and lens plate (7). The lens plate is mounted for easy motion in a guideway. 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 is dependent on the input flow and the displacement of the hydraulic motor.



Various control devices are available depending on requirements. Information about this can be found in the data sheet 91650 and 91655.

5.3 Product identification

The axial piston unit can be identified by the name plate. The following example shows an A36VM name plate:

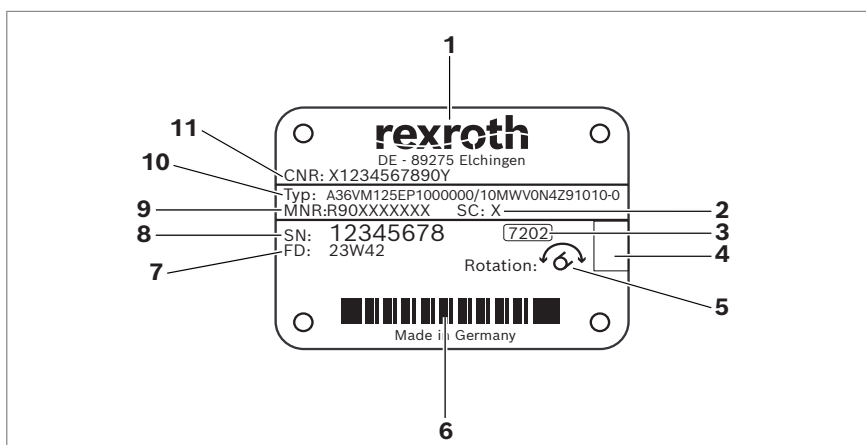


Fig. 4: Name plate A36VM

- | | |
|--|--|
| 1 Trademark | 7 Manufacturing date |
| 2 Sample category (optional) | 8 Serial number |
| 3 Internal plant designation | 9 Material number of the axial piston unit |
| 4 Designated area for inspection stamp | 10 Type code |
| 5 Direction of rotation (viewed on drive shaft) – here: bi-directional | 11 Customer material number |
| 6 Barcode | |

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 24.



Information on unpacking can be found in chapter 7.1 "Unpacking" on page 26.

6.1 Transporting the axial piston unit

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

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

Dimensions and weights

Table 6: Dimensions and weights

Size		60	125	255
Ground	kg	30.7	43.6	80
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 Transport by hand

Up to a specific maximum weight, axial piston units can be transported by hand for a short distance. Observe the national regulations in your country. To prevent health damage, we recommend renouncing any transport by hand.

CAUTION! Risk of injury due to heavy loads!

Health hazard from carrying axial piston units.

- ▶ Only manually transport the axial piston unit for a short period of time. Observe the national regulations in your country for manual transport.
- ▶ Always use appropriate lifting, lowering and moving techniques.
- ▶ Use your personal protective equipment (e.g. safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Do not transport the axial piston unit by sensitive assembled parts (e.g. sensors or valves).
- ▶ Carefully place the axial piston unit on the seating to prevent it from being damaged.

6.1.2 Transport with lifting devices

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

Transporting 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 indicated in the installation drawing.
- ▶ Make sure that the eye bolt can bear the total weight of the axial piston unit plus 20%.

You can lift the axial piston unit as shown in Fig. 5 with the eye bolt screwed into the drive shaft.

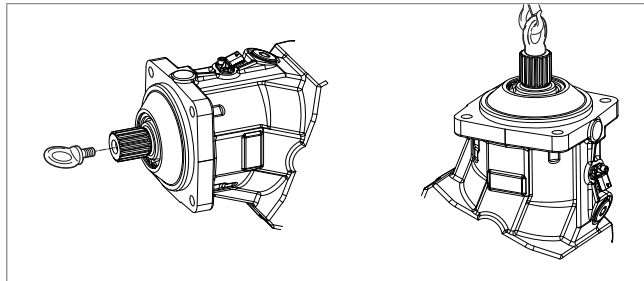


Fig. 5: Mounting the eye bolt

Transport with lifting strap

WARNING! Danger due to suspended loads!

During transport with lifting strap, the axial piston unit can topple out of the lifting strap and cause 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 swinging.
- ▶ Never step or grip under suspended loads.
- ▶ Place the lifting strap around the axial piston unit in such a way that it does not pass over assembled parts (e.g. valves, piping) and that the axial piston unit is not suspended from assembled parts (see Fig. 6).

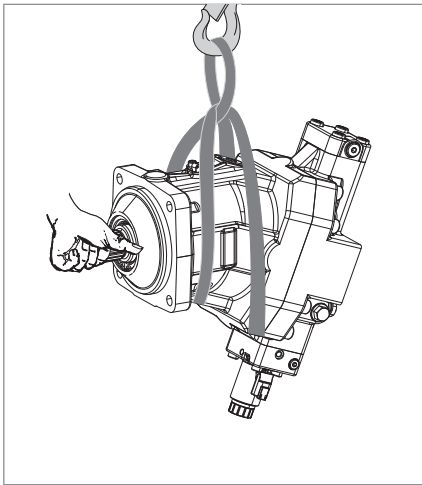


Fig. 6: Transport with lifting strap

6.2 Storing the axial piston unit

- Requirement
- Storage areas must be free of corrosive materials and gases.
 - To prevent damage to the seals, do not operate ozone-forming equipment (e.g. mercury-vapor lamps, high-voltage equipment, electric motors, sources of electrical sparks or electrical discharge) in storage areas.
 - Storage areas must be dry.
Recommended relative humidity ≤ 60%.
 - Ideal storage temperature: +5 °C to +20 °C.
 - Minimum storage temperature: -50 °C.
 - 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 assembled parts, e.g. sensors or valves.
 - For further storage conditions, see Table 7.
- Check the axial piston unit monthly to ensure professional storage.

After delivery The axial piston units come in corrosion protection packaging (corrosion protection film) provided at the factory.
Table 7 lists the maximum permissible storage times for an unpackaged axial piston unit as per data sheet 90312.

Table 7: Storage time with factory-supplied corrosion protection

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



The warranty will be voided if the requirements and storage conditions are not observed or after expiration of the max. storage time (see Table 7).

How to proceed once the max. storage time elapses:

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 functioning and leak-tightness.
3. If storage time exceeds 24 months, replace the shaft seal.



Once the max. storage time has elapsed, we recommend that you have the axial piston unit checked by your Bosch Rexroth service partner.

For questions regarding repair and spare parts, contact your proper Bosch Rexroth service partner or the service department of the manufacturer's plant of the axial piston unit, see chapter 10.5 "Spare parts" on page 45.

After removal

An uninstalled axial piston unit must be preserved with corrosion protection for the duration of storage.



The following instructions only refer to axial piston units operated with a mineral oil-based hydraulic fluid. Other hydraulic fluids require other specific preservation measures. In such a case, consult your local contact person; you can find their contact information at <https://addresses.boschrexroth.com>

Bosch Rexroth recommends the following procedure:

1. Clean the axial piston unit; see chapter 10.1 "Cleaning and care" on page 43.
2. Drain the axial piston unit.
3. For storage times 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 times up to 24 months: Fill the axial piston unit with VCI corrosion protection oil (20 ml).
Fill through the drain port **T₁** or **T₂**; see chapter 7.4 "Installing the axial piston unit", Fig. 9 to Fig. 11 on page 34.
4. Plug all ports so they are airtight.
5. Coat unpainted areas of the axial piston unit with mineral oil or suitable, easily removable corrosion protection, e.g. acid-free grease.
6. Pack the axial piston unit with desiccant in an airproof manner in corrosion protection film.
7. Store the axial piston unit in a shock-proof manner; see "Requirement" on page 24 in this chapter.

7 Installation

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

- Data sheet of the axial piston unit (contains the permissible technical data, main dimensions and circuit diagrams of standard versions)
- Installation drawing for the axial piston unit (can be obtained from your contact person at Bosch Rexroth, if required)
- Hydraulic circuit diagram for the axial piston unit (in the data sheet and on the installation drawing)
- Hydraulic circuit diagram for the machine/system (available from the machine/system manufacturer upon request)
- Order confirmation (contains the order-related technical data for your axial piston unit)

7.1 Unpacking

The axial piston unit comes in a polyethylene material (PE) corrosion protection film.

CAUTION! Danger due to falling parts!

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

- ▶ Place the packaging on a level underground with sufficient load-bearing capacity.
- ▶ 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 18.
- ▶ Dispose of the packaging in accordance with the regulations in your country.

7.2 Installation conditions

The installation position and location of the axial piston unit essentially determine how it is installed and commissioned (such as when filling and air bleeding the axial piston unit).

- ▶ Fasten the axial piston unit so that the expected forces and torque can be transferred without any danger. The machine/system manufacturer is responsible for sizing the fastening elements.
- ▶ Observe the permissible radial forces on the drive shaft when transferring output drive with radial force loading (belt drives).
- ▶ Make sure the axial piston unit is always filled with hydraulic fluid during commissioning and operation. Also do this also after relatively long standstill periods, since the axial piston unit may drain out through the hydraulic lines.
- ▶ Direct the leakage in the housing area to the reservoir through the highest drain port. Use a line size that matches the port.
- ▶ Avoid using a check valve in the drain line.
- ▶ To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts).
- ▶ Make sure that the drain line and return line flow into the reservoir below the minimum fluid level under all operating conditions. This prevents foaming.
- ▶ Make sure that the working environment at the installation site is completely free of dust and foreign substances. The axial piston unit must be clean when installed. Contamination of the hydraulic fluid can considerably affect the function and service life of the axial piston unit.
- ▶ Use fiber-free cleaning cloths for cleaning.
- ▶ Use suitable, mild cleaning agents to remove lubricants and other heavy contamination. Do not allow cleaning agents to enter into the hydraulic system.

7.3 Installation position

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



Recommended installation positions: 1 and 2.



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

Key	
F	Filling/air bleeding
T₁, T₂	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

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.

Installation position 1

A36VM		A36VE	
Air bleed	Filling	Air bleed	Filling
T ₁ (F)	T ₁ (F)	T ₁ or T ₂ (F)	T ₁ or T ₂ (F)

The diagram shows two axial piston pumps, A36VM and A36VE, installed in position 1. Both are oriented vertically with their drain ports (T1 and T2) pointing upwards. A horizontal line represents the fluid level in the reservoir. The immersion depth of the pump body is labeled as h_{t min}. The distance from the pump body to the reservoir bottom is labeled as h_{min}. The filling port (F) is connected to the top of the pump body. The A36VM has two drain ports (T1 and T2), while the A36VE has a single combined drain port (T1(T2)).

Installation position 2

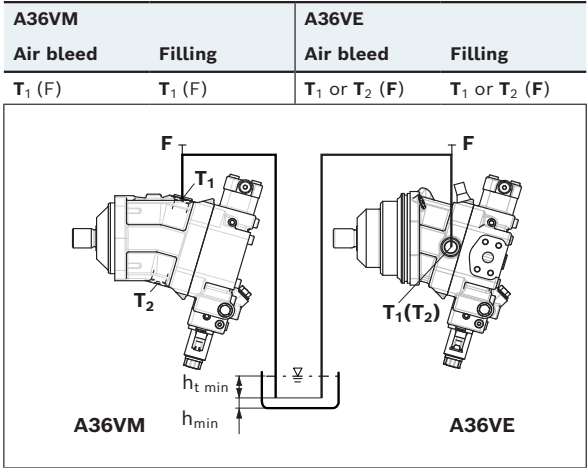
A36VM		A36VE	
Air bleed	Filling	Air bleed	Filling
T ₂ (F)	T ₂ (F)	T ₁ or T ₂ (F)	T ₁ or T ₂ (F)

The diagram shows two axial piston pumps, A36VM and A36VE, installed in position 2. Both are oriented horizontally with their drain ports (T1 and T2) pointing to the left. A horizontal line represents the fluid level in the reservoir. The immersion depth of the pump body is labeled as h_{t min}. The distance from the pump body to the reservoir bottom is labeled as h_{min}. The filling port (F) is connected to the top of the pump body. The A36VM has two drain ports (T1 and T2), while the A36VE has a single combined drain port (T1(T2)).

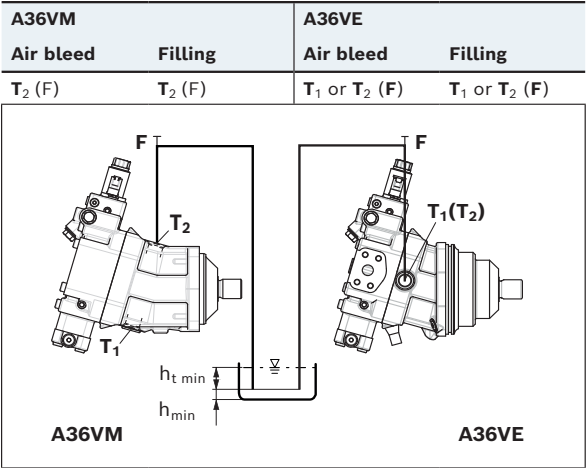
7.3.2 Above-reservoir installation

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

Installation position 3



Installation position 4



7.4 Installing the axial piston unit

7.4.1 Preparation

- 1. Check the specifications on the name plate to see you have the correct axial piston unit.
- 2. Compare the material number and designation (type code) with the parameters in the order confirmation.



If the material number for the axial piston unit does not match the one in the order confirmation, contact your local contact person for clarification. You can find their contact information at <https://addresses.boschrexroth.com>

- 3. Before installing, completely drain 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.

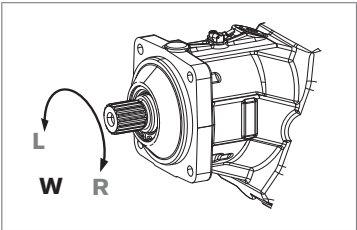


Fig. 7: Direction of rotation

- W Bi-directional (can rotate counter-clockwise and clockwise)
- L Counter-clockwise
- R Clockwise



The direction of rotation as indicated 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 21.

7.4.2 Dimensions

For standard versions, the data sheet 91650 and 91655 contains all required installation dimensions as well as the position and dimensions of the connections. If necessary, an installation drawing can be requested. 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 notices when installing the axial piston unit:

- Note that certain installation positions will affect the control system. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.
- If a shared drain line is used for several units, make sure that the respective case pressure in each unit 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 condition, particularly at cold start. If this is not possible, separate drain line must be laid.

How the axial piston unit is installed 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 a coupling

The following describes how to install the axial piston unit with a coupling:

NOTICE! Danger from improper handling!

Product can be damaged!

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

1. Install the specified coupling half on 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. Make sure that the installation location is clean and free from dirt and foreign particles.

3. 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.
4. Transport the axial piston unit to the installation location.
5. Assemble the clutch on the drive shaft of the machine in accordance with the specifications provided by the coupling manufacturer.



Do not fasten down the axial piston unit until the coupling has been correctly installed.

6. Fasten 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 so that there is no angular deviation.
Make sure no excessive axial and radial forces are acting on the drive shaft.
8. Details on the required tools and tightening torques for the mounting bolts are available from the machine/system manufacturer.

7.4.5 Installation on a gearbox

The following describes how to install the axial piston unit on a gearbox.

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

- ▶ Before installing, make sure that the spigot diameter centers the axial piston unit (observe tolerances) and that no excessive axial or radial forces are acting on the drive shaft of the axial piston unit (installation length).
- ▶ Protect the drive shaft against frictional corrosion by ensuring permanent lubrication.
- ▶ Fasten the axial piston unit at the installation location.

For attachment via gear wheel or helical gear shaft

No spline forces higher than the permissible axial and radial forces should act on the shaft; if necessary, support the gear wheel at the gearbox output separately.

7.4.6 Completion of installation

1. Remove any installed transport screws.

CAUTION! Operation with protective plugs!

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

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

2. Remove the transport protection.

The axial piston unit comes with protective covers **(1)** and protective plugs **(2)**. **(1)** and **(2)** 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 of the axial piston unit.

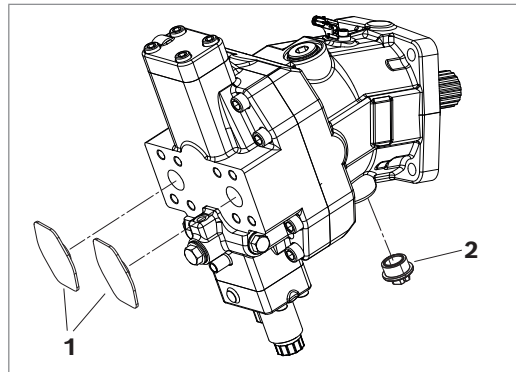


Fig. 8: Removing transport protection

- 1 Protective covers
- 2 Protective plugs/threaded plugs



Ports intended for connecting lines come with protective plugs and/or threaded plugs, which serve as transport protection. Make sure all ports required for functional operation are connected (see Table 8 "Ports A36VM/A36VE Series 10 and 50" on page 35). Non-compliance could lead to malfunctions or damage. If a port is not being used, plug it with a threaded plug since the protective plugs are not pressure-resistant.



Setting screws are protected against unauthorized adjustment by tamper-proof caps. Removal of the tamper-proof caps will void the warranty. If you need to change the settings, please contact your local contact person. You can find their contact information under <https://addresses.boschrexroth.com>

7.4.7 Hydraulically connecting the axial piston unit

The machine/system manufacturer is responsible for dimensioning of the lines. Connect the axial piston unit 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 p_{\max} permissible pressures of the respective ports, see Table 8 "Ports A36VM/A36VE Series 10 and 50" on page 35.

The machine/system manufacturer is required to 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 match the axial piston unit port (pressure level, size, system of units).

Information on routing of lines

Observe the following information when routing the pressure and drain lines.

- Lines and hoses must be assembled without pre-charge pressure so no further mechanical forces are applied during operation that will reduce the service life of the axial piston unit and, possibly, the entire machine/system.
- Use suitable seals as sealing material.
- Pressure line
 - For the pressure lines, use only pipes, hoses and connecting elements that are rated for the working pressure range specified in data sheets 91650 and 91655 (see Table 8).
- Drain line
 - Always route the drain lines so that the housing is constantly filled with hydraulic fluid and to ensure no air gets through the shaft seal, even during extended standstill periods.
 - The case pressure must never exceed the limit values specified for the axial piston unit in the data sheet.
 - The drain line inflow 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 assembled screw fittings, do not remove them. Screw the stud end of the fitting directly into the installed fitting.

Risk of confusion with threaded connections

Axial piston units are used in application areas that use the metric system as well as the Anglo-American (imperial) and the Japanese measuring system (JIS – **J**apan **I**ndustrial **S**tandard). Various kinds of seals are also 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. There is a risk of confusion due to the limited ways of visually telling them apart.

WARNING! Leaky and bursting stud ends!

For fittings, if a stud end that does not match the system of units, kind of seal and size of 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.

Port overview

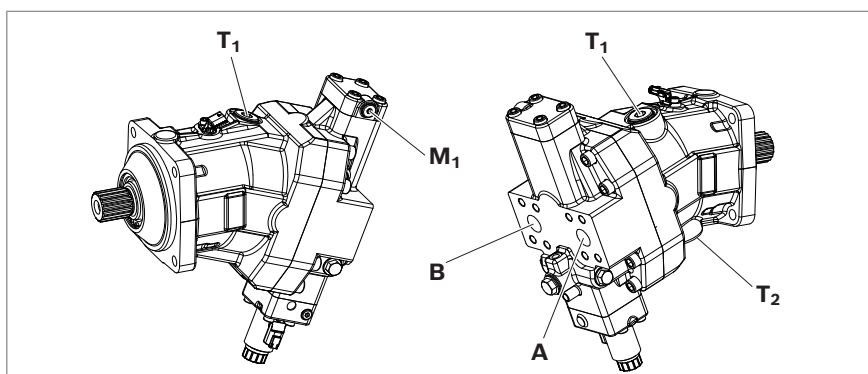


Fig. 9: Port overview A36VM with EP1, EP2 control, working ports at rear (port plate 1)

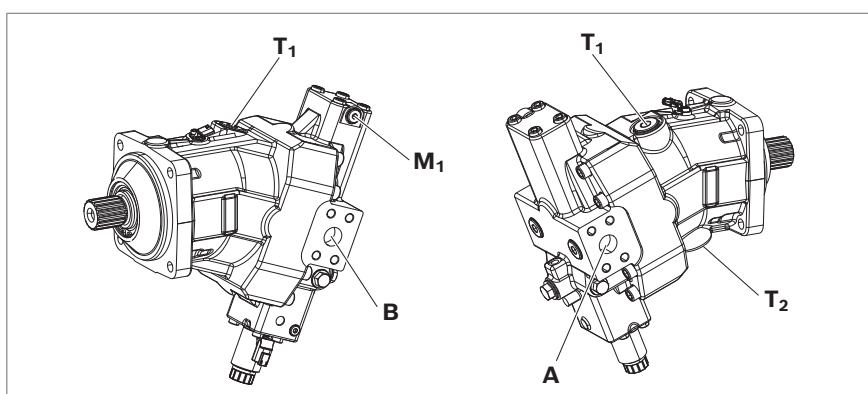


Fig. 10: Port overview A36VM with EP1, EP2 control, working ports on opposing sides (port plate 2)

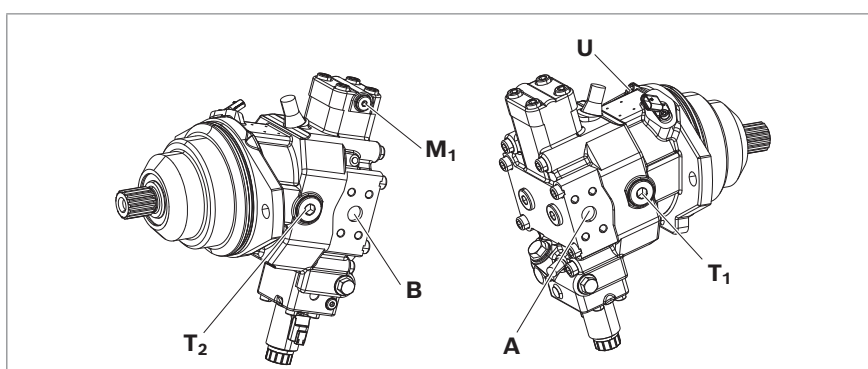


Fig. 11: Port overview A36VE with EP1 control, working ports on opposing sides (port plate 2)

Table 8: Ports A36VM/A36VE Series 10 and 50

Ports ¹⁾		p_{\max} [bar] ²⁾	State ³⁾
A, B	Working port	530	O
T₁	Drain port	3	O ⁴⁾
T₂	Drain port	3	X ⁴⁾
U	Bearing flushing port	3	X
M₁	Measuring port, control pressure	530	X

1) The measuring system and thread size can be found in the installation drawing.

2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

4) Depending on the installation position, **T₁** or **T₂** must be connected (see chapter 7.3 "Installation position" on page 28)

Tightening torques

The following tightening torques apply:

- Fittings:

Observe the manufacturer's specifications regarding the tightening torques of the fittings used.

- Female threads in the axial piston unit:

The max. permissible tightening torques $M_{G \max}$ are the maximum values for the female threads and must not be exceeded. For values, see Table 9.

- 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 9.

- Mounting bolts:

For mounting bolts with metric ISO threads according to DIN 13 and/or ASME B1.1 threads, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.



In addition to the ports specified in Table 8 "Ports A36VM/A36VE Series 10 and 50" on page 35, axial piston units may have openings that are also closed with a threaded plug. These plugs must not be opened on the customer side. If you have opened the threaded plug accidentally, please contact your local contact person to ensure safe re-closing of the plug. You can find the address at <https://addresses.boschrexroth.com>

Table 9: Tightening torques for female threads and threaded plugs

Ports Standard	Thread size	Maximum permissible tightening torque of female threads $M_{G \max}$	Required tightening torque of threaded plugs M_V	WAF hexagon socket of the threaded plug
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

Procedure

To connect the axial piston unit to the hydraulic system:

1. Remove the protective plugs and/or threaded plugs from the ports where the connections must be made according to the hydraulic circuit diagram.
2. Make sure 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 37 when you flush the hydraulic system.)
4. Connect the lines in accordance with the installation drawing and the machine or system circuit diagram. Check that all ports are connected or plugged with threaded plugs.
5. Properly tighten the fittings (observe tightening torques!). Mark all properly 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 safe working condition.



Relationship between direction of rotation and flow direction:

Clockwise rotation: **A to B**

Counter-clockwise rotation: **B to A**

7.4.8 Electrically connecting the axial piston unit

NOTICE

Short circuit due to 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 electric control layout. 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, observe the parameters in data sheet 91650 and 91655, e.g.:

- 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 91650 and 91655. The mating connector is not included in the scope of delivery.

Procedure

1. Switch off the power supply to the relevant machine/system component.
2. Electrically connect the axial piston unit (12 or 24 V). Before establishing the connection, check the connector and all seals for damage.

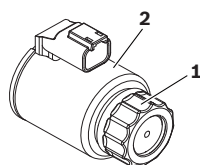
Changing connector position

If necessary, you can change the position of the connector by turning the solenoid body. This is independent of the connector version.

CAUTION! Hot surfaces on the solenoid!

Risk of getting burnt!

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



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. Re-tighten the mounting nut. Tightening torque of the mounting nut: 5+1 Nm (width across flats SW26, 12kt DIN 3124).

7.5 Performing flushing cycle

In order to remove foreign particles from the system, Bosch Rexroth recommends a flushing cycle for the hydraulic system before the first commissioning. To avoid internal contamination, do not include the axial piston unit in the flushing cycle.



Use an additional flushing unit to perform the flushing cycle. 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 injury!

- ▶ Pay attention to and eliminate potential danger sources before commissioning 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 incorrectly installed product!

Risk of injury and property damage!

- ▶ Make sure all electrical and hydraulic ports are connected or plugged.
- ▶ Commission only a fully installed, fully functioning product with original accessories from Bosch Rexroth.

8.1 Initial commissioning



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

- ▶ Connect the pressure gauge for 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 during the first operation.
- ▶ During commissioning, monitor the temperature of the hydraulic fluid in the reservoir to ensure that it lies within permissible viscosity limits.

8.1.1 Filling the axial piston unit

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



Usually, the cleanliness level of commercial hydraulic fluids is insufficient for the requirements of 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: Details of minimum requirements for hydraulic fluids can be found in the Rexroth data sheets 90220 and 90221 (only permissible with series 50). 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)". Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} ; see selection diagram in the data sheet 91650 and 91655).

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 mm²/s (e.g. due to high temperatures during short-term operation), 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 91650 and 91655.

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 commercial hydraulic fluids are usually insufficient for the requirements of our components.

- Use a suitable filter system to filter hydraulic fluids during filling to minimize solid particle contamination 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. Also fill the hydraulic lines of the system.

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

For information on troubleshooting, see chapter 14 "Troubleshooting" on page 49. To test the hydraulic fluid supply:

1. Allow the axial piston unit to run at low rotational speed and low load. Pay attention to leaks and noises.
2. Check the axial piston unit's drain line during the test. The leakage should be without bubbles.
3. Increase the load and check whether the working pressure rises as expected.
4. Perform a leak test to ensure the hydraulic system is sealed and can withstand the max. pressure.
5. At maximum working pressure, check the case pressure at port **T₁** or **T₂**. Refer to data sheet 91650 and 91655 for the permissible value.

8.1.3 Performing a functional test



WARNING

Improperly connected axial piston unit!

Mixing up the ports will cause malfunctions (e.g. lift instead of lower) and could endanger personnel 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, perform a functional test of the machine/system. The functional test must be performed according to the instructions of the machine/system manufacturer.

The axial piston unit is tested for functional capability and performance before delivery according to the technical data. During commissioning, make sure the axial piston unit was installed in the machine/system as intended.

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

8.2 Running-in phase

NOTICE

Property damage due to insufficient viscosity!

Elevated hydraulic fluid temperature may excessively reduce viscosity 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 unacceptable operating temperatures and/or viscosities occur.
- ▶ Excessively high operating temperatures indicate faults that have to be analyzed and eliminated.

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 mechanical-hydraulic efficiency is also greater until the running-in phase of about 10 operating hours is concluded.

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, Bosch Rexroth recommends changing 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.

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 38.

9 Operation



WARNING

Overloading of the axial piston motor!

Risk of injury or property damage!

When using the axial piston motor in winch drives it may, when extremely overloaded (e.g., if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), cause the rotary group to be damaged and, in the worst case, the axial piston motor may burst.

- ▶ Ensure that the technical limit values are not exceeded in any operating conditions.
- ▶ Check whether any additional measures are needed for your machine/system (up to an encapsulation) in order to avoid any hazard to persons. If necessary, make sure that these are properly implemented.
- ▶ For safety reasons, axial piston variable motors with beginning of control at $V_{g \min}$ (e.g. HA) are not permissible for winch drives (e.g. anchor winches).

This 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 proper project planning of the hydraulic system and its control.

10 Maintenance and repair

NOTICE

Overdue inspection and maintenance work!

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 effects!

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

- ▶ Do not point a 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 plug-in connections are securely seated to ensure 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 aggressive cleaning agents.
- ▶ Remove major external contamination and keep clean sensitive and important components, such as solenoids, valves, indicators and sensors.

10.2 Inspection

In order for the axial piston unit to be reliable and long-lasting, Bosch Rexroth recommends inspecting the hydraulic system and axial piston unit on a regular basis, and documenting and archiving the following operating conditions:

Table 10: Inspection schedule

Tasks to be performed	Interval
Hydraulic system	Check hydraulic fluid level in the reservoir. Daily
	Perform hydraulic fluid analysis: Viscosity, aging and contamination Yearly or every 2000 operating hours (whichever occurs first)
	Check filter. The replacement interval may vary depending on the cleanliness of the hydraulic fluid. We recommend using a contamination indicator. Yearly or every 1,000 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 rectify them. This is why Bosch Rexroth recommends always keeping the axial piston unit and system clean. Daily
	Check axial piston unit for unusual noise development. Daily
	Check mounting 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 if the permissible operating parameters are observed. You can ask your local contact person about service life based on load cycle. You can find their contact information at <https://addresses.boschrexroth.com>

Based on these parameters, a maintenance interval must 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 assembled parts should only be performed by service centers certified by Bosch Rexroth.

- Only use original spare parts from Rexroth to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit cannot be guaranteed, and the warranty will be voided.

For questions regarding repairs, contact your proper Bosch Rexroth service partner or the service department of the manufacturer's plant of the axial piston unit; see chapter 10.5 "Spare parts" on page 45.

10.5 Spare parts

CAUTION

Use of unsuitable spare parts!

Spare parts that do not meet the technical requirements specified by Bosch Rexroth can cause injury and property damage!

- Only use original spare parts from Rexroth to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit cannot be guaranteed, and the warranty will be voided.

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 manufacturer's plant of the axial piston unit.

Bosch Rexroth AG
Glockeraustrasse 2
89275 Elchingen, Germany
Hotline +49 9352 405060

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

For general inquiries, please contact your local contact person, you can find the address under <https://addresses.boschrexroth.com>

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 relevant system part 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 the relevant machine/system components are depressurized and de-energized.
2. Secure the relevant system part against reactivation.

11.3 Performing the 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, seal the connection to the reservoir and/or drain the reservoir.
4. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may leak.
5. Disconnect 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 drain 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 24.

12 Disposal

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

Observe the following when disposing of the axial piston unit:

1. Completely drain the axial piston unit.
2. Dispose of the axial piston unit and packaging material in accordance with the regulations in your country.
3. Dispose of the hydraulic fluid in accordance with the regulations of your country. Also observe the applicable safety data sheet for the hydraulic fluid.
4. Disassemble the axial piston unit into its constituent parts for proper recycling.
5. For example, separate the parts into:
 - 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. This also includes changing the wiring.

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 configuration as delivered. The warranty will be voided if the unit is modified or extended.



Setting screws are protected against unauthorized adjustment by tamper-proof caps. Removal of the tamper-proof caps will void the warranty. If you need to change the settings, please contact your local contact person. You can find their contact information under <https://addresses.boschrexroth.com>

14 Troubleshooting

The Table 11 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).
- ▶ Work systematically and in a targeted manner, 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 functions 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: Which ones?
 - 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.

14.2 Malfunction table

Table 11: Axial piston unit malfunction table

Malfunction	Possible cause	Remedy
Unusual noises	Insufficient air bleeding of the hydraulic system	Fill the axial piston unit, suction line for the hydraulic pump and the reservoir
		Completely air bleed the 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 assembled parts, hydraulic lines or improper installation of the coupling	Fasten assembled parts according to the parameters provided by the coupling fitting manufacturer
Increased, unusual vibration	Resonances due to a defective or unsuitable elastic coupling	Check the specification of the elastic coupling and/or exchange defective or worn coupling
	Mechanical damage to the axial piston unit (e.g. bearing damage)	Replace axial piston unit Contact Bosch Rexroth Service
	Bearings worn	Contact Bosch Rexroth Service
No or insufficient pressure	Insufficient air bleeding of the hydraulic system	Fill the 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 of the control device or controller of the axial piston unit	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
Pressure/flow fluctuations/ instabilities	Drive unit defective (e.g. hydraulic pump)	Contact machine/system manufacturer
		Fill the axial piston unit, suction line for the hydraulic pump and the reservoir
		Completely air bleed the axial piston unit and hydraulic system
	Unstable control signal	Check correct installation position
		Contact machine/system manufacturer or Bosch Rexroth Service
	Malfunction in the control devices or the controller	Contact Bosch Rexroth Service

Table 11: Axial piston unit malfunction table

Malfunction	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 optimal 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
Excessively high temperature of hydraulic fluid and housing	Wrong direction of rotation	Check function of the hydraulic pump
		Machine/system manufacturer: Check correct direction of rotation, see chapter 1.1.11 "Preparation" on page 29
	Excessively high inlet temperature at the axial piston unit	Machine/system manufacturer: Inspect system, e.g. malfunction in the cooler, insufficient hydraulic fluid in the reservoir
	Wrong setting and/or malfunction of the pressure limitation and pressure control valves (e.g. high-pressure relief valve, 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

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