DBR AUTOMATION

rexroth
A Bosch Company

Operating instructions

Servo-hydraulic pump unit

Type SHP4V with A4VZA and MS2N

RE 51195-B, Edition: 2023-05, Replaces: -

The data specified above only serve to describe the product. 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 configuration. The product supplied may therefore differ from the figure shown.

The original operating instructions were prepared in German.

Contents

1 About this documentation

1.1 Validity of the documentation

The present documentation applies to the following products:

- Servo-hydraulic pump unit, type SHP4V, consisting of axial piston variable displacement pump A4VZA incl. control/adjustment device and synchronous servo motor MS2N

This documentation is intended for assemblers, operators, service engineers and system end-users and machine and system manufacturers.
This documentation contains important information on the safe and proper assembly, transport, commissioning, operation, use, maintenance, disassembly and simple troubleshooting of the product.

▶ Read this documentation thoroughly, and in particular chapter 2 "Safety instructions" and chapter 3"General information on damage to property and damage to product", before handling the product.

1.2 Required and amending documentation

▶ The product must not be commissioned until you have been provided with the documentation marked with the book symbol 🕮 and you have understood and observed it.

Table 1: Required and amending documentation

	Title	Document number	Document type
🕮	Servo-hydraulic pump unit, type SHP4V with A4VZA and MS2N	51195	Data sheet
🕮	Hydraulic fluids based on mineral oils and related hydrocarbons	90220	Data sheet
🕮	Environmentally compatible hydraulic fluids; includes application notes and requirements for Rexroth hydraulic components	90221	Data sheet
🕮	Flame-resistant, water-free hydraulic fluids (HFDR/HFDU); application notes and requirements for Rexroth hydraulic components	90222	Data sheet
🕮	Hydraulic valves and hydroelectric pressure switches for industrial applications; on/off valves, proportional servo valves, pressure switches	07600-B	Operating instructions
🕮	General operating instructions for axial piston units	90300-B	Operating instructions
🕮	Axial piston variable displacement pump A4VZA series 1X for servo-hydraulic axes	In preparation	Data sheet
🕮	Proportional directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE), type 4WREE	29105	Data sheet
🕮	Control and adjustment systems HM, HS5 and EO series 1x and 30	92076	Data sheet
🕮	MS2N, synchronous servo motors	R911347580	Operating instructions
🕮	MS2N, synchronous servo motors	R911347582	Project planning instructions

1.3 Representation of information

Uniform safety instructions, symbols, terms and abbreviations are used so that you can quickly and safely work with your product using this documentation.
For a better understanding, they are explained in the following sections.

1.3.1 Safety instructions

In this documentation, safety instructions are indicated whenever sequences of actions are explained which bear the risk of personal injury or damage to property. The measures described for hazard avoidance must be observed.
Safety instructions are set out as follows:

⚠ SIGNAL WORD
Type and source of danger Consequences in case of non-compliance ▶ Hazard avoidance measures ▶ <Enumeration>

- **Warning sign:** Draws attention to the danger
- **Signal word:** Identifies the degree of danger
- **Type and source of danger:** Specifies the type and source of danger
- **Consequences:** Describes the consequences of non-compliance
- **Precaution:** Specifies how the danger can be prevented

Table 2: Risk classes according to ANSI Z535.6-2006

Warning sign, signal word	Meaning
⚠ DANGER	Indicates a dangerous situation which will cause death or severe injury if not avoided.
⚠ WARNING	Indicates a dangerous situation which may cause death or severe personal injuries if not avoided.
⚠ CAUTION	Indicates a dangerous situation which may cause minor or medium personal injuries if not avoided.
NOTICE	Damage to property: The product or the environment could be damaged.

1.3.2 Symbols

The following symbols indicate notes which are not safety-relevant but increase the comprehensibility of the documentation.

Table 3: Meaning of the symbols

Symbol	Meaning
	If this information is not observed, the product cannot be optimally used and/or operated.
▶	Individual, independent action
1. **2.** **3.**	Numbered instruction: The numbers indicate that the actions must be carried out one after the other.

1.3.3 Abbreviations

The following abbreviations are used in this documentation:

Table 4: Abbreviations

Abbreviation	Meaning
ATEX	EU Explosion Protection Directive (Atmosphère explosible)
RE XXXXX	Rexroth document in English language
RE XXXXX-B	Rexroth operating instructions in English
SHP	**S**ervo-**H**ydraulic **P**ump unit

2 Safety instructions

2.1 About this chapter

The SHP4V has been manufactured according to the generally accepted codes of practice. However, there is still the danger of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- Read this documentation completely and thoroughly before working with the SHP4V.
- 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 SHP4V on to third parties.

Installation of the SHP4V in the machine/system results in additional potential hazards due to the interaction between the SHP4V and the overall machinery/system. This applies in particular to the influence of hydraulic and electric controls on hydraulic drives generating mechanical movements. It is therefore essential for the manufacturer of the overall machinery/system to have undertaken an independent risk assessment. Furthermore, the manufacturer must on this basis have prepared operating instructions for the overall machinery/system.

These operating instructions do not serve as replacement of the operating instructions of the overall machinery/system.

2.2 Intended use

The SHP4V is an electro-hydraulic drive system.

The SHP4V may be used as follows:
The SHP4V constitutes partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC and is respectively not usable.
The SHP4V is exclusively intended for integration into a machine or system or to be assembled with other components to form a machine or system.
The SHP4V may be commissioned only if it has been integrated into the machine or system for which it is designed and if the machine or system fully complies with the requirements of the EC Machinery Directive.
The SHP4V is used for pressure-controlled hydraulic supply of a machine or system.

The SHP4V is not considered to be a safety component in the sense of the EC Machinery Directive 2006/42/EC.
The SHP4V must not exceed the operating conditions and performance limits specified in the technical data.

The SHP4V may only be operated in its original condition and not damaged.

The SHP4V is only intended for professional use and not for private use.

Intended use includes having read and understood this documentation, especially chapters 2 "Safety instructions" and 3 "General information on damage to property and damage to product".

2.3 Improper use

Any use deviating from the intended use is improper and thus not admissible.

Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes responsibility for all risks surrounding improper use.

The SHP4V is not suitable for operation in explosive environments.

Improper use of the SHP4V also includes:
- Incorrect installation
- Incorrect storage
- Incorrect transport
- Lack of cleanliness during storage, assembly and operation
- Non-compliance with the prescribed maintenance intervals
- Performing unauthorized maintenance and repairs
- Operation outside the specified environmental and application conditions as well as the specified performance limits according to the technical data sheet
- Use in safety-relevant functions

2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics and hydraulics as well as knowledge of the appropriate technical terms.

Transport

For transporting and handling the SHP4V, additional knowledge of how to handle lifting gear and the necessary attachment devices is required.

Installation and removal

Installation and removal of the SHP4V in/from the machine or system is permitted to the extent specified in these operating instructions by trained specialist personnel of the customer.

Repairs

Repairs may only be carried out by Bosch Rexroth or by personnel trained by Bosch Rexroth.

Specialist

In order to ensure safe use, these activities may only be carried out by an expert in the respective field or an instructed person under the direction and supervision of an expert.
Experts are those who can recognize potential dangers and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant conditions pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules.

Expertise

Expert knowledge means for example:
- Being able to read and completely understand hydraulic and electric circuit diagrams
- Having knowledge of the function and set-up of electro-hydraulic components

Bosch Rexroth offers measures supporting the training in specific fields. An overview of the training contents is available on the Internet via the following link: www.boschrexroth.com/en/de/academy.

2.5 General safety instructions

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Only use Rexroth products in technically perfect condition.
- Observe all notes on the product.
- Persons who assemble, operate, disassemble or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to react.
- Only use accessories and spare parts approved by the manufacturer in order to exclude hazards to persons due to unsuitable spare parts.
- Comply with the technical data and environmental conditions specified in the product documentation.
- The installation or use of inappropriate products in safety-relevant applications could result in unintended operating conditions when being used which in turn could cause personal injuries and/or damage to property. Therefore, only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product, or if the safe suitability of the product in the application is confirmed by a separate conformity assessment procedure for the end product, e.g. in explosion protection zones or in safety-related parts of control systems (functional safety).
- Do not commission the product until you can be sure that the end product (for example a machine or system) where the Rexroth product is installed complies with the country-specific provisions, safety regulations and standards of the application.

2.6 Product- and technology-dependent safety instructions

⚠ WARNING

Pressurized SHP4V!
Danger to life, risk of injury, severe injury when working on the pressurized SHP4V! Damage to property!

- Make sure that the SHP4V is depressurized (force-free)!
- Do not disconnect any line connections, connections or components as long as the SHP4V is under pressure.
- Switch off all force-transmitting components and connections (electric and hydraulic) according to the manufacturer's specifications and secure them against restarting. If possible, remove the main fuse of the overall machinery/system.

Leakage of hydraulic fluid under high pressure due to bursting of hydraulic components during operation of the SHP4V above the maximum admissible peak pressure!
Danger to life! Risk of injury! Damage to property!

- Make sure that changes to the factory parameters are only made by a hydraulics specialist.
- Use a pressure relief valve to protect the hydraulic system, as the pressure cut off and/or the pressure controller of the axial piston unit do not provide sufficient protection against pressure overload.

High electrical voltage!
Danger to life and risk of injury caused by electric shock!

- Make sure the relevant machine/system part is de-energized before assembling the product or when connecting or disconnecting connectors.
- Secure the overall machinery/system against restarting.
- Only operate the SHP4V with a permanently installed protective grounding conductor.

Electro-magnetic/magnetic fields!
Health hazard for persons with heart pacemakers, metal implants/metal fragments or hearing aids in proximity to electrical equipment!

- Make sure that the above-mentioned persons are not allowed to enter areas where electrical equipment and parts are assembled, operated or commissioned, or where motor parts with permanent solenoids are stored, repaired or assembled, or are allowed to do so only after consulting a physician.

⚠ WARNING

Sucking in hair, clothing or loose objects through the fan wheel of the synchronous servo motor MS2N!

Danger to life! Risk of injury!

- Take personal protective measures before approaching running fan units.
  - Do not wear any jewelry.
  - Wear tight-fitting clothing.
  - Use personal protective equipment.
  - Tie back long hair.

Direct contact with live components in case of fault, e.g. loose terminals, insulation defects, missing grounding, malfunction of fuses or damaged lines, components or terminals!

Danger to life! Risk of injury! Danger caused by electric shock or severe injury!

- Before any maintenance work, de-energize the relevant machine/system part.
- Do not open any live parts during operation.
- Carry out regular inspection according to e.g. DGUV-V3.
- Ensure continuous connection of the protective grounding conductor.
- Observe the operating conditions and performance limits specified in the technical data.
- Work at electric equipment may only be performed by specialized electricians.
- Comply with the recommended inspection and maintenance intervals.

Leakage of (pressurized) hydraulic fluid or coolant (due to leakage) and liquid mist!

Danger to life! Risk of injury! Explosion hazard! Risk of fire! Environmental pollution! Damage to property!

- Switch the machine/system off immediately (emergency stop switch).
- Identify and eliminate the leakage and contact your Bosch Rexroth account manager if necessary.
- Never try to stop or seal the leakage or the fluid jet using a cloth.
- Avoid direct contact with the leaking fluid.
- Carry out regular visual inspections for leak-tightness of the SHP4V and the fluid-carrying components.
- Escaping fluids may be hot. Allow the SHP4V to cool down sufficiently and wear protective clothing if work is required on a hot SHP4V.
- Wear your personal protective equipment.
- Keep open flames and ignition sources away from the SHP4V.
- When dealing with fluids, you must imperatively observe the manufacturer's information.

⚠ CAUTION

Hot surfaces on the SHP4V!

Risk of burning! Risk of injury! Risk of ignition!

- Only touch the surfaces of the SHP4V with protective gloves or do not work at hot surfaces.
  During or after the operation, temperatures may rise to values higher than 80 °C (176 °F), depending on the operating conditions.
- Allow the SHP4V to cool down sufficiently before touching it.
- Observe the protective measures of the end machine manufacturer.

Leaked hydraulic fluid, oily surfaces!

Risk of injury! Slip hazard!

- Protect and mark the danger zone.
- Immediately remove hydraulic fluid that has leaked out.
- Use an oil binding agent in order to bind the leaked hydraulic fluid.
- Remove and dispose of the contaminated oil binding agent, see chapter 12 "Disposal".
- Wear the personal protective equipment, e.g. safety shoes, prescribed for your activity.
- Perform a leak test.

Contact with hydraulic fluid!

Health hazard/impairment of health, e.g. eye injuries, skin lesions, intoxication upon inhalation or due to swallowing, sensitization!

- Avoid contact with hydraulic fluids.
- When dealing with hydraulic fluids, you must implicitly observe the safety instructions of the hydraulic fluid manufacturer.
- Wear your personal protective equipment, like e.g. safety goggles, protective gloves, suitable working clothes, safety shoes.
- If nevertheless hydraulic fluid comes into contact with the eyes or gets into the bloodstream or is swallowed, please consult a doctor immediately.

Sharp edges and burrs!

Risk of injury!

- Wear personal protective equipment, e.g. protective gloves.

Improperly laid lines and cables!

Risk of stumbling!

- Lay cables and lines so that no-one can trip over them.
- Fasten cables and lines in order to prevent them from getting loose during vibrations.

⚠ CAUTION

High noise development during operation! Health hazard in the immediate vicinity of the SHP4V due to high noise emission!

Danger of hearing damage (temporary/permanent), stress/loss of attention!

Fault in voice communication and acoustic signals!

- If required, provide suitable structural noise protection measures.
- Use a suitable ear protection, if required.
- Consult the machine manufacturer or Bosch Rexroth to identify any malfunction if applicable.

2.7 Personal protective equipment

During operation and maintenance work as well as during installation and removal of the SHP4V, always wear the following personal protective equipment:

- Heat or cold-resistant protective gloves
- Ear protection
- Safety shoes
- Perfectly fitting safety goggles
- Protective helmet

2.8 Obligations of the machine end-user

In order to ensure safety when handling the SHP4V and its components, the machine/system end-user must:

- guarantee the intended use of the SHP4V and its components according to chapter 2.2 "Intended use".
- instruct the operating personnel regularly in all items of the operating instructions and make sure that they are observed.
- ensure compliance with the instructions on occupational safety and with the operating instructions.
- ensure compliance with operating data (admissible operating temperature, maximum operating pressure).

The machine end-user of the Rexroth SHP4V is obliged to provide personnel training on a regular basis regarding the following subjects:

- Observation and use of the operating instructions and the legal regulations
- Intended operation of the Rexroth product
- Observation of the instructions of factory security officers and of the operating instructions of the machine end-user
- Behavior in case of emergency

The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology. Accordingly, Rexroth products and their properties have to be considered as components of installations, systems and machines for their holistic IT security concept.
Unless otherwise documented, Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

3 General information on damage to property and damage to product

The warranty only applies to the delivered configuration. The claim to warranty expires if the product is assembled, commissioned and operated incorrectly, not used as intended and/or handled improperly.

NOTICE

Danger due to improper handling!

Damage to property!

- Use the SHP4V only according to chapter 2.2 "Intended use".
- Do not expose the SHP4V to any mechanical loads under any circumstances.
- Do not place any objects on the SHP4V.
- Do not use the SHP4V as handle or step.
- Do not apply any external loads on the SHP4V.

Operation with insufficient hydraulic fluid!

Damage to property!

- When commissioning or re-commissioning the machine/system, the oil tank as well as the working lines of the SHP4V and the components must be filled and remain filled with hydraulic fluid during operation according to manufacturer's specifications.
- Observe the machine/system manufacturer's specifications regarding the point "Control of the hydraulic fluid" and the prescribed remedial measures for the control result.

Leaking or spilled hydraulic fluid!

Environmental pollution and contamination of the ground water!

- Use an oil binding agent in order to bind the leaked hydraulic fluid.
- When filling and draining the hydraulic fluid, always put a collecting pan under the SHP4V.
- Observe the information in the safety data sheet of the hydraulic fluid and the machine/system manufacturer regulations.

NOTICE

Mixing hydraulic fluids!

Damage to property!

- Generally avoid any mixing of hydraulic fluids of different manufacturers and/or of different types of the same manufacturer.
- Check the compatibility of the various hydraulic fluids and their compatibility with the components and seals. Mixing of hydraulic fluids may occur, for example, due to hydraulic fluid residues in a component.

Contamination by fluids and foreign particles!

Early wear and malfunctions!

Take the following measures to protect the SHP4V:

- During assembly, provide for cleanliness in order to prevent foreign particles e.g. welding beads or metal chips from getting into the hydraulic lines and causing wear or malfunctions in the SHP4V.
- Make sure that all connections, hydraulic lines and attachment parts (e.g. measuring devices) are clean and free of chips.
- For removing lubricants or any other contamination, use industrial residue-free wipes.
- Only complete cleaning processes at the SHP4V if the hydraulic connections are closed.
- Before commissioning, ensure that all hydraulic and mechanical connections have been made.
- Ensure that no pollutants are able to penetrate when sealing the measuring ports.

Improper cleaning!

Damage to property!

- Cover all openings with the appropriate protective threads in order to prevent cleaning agents from penetrating the system.
- Check that all seals and electric plug-in connections are firmly fitted to prevent the penetration of cleaning agents.
- Do not use aggressive cleaning agents for cleaning. Clean the SHP4V with a suitable cleaning liquid.
- Do not use high-pressure washers.
- Do not use compressed air for the cleaning at functional interfaces.

Environmental pollution caused by incorrect disposal!

Environmental pollution! Damage to property!

- Dispose of the SHP4V, the hydraulic fluid and the packaging in accordance with the applicable national regulations in your country.
- Dispose of the hydraulic fluid according to the applicable safety data sheet of the hydraulic fluid.

4 Scope of delivery

Included within the scope of delivery:

- Servo-hydraulic pump unit SHP4V consisting of axial piston variable displacement pump A4VZA incl. control/adjustment device and synchronous servo motor MS2N
- Operating instructions (this document)

For further information on optionally available components and accessories, see data sheet 51195, see chapter 1.2 "Required and amending documentation".

5 Product information

5.1 Performance description

Fields of application

The SHP4V is a closed-circuit electro-hydraulic drive system for hydraulic machines, such as presses or plastics processing machines. It provides hydraulic power (p, Q) so that either an actuator can be operated directly or hydraulic power can be provided into a hydraulic system as needed.

Closed circuit

In a closed circuit, the hydraulic fluid flows from the hydraulic pump to the actuator, e.g. cylinder, and from there directly back to the hydraulic pump. There is a high-pressure side and a low-pressure side, which alternate depending on the load.

2-point adjustment

2-point adjustment of the displacement is realized via an on/off valve. In this case, the user can choose between two displacements depending on the switching position of the control valve. The choice of the respective displacement is mostly based on the required hydraulic pressure and the resulting torque for the drive motor.

Optionally, the exact actual value of the displacement can be recorded by means of a swivel angle sensor (see also proportional adjustment).

Proportional adjustment

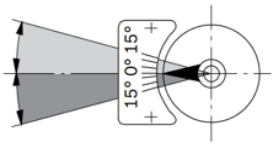
The displacement of the pump is continuously adjusted with the attached proportional servo valve in accordance with the command value presettings. The actual displacement is fed back via a position transducer.

This adjustment system gives the user maximum flexibility for their control tasks.

Multi-quadrant operation

The SHP4V is designed as a 4-quadrant-capable system, i.e. it can be used – depending on the application – for pressure build-up/pump operation or for pressure reduction/motor operation.
The flow direction can be changed by reversing the direction of rotation or optionally by reversing the swivel angle.

Table 5: Flow direction

Direction of rotation (view on shafts)		**Swivel range**		
Servo motor / Pump	Servo motor / Pump	Pilot control valve		Display
left / right	left / right	Control		
B to A	A to B	-100%	right	
A to B*	B to A	+100%	left	

*Preferred direction

For further information on this or your specific requirements, please contact your Bosch Rexroth account manager.

Space-saving installation

The axial piston variable displacement pump A4VZA is attached to the synchronous servo motor MS2N without a coupling and forms a compact and inertia-optimized motor-pump unit with it. Direct connection to the control block or cylinder is made possible by the optimized subplate of the pump.

Low noise level

This set-up and other technical features of the axial piston unit optimized for variable-speed operation not only reduce the space required, but in particular the pressure pulsation and the noise emission of the drive in the machine/system.

5.2 Product description

The SHP4V consists of a synchronous servo motor MS2N and an axial piston variable displacement pump A4VZA including a control/adjustment device.

5.3 Component overview

The SHP4V mainly consists of the following components:

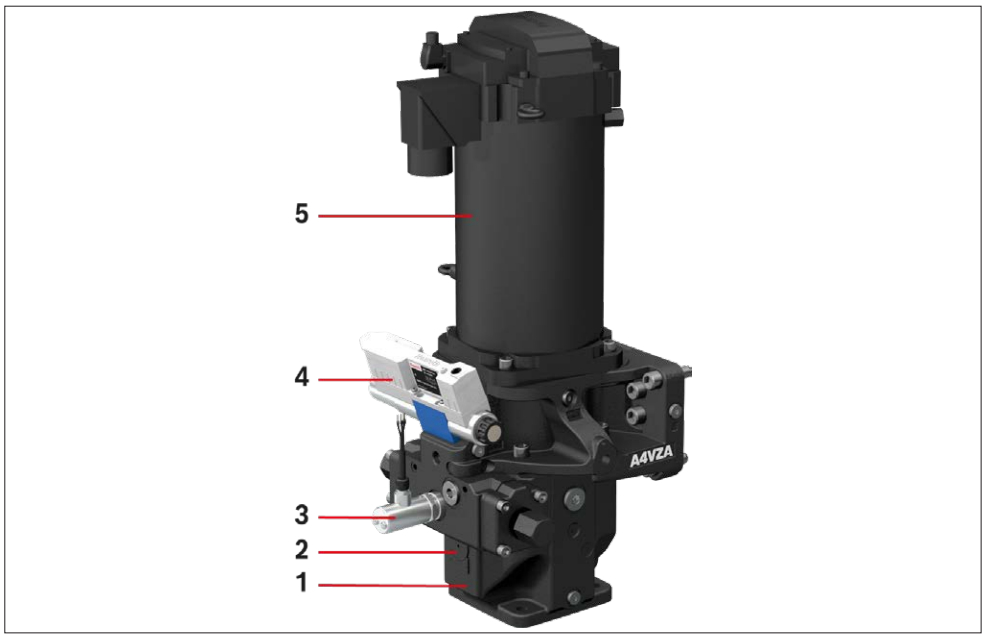


Fig. 1: Component overview

1 Axial piston variable displacement pump A4VZA incl. control/adjustment device
2 Optical swivel angle display (scale)
3 Swivel angle sensor
4 Control valve (proportional servo valve or on/off valve)
5 Synchronous servo motor MS2N

5.3.1 Axial piston variable displacement pump A4VZA

The A4VZA is a variable displacement pump with axial piston transmission in swash plate design for hydrostatic drives in a closed circuit. The flow is proportional to the drive speed and the displacement. By adjusting the swash plate, the flow can be steplessly changed. In axial piston units of swash plate design, the pistons are arranged axially to the drive shaft.

Adjustment

The swivel angle of the swash plate is steplessly adjustable. Adjusting the swivel angle of the swash plate changes the piston stroke and thus the displacement. When the swash plate is adjusted through the zero position, the flow direction changes (reversing operation possible). The swivel angle is adjusted hydraulically via the actuating piston.
When the swivel angle is increased, the displacement increases; when it is reduced, it decreases accordingly.

Depending on the requirements, different control and adjustment devices are available. For further information, refer to data sheet 92076, see chapter 1.2 "Required and amending documentation".

Connections The following figure shows the connections of the A4VZA:

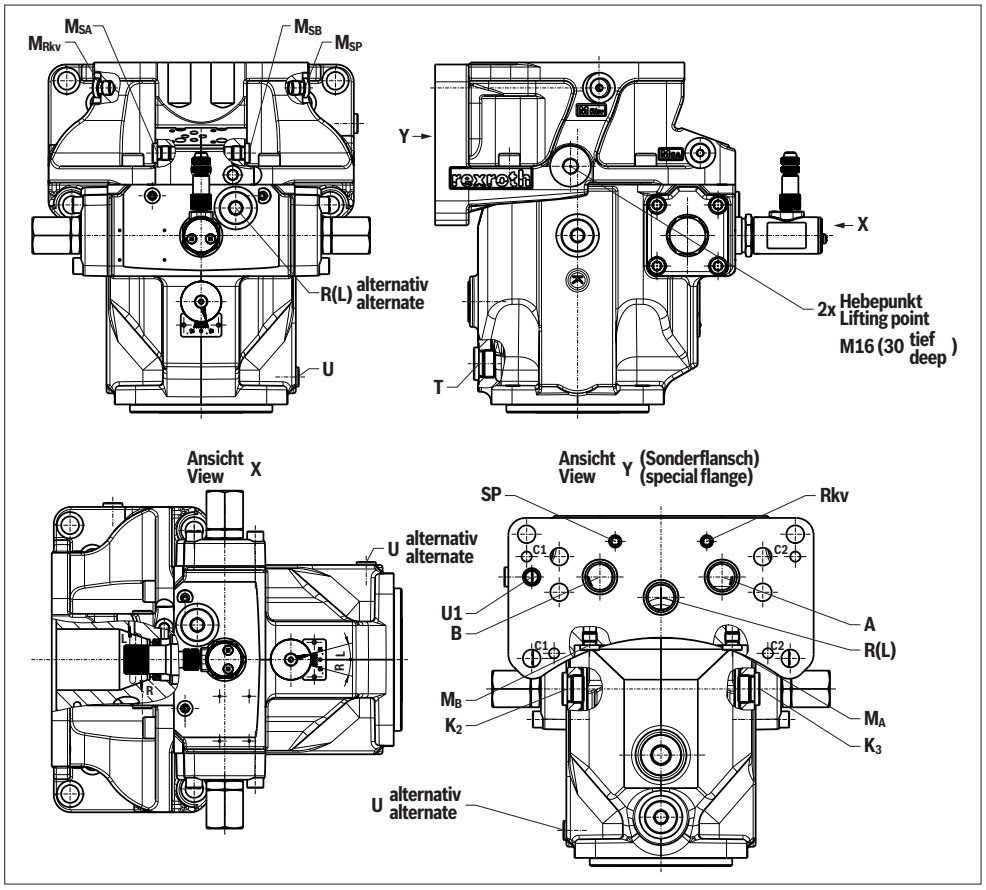


Fig. 2: Connections of the A4VZA

Abbreviation	Description
A, B	Working port (high-pressure series)
K_2, K_3	Filling – bleeding, return flow (drain port)
M_A, M_B	Measurement of operating pressure A/B
M_{Rkv}	Measuring port for pilot fluid
M_{SA}, M_{SB}	Measuring port for set pressure in A or B
M_{SP}	Measuring port for pilot fluid
Rkv	Pilot fluid return flow
R(L) alternative	Return flow (drain port)
R(L)	Filling – bleeding, return flow (drain port)
S_P	Set pressure port
T	Fluid drain
U alternative	Bearing flushing
U1	Bearing flushing

5.3.2 Synchronous servo motor MS2N

The synchronous servo motor MS2N is designed with an internally geared hollow shaft to enable direct coupling of motor and pump. The synchronous servo motor MS2N converts the electric power (U, I) of the converter into a mechanical power (M, n) and realizes the variable-speed use of the SHP4V.

5.3.3 Control valve

The application-specific control valve regulates the swivel angle and thus the displacement of the SHP4V.

5.3.4 Swivel angle sensor with swivel angle display

The swivel angle sensor is used to record the swivel angle of the axial piston variable displacement pump A4VZA and to convert the measured value into an electrical signal.
The current swivel angle of the axial piston variable displacement pump A4VZA can be read off a scale on the optical swivel angle display.

5.4 Product identification

The SHP4V can be identified by its name plate. The following figure shows an exemplary representation:

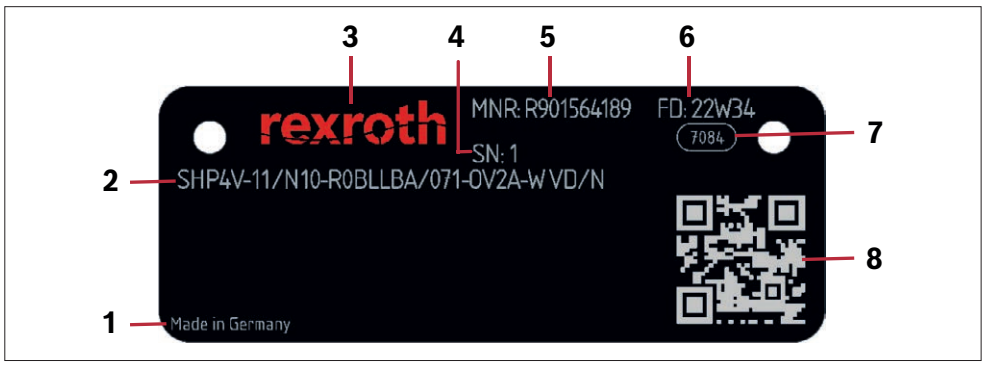


Fig. 3: Name plate

1 Designation of origin
2 Type designation
3 Manufacturer's logo
4 Serial number
5 Material number
6 Date of production
7 Area / works number
8 QR code

6 Transport and storage

- For transportation and storage of the product, always observe the environmental conditions specified in data sheet 51195, see chapter 1.2 "Required and amending documentation".
- If the packaging has to be opened e.g. for inspection purposes, you should reseal the packaging to the condition in which it was supplied. Wherever possible, the packaging should not be removed until directly before assembling the unit.

The axial piston variable displacement pump A4VZA is equipped with a protective cover on the subplate flange. During transport and storage, this protective device must remain on the axial piston variable displacement pump A4VZA.

6.1 Transporting the SHP4V

⚠ WARNING

SHP4V toppling over, falling down!
Danger to life, risk of injury or damage to property!
- Observe the weight and the position of the center of gravity of the SHP4V.
- Always use adequate lifting gear and, if necessary, floor conveyors to transport the SHP4V.
- Only use the intended locations and attachment devices for securing the means of transport or lifting the SHP4V.
- Check attachment devices and lifting points for proper condition.
- Observe the maximum load-bearing capacity of the attachment devices and floor conveyors.
- Place the SHP4V on a suitable ground.
- Ensure that no unauthorized persons are within the danger zone.

Damage to pressurized and functional components!
Risk of injury! Damage to property!
- During transport, make sure that these components do not come into contact with attachment devices and lifting gear.
- Ensure that the SHP4V is not attached or lifted at these components.

⚠ CAUTION

Heavy loads with a weight of more than 15 kg!
Risk of injury! Health hazard! Damage to property!
- Use a forklift or suitable lifting gear e.g. lifting slings or lifting straps to transport the SHP4V.
- During transport, secure the SHP4V against toppling over.
- Carefully place the SHP4V on the mounting surface so that the SHP4V is not damaged.

For transport of the SHP4V, proceed as follows:

- If possible, transport the SHP4V in its original packaging.
- Observe the transport instructions on the packaging.
- Use suitable shock absorbers if major shocks might occur during transport.

6.1.1 Preparing for transport

Prior to transport, make the following preparations:

- Check the space required for installation of the SHP4V at the place of use.
- Check the transport route.
- Depending on the type of transport, ensure additional space besides and above the SHP4V.

Transport after previous operation

- For transportation after operation, drain the hydraulic fluid from the SHP4V.

6.1.2 Transport using forklifts and similar floor conveyors

To transport the SHP4V using forklifts proceed as follows:

1. Move the fork of the forklift under the packaging of the SHP4V or under the SHP4V secured for transport.
2. Carefully lift the load for checking the center of gravity position. Ensure a stable center of gravity position.
3. Make sure that the SHP4V cannot move out of the intended position.
4. Secure the SHP4V against the occurring acceleration forces and associated unwanted movement of the SHP4V.
5. During transport, only lift the SHP4V as far off the floor as necessary for the transport.

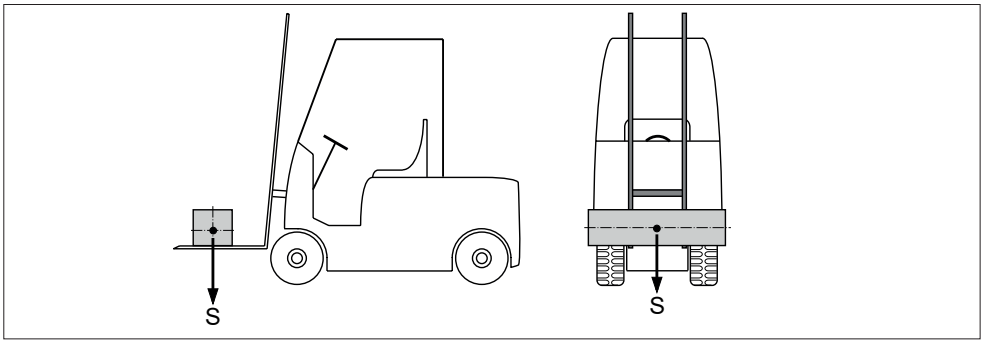


Fig. 4: Transport using a forklift

6.1.3 Transport using lifting gear

For transport and lifting out of the packaging, the SHP4V can be connected to lifting gear at the lifting points provided for this purpose.

For lifting and transport of the SHP4V, proceed as follows:

1. Screw 2 attachment devices M16, e.g. lifting eyes, according to DIN 580 completely into the screw-in holes of the pump housing, see Fig. 5, pos. 1.
   – Make sure that the attachment devices can support the total weight of the SHP4V.

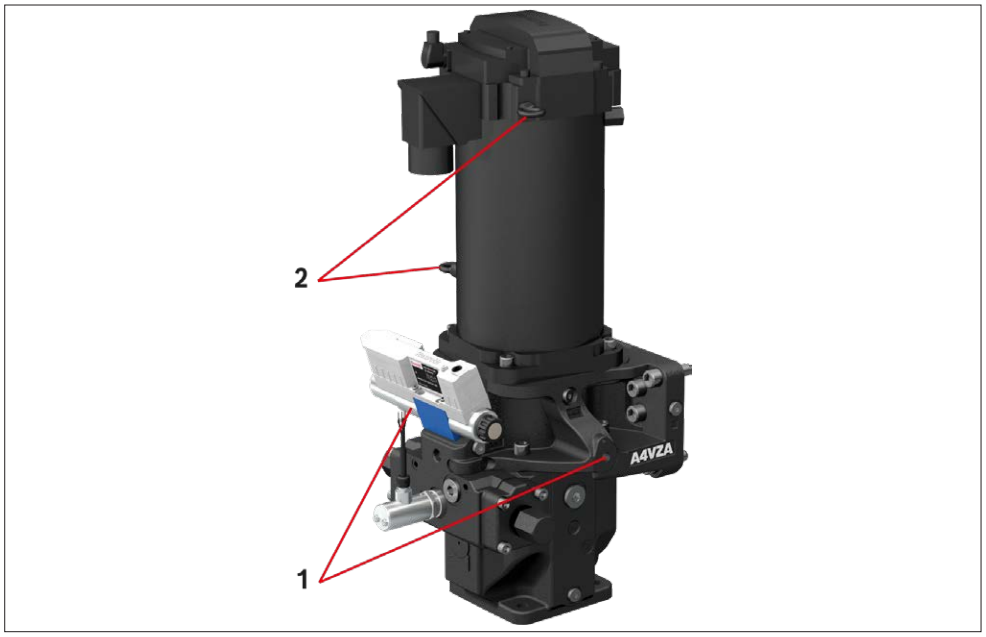


Fig. 5: Transport using lifting gear

1 Lifting points (screw-in holes for attachment devices)

2 Lifting eyes

2. Use a traverse to properly align the SHP4V.
3. Use the lifting eyes on the synchronous servo motor MS2N, see Fig. 5, pos. 2, or lifting straps to support and secure the alignment of the position.
   – When using lifting eyes on the synchronous servo motor MS2N: If not present, securely screw in the lifting eyes.

For further information, refer to the operating instructions of synchronous servo motors MS2N, chapter 6.2, see chapter 1.2 "Required and amending documentation".

   – When using lifting straps:
   Place the lifting strap around the SHP4V so that it does not run over any attachment parts (e.g. control valve, swivel angle sensor) nor is it suspended from any of these attachment parts.

WARNING! Danger due to suspended loads!
The SHP4V can tip out of the loop during transport with a lifting strap and cause injury.

- Use the widest possible lifting strap.
- Make sure that the SHP4V is securely fixed with the lifting strap.
- Guide the SHP4V by hand for fine positioning and to avoid swinging.
- Never step or reach below suspended loads.

4. Suspend the lifting gear on the traverse or crane hook.
5. Lift the SHP4V slowly and carefully to prevent it from swinging.

6.2 Storing the SHP4V

The claim to warranty expires in case of non-compliance with the storage conditions or after expiry of the maximum storage time.

Storage conditions

- Store the SHP4V in a dry and dust-free location at constant temperature and in its original packaging if possible.
  Optimum storage temperature: +5 °C to +20 °C
  Maximum storage temperature: +55 °C
  Minimum storage temperature: -25 °C
  Relative humidity: 5 ... 75%
  Absolute humidity: 1 ... 29 g/m³
- Provide for 100% UV protection.
- During storage, make sure that the SHP4V is protected from shock, vibrations and oscillations.
- Do not store the SHP4V on attachment parts, e.g. control valve, swivel angle sensor.

Maximum storage time

The maximum storage time of the SHP4V is 12 months.

Procedure after expiration of maximum storage time

- Check the complete SHP4V for damage and corrosion prior to installation.
- In a test run, check the SHP4V for correct function and leak-tightness.

Bosch Rexroth recommends inspection of the SHP4V by your responsible Bosch Rexroth service after the maximum storage time of 12 months.

For questions regarding repair and spare parts, contact your local Bosch Rexroth service or the service department of the SHP4V manufacturer, see chapter 10.5 "Spare and wear parts".

After disassembly

If a dismounted SHP4V is to be stored, it has to be preserved for the time of storage to protect it against corrosion.

The following instructions only refer to servo-hydraulic pump units that are operated with a hydraulic fluid based on mineral oil. Other hydraulic fluids require preservative measures that are specifically designed for them.
In this case consult the Bosch Rexroth service. For the addresses, please refer to chapter 16.1 "List of addresses" and www.boschrexroth.com.

Bosch Rexroth recommends the following procedure:

1. Clean the SHP4V, see chapter 10.1 "Cleaning and care".
2. Drain the SHP4V.
3. **In case of storage time up to 12 months:**
   Wet the SHP4V inside with mineral oil by filling it with approx. 100 ml mineral oil.
   In case of storage time up to 24 months:
   Fill the SHP4V with VCI 329 corrosion protection agent (20 ml).
   It is alternatively filled via port R(L), see Fig. 2.
4. Close all connections so that they are airtight.
5. Wet the unpainted surfaces of the SHP4V with mineral oil or suitable, easily removable corrosion protection agent, e.g. acid-free grease.
6. Pack the SHP4V together with a desiccant in corrosion protection film in an air-tight manner.
7. During storage, protect the SHP4V from shocks.

Further information on storage of the SHP4V can be found in this chapter in sections "Storage conditions" and "Maximum storage time".

7 Assembly

7.1 Preparing for assembly

Prior to installation, make sure the following documents are at hand:

- Data sheet or installation drawing of the SHP4V
  (contains the admissible technical data)
- Order confirmation
  (contains the order-specific technical data of your SHP4V)
- Hydraulic circuit diagram of the overall machinery/system
  (available from the machine/system manufacturer)

7.2 Unpacking the SHP4V

- ▶ Before opening the packaging and/or loosening the tension belts, make sure that the SHP4V cannot fall over.
- ▶ Remove the packaging of the SHP4V.
- ▶ Check the SHP4V for obvious defects, for example transport damage, leakage or other external damage, and for completeness, see chapter 4 "Scope of delivery".
- ▶ Only use the SHP4V if it is in perfect technical condition.
- ▶ Dispose of the packaging material in accordance with the national regulations in your country and/or your company-internal specifications/procedures.

7.3 Installation conditions and position

7.3.1 Installation conditions

Installation position and orientation of the SHP4V have a decisive impact on the installation and commissioning procedure, e.g. when filling and bleeding the SHP4V.

- ▶ Mount the SHP4V in such a way that the forces and torques to be expected can be transmitted without risk. The machine/system manufacturer is responsible for the design of the mounting elements.
- ▶ Ensure that the axial piston variable displacement pump A4VZA of the SHP4V is air-free and filled with hydraulic fluid during commissioning and operation.

This must also be observed during longer standstill times, as the axial piston variable displacement pump A4VZA can be emptied via the hydraulic connections.

- ▶ Drain the leakage in the housing area of the axial piston variable displacement pump A4VZA to the tank via the highest leakage connection.
  – Use the line size that corresponds to the port.

- Make sure that the feed, tank and return lines of the axial piston variable displacement pump A4VZA open into the tank below the minimum liquid level in any operating condition. This will prevent air from being sucked in and avoid the formation of foam.
- Ensure that a minimum feed pressure of 6 bar absolute is present for the axial piston variable displacement pump A4VZA in all installation positions and orientations during operation and cold start.

Further pressure values can be found in data sheet 51195, see chapter 1.2 "Required and amending documentation".

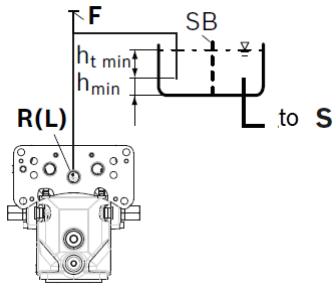
7.3.2 Admissible installation positions

For other installation positions, please contact the responsible Bosch Rexroth service. For the addresses, please refer to chapter 16.1 "List of addresses" and www.boschrexroth.com.

Below-tank installation (standard)

Below-tank installation is at hand if the axial piston variable displacement pump A4VZA is installed below the minimum liquid level outside the tank.

Table 6: Preferred installation position for below-tank installation

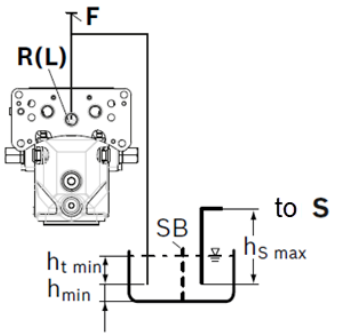
Installation position	Bleeding	filling
	R(L); F	R(L); F
	Preferred installation position: No external piping of the leakage oil connection and bearing flushing necessary.	

Key	
F	Filling – bleeding
R(L)	Filling – bleeding, return flow (drain port)
S	Suction port
SB	Baffle (baffle plate)
h_{min}	Minimum required distance to the tank bottom (100 mm)
$h_{t\ min}$	Minimum required immersion depth (200 mm)

Over-tank installation

The installation is deemed an over-tank installation if the axial piston variable displacement pump A4VZA is installed above the minimum liquid level of the tank.

Table 7: Preferred installation position for over-tank installation

Installation position	Bleeding	filling
	R(L); F	R(L); F
	Preferred installation position: No external piping of the leakage oil connection and bearing flushing necessary.	

Key	
F	Filling – bleeding
R(L)	Filling – bleeding, return flow (drain port)
S	Suction port
SB	Baffle (baffle plate)
h_{min}	Minimum required distance to the tank bottom (100 mm)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
$h_{s\ max}$	Maximum admissible suction height (800 mm)

7.4 Assembling the SHP4V

- The dimensions for all connections can be found in the installation drawing or the data sheet of the SHP4V, see chapter 1.2 "Required and amending documentation".
- Also observe the instructions of the manufacturers of the other hydraulic components when selecting the required tools.

Dimensioning of the screw connection is the responsibility of the machine/system manufacturer.
A hole pattern for the control block and corresponding hexagon socket head cap screws are recommended in data sheet 51195, see chapter 1.2 "Required and amending documentation".

7.4.1 Mechanical/hydraulic connection of the SHP4V

To connect the SHP4V to the control block both mechanically and hydraulically, proceed as follows:

1. Remove any attachment devices that may have been attached.
2. Remove the transport protection on the axial piston variable displacement pump A4VZA, i.e. the protective cover on the subplate flange.

All connections of the axial piston variable displacement pump A4VZA are provided by default with pressure-resistant screw plugs or minimess couplings.

Adjustment of the setscrews of the swivel angle adjustment will void the warranty. If you require the settings to be adjusted, contact your local Bosch Rexroth service. For the addresses, please refer to chapter 16.1 "List of addresses" and www.boschrexroth.com.

3. Make sure that the sealing surfaces on the SHP4V and on the control block are not damaged and are clean.
4. Check that all seals are in place in the mounting surface of the SHP4V.
5. Assemble the heavy-duty pins supplied with the SHP4V in the control block.
6. Align the SHP4V on the control block in advance by means of 2 diagonally screwed in hexagon socket head cap screws.
   – Make sure that the flange surfaces are not damaged.
7. Use the heavy-duty pins provided to position the SHP4V on the control block and then press it flat onto the mating surface of the control block.
8. Now assemble the remaining hexagon socket head cap screws and tighten them all correctly, crosswise (observe tightening torque!).

For some of the screws, an Allen key with ball head is required for assembly.

– The SHP4V is now firmly screwed to the control block.

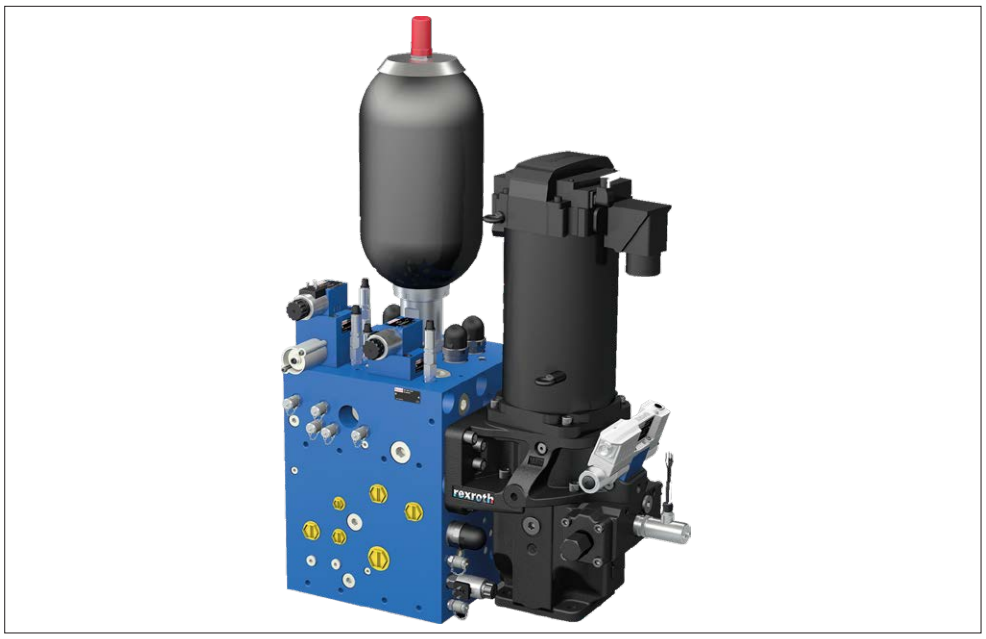


Fig. 6: Installation example: SHP4V with control block

7.4.2 Electrical connection of the SHP4V

The machine/system manufacturer is responsible for the design of the electric control. The SHP4V must be connected according to the electrical circuit diagram of the machine/system.

For servo-hydraulic pump units with electrical adjustment and/or attached sensors, please refer to data sheet 51195 or the data sheet of the adjustment, see chapter 1.2 "Required and amending documentation" for further information.

- For example, observe the following:
  - the admissible voltage range
  - the admissible current
  - the correct pin assignment
  - the recommended electrical control units

- For detailed information on the connector, the protection class and the suitable mating connector, also refer to data sheet 51195 or the data sheet of the adjustment, see chapter 1.2 "Required and amending documentation".
- To connect the synchronous servo motor MS2N of the SHP4V electrically, observe the information according to data sheet 51195 or the synchronous servo motor MS2N's operating instructions, chapter 7.4, see chapter 1.2 "Required and amending documentation".

When connecting an SHP4V with terminal box, observe the following:

- Only connect or disconnect clamping connections when they are de-energized, dry and clean.
- Connect the motor with assembled connection cables.
- Remove the blind screw connection "X" or "Y" on the side of the cable entry.
- Select the cable gland according to the manufacturer specifications on cable diameter and tighten it accordingly.
- Make sure that the connection is established so that permanently safe connection is ensured.
- Establish a safe protective grounding connection.
- Close all openings after connection.

7.4.3 Water supply connection of the SHP4V (optional)

The SHP4V requires a cooling water connection for cooling of the synchronous servo motor MS2N.

Leak-tightness of the cooling water connection is the responsibility of the machine/system manufacturer and has to be tested and inspected by them after installation.
In addition, a regular inspection of the proper state of the coolant connection is to be included in the maintenance schedule of the overall machinery/system.

Installation material such as hoses and mounting clamps are not included in the Bosch Rexroth scope of delivery.

- Select a supply hose with correct internal diameter.

For further information, refer to the operating instructions of synchronous servo motors MS2N, chapter 7.5, see chapter 1.2 "Required and amending documentation".

7.5 Painting the SHP4V

NOTICE

Limitation of functionality or overheating of the SHP4V due to coating!
Damage to property!

- Never paint measurement systems and/or cooling and contact surfaces.
- Protect the surface of valve solenoids against paint application.
- Close the hydraulic connections completely before the paint application.
- Protect the fixing holes and surfaces against paint application.
- Mask the name plate and information signs that might exist so that they are still readable after painting.
- Cover the connectors of the electrical connections with protective foil and make sure not to cause any damage to the connector.
- When removing the paint protection and the covers make sure that no paint chips or other foreign particles enter the SHP4V.

The SHP4V is delivered with standard paint.

When painting over or repainting the overall machinery/system, the following must be observed:

- Make sure that painting layer thickness of the synchronous servo motor MS2N does not exceed 40 µm.

8 Commissioning

⚠ WARNING

Leakage of hydraulic fluid under high pressure due to faulty assembly of the SHP4V!

Risk of injury, damage to property!

- Before commissioning the SHP4V, make sure that the SHP4V has been fully assembled by a specialist, see chapter 2.4 "Qualification of personnel".

According to EC Machinery Directive 2006/42/EC, commissioning must not be undertaken until it has been determined that the machine/system to be equipped with the SHP4V complies with the provisions of all relevant directives. Combination of components may lead to additional/other types of hazards.
For commissioning of the SHP4V, always observe the operating instructions of the overall machinery/system. This applies in particular to "mechanical hazards", which can be caused by the mechanical movements of the overall machinery/system initiated by the SHP4V.

Bosch Rexroth recommends bleeding and flushing the hydraulic system before connecting the SHP4V. Please observe the operating instructions of the overall machinery/system.

8.1 First commissioning

Commissioning of the SHP4V is only possible with additional components (drive controller, control system).

- For the commissioning sequence, refer to the relevant drive controller documentation or the firmware description.

For all work on commissioning the SHP4V, observe the basic safety instructions and intended use in chapter 2 "Safety instructions" and the safety instructions in chapter 3 General information on damage to property and damage to product.

- Connect the following pressure gauges to the intended measuring points on the SHP4V or in the hydraulic system to check the technical data during initial operation:
  - M_A, M_B = Operating/working pressure
  - M_{SP} = Set pressure supply upstream of control valve
  - M_{SA}, M_{SB} = Set pressure A and B downstream of control valve
  - M_{Rkv} = Set pressure oil return downstream of control valve

- During the commissioning process, monitor the temperature of the hydraulic fluid in the tank to ensure that it is within the admissible viscosity limits.

8.1.1 Before commissioning

Maximum storage time

- Make sure that the maximum storage time of the SHP4V has not been exceeded. Otherwise, take measures to ensure safe operation, e.g. check the entire SHP4V for damage and corrosion.

For further information on measures to be taken if the maximum storage time is exceeded, refer to the operating instructions for the synchronous servo motor MS2N and the axial piston variable displacement pump A4VZA, see chapter 1.2 "Required and amending documentation" and chapter 6.2 "Storing the SHP4V" in these operating instructions.

General information

- Check the mechanical, electrical and hydraulic connections for safe working condition:
  - Make sure that the SHP4V is firmly screwed to the control block and that no hydraulic fluid can escape at the sealing surfaces.
  - Make sure that all connectors are properly connected and secured against loosening.

Bleeding the A4VZA

- Ensure that the axial piston variable displacement pump A4VZA of the SHP4V is air-free and filled with hydraulic fluid during commissioning and operation. This must also be observed during longer standstill times, as the axial piston variable displacement pump A4VZA can be emptied via the hydraulic lines.

Solenoid bleeding on proportional valve (optional)

- Bleed at the highest point of the proportional valve (optional) during commissioning to ensure proper function.
- Prevent the tank line from running empty by installing a preload valve if the installation conditions are suitable.

8.1.2 Filling the SHP4V

To prevent damage to the axial piston variable displacement pump A4VZA installed in the SHP4V and to ensure proper function, professional filling and bleeding is required.

The axial piston variable displacement pump A4VZA should be filled with a filling unit (10 µm filter rating). The SHP4V must not be operated during the filling process with the filling unit.

Use only hydraulic fluids that meet the following requirements:

- Information on minimum requirements for hydraulic fluids can be found in data sheets 90220, 90221 or 90222, see chapter 1.2 "Required and amending documentation".
- Information on the admissible and optimum viscosity as well as the admissible temperatures can be found in data sheet 51195, see chapter 1.2 "Required and amending documentation".
- In order to guarantee functional safety of the axial piston variable displacement pump A4VZA, at least cleanliness class 20/18/15 in accordance with ISO 4406 is necessary for the hydraulic fluid.

For filling of the SHP4V, proceed as follows:

1. Place a collecting pan under the axial piston variable displacement pump A4VZA to collect any leaking hydraulic fluid.
2. Fill and bleed the SHP4V.
   - Observe the points mentioned under 8.1.1 for bleeding.
   - Also fill the hydraulic lines of the overall machinery/system.

NOTICE! Insufficient lubrication!
Damage to property!

- When using a shut-off valve in the feed and/or tank line, ensure that the axial piston variable displacement pump A4VZA drive can only be started when the shut-off valves are open.

3. When using a shut-off valve in the feed and/or tank line, operate the SHP4V only with the shut-off valves open.
4. Operate the axial piston variable displacement pump A4VZA at low speed (jog mode) until the hydraulic system is completely filled and bled.
   - Check this by discharging the hydraulic fluid at the tank port and waiting until it comes out without any bubbles.

8.1.3 Testing supply with hydraulic fluid

The axial piston variable displacement pump A4VZA must always be supplied with sufficient hydraulic fluid. It is therefore inevitable to ensure the hydraulic fluid supply at the beginning of the commissioning.
When testing the hydraulic fluid supply, check the noise development and the hydraulic fluid level in the tank on a permanent basis. If the noise of the axial piston variable displacement pump A4VZA increases (cavitation) or the leakage fluid is discharged with bubbles, this is an indication that it is not sufficiently supplied with hydraulic fluid.

Further information on troubleshooting can be found in chapter 14 "Troubleshooting".

To test the supply of hydraulic fluid, proceed as follows:

1. Let the synchronous servo motor MS2N of the SHP4V run at the lowest speed.
   - Make sure that the axial piston variable displacement pump A4VZA of the SHP4V is running without load.
   - Pay attention to leakage and noise.
2. Increase the load and check that the operating pressure increases as expected.
3. Perform a leak test to ensure that the hydraulic system is tight and can withstand the maximum pressure.
4. At rated speed and maximum swivel angle, check the feed pressure at ports A and B, see Fig. 2, of the axial piston variable displacement pump A4VZA.
   - For the admissible value, refer to data sheet 51195, see 1.2 "Required and amending documentation".

8.1.4 Performing the functional test

After testing the supply of the hydraulic fluid, a functional test for the overall machinery/system must be carried out in accordance with machine/system manufacturer specifications. The SHP4V is checked for functionality before delivery according to the technical data. During commissioning, it must be ensured that the SHP4V has been installed in the overall machinery/system as intended.

Proceed as follows:

- ▶ Check the specified pressures, e.g. system pressure, feed pressure and housing pressure, in particular after starting the synchronous servo motor MS2N of the SHP4V.
- ▶ If necessary, disassemble the pressure gauges and close the connections with pressure-resistant plug screws.

8.1.5 Run-in phase

The bearings and sliding surfaces are subject to a running-in process.
The increased friction at the beginning of the run-in phase leads to increased heat generation, which is reduced with increasing operating hours. By the end of the run-in phase of approx. 10 operating hours, the volumetric and mechanical-hydraulic efficiency also increases.

To ensure that contamination in the hydraulic system does not damage the SHP4V, Bosch Rexroth recommends the following procedure after the run-in phase:

- ▶ After the run-in phase, have a hydraulic fluid sample analytically tested for the required cleanliness class.
- ▶ Exchange the hydraulic fluid if the required cleanliness class is not achieved. If no laboratory test is carried out after the run-in phase, Bosch Rexroth recommends changing the hydraulic fluid.

8.2 Re-commissioning after standstill

Depending on the installation and environmental condition, changes may occur in the overall machinery/system requiring re-commissioning.
The following criteria, among others, may require re-commissioning:

- Air and/or water in the hydraulic system
- Old hydraulic fluid
- Other contamination

- ▶ Carry out re-commissioning as described in chapter 8.1 "First commissioning".

9 Operation

The SHP4V is intended as partly completed machinery for installation into a machine/system.

The SHP4V does not have any direct function (e.g. switch) to put the product out of operation.

- Make sure that required measures for decommissioning are implemented by the machine/system manufacturer.

- Ensure that environmental and operating conditions as well as the technical data specified in data sheet 51195, see chapter 1.2 "Required and amending documentation", are observed during operation.

Information on operating the SHP4V can only be provided in connection with the machine/system.

- For this information, please refer to the operating instructions of the machine/system manufacturer.

Checks during operation:

- Listen for unusual noise.
- Watch for increased vibration.
- Check the cleanliness of the SHP4V.
- Check the leak-tightness of cooling water connections.
- Check the monitoring equipment and the diagnosis/error messages of the controllers.
- Take the SHP4V out of operation if deviations from normal operation occur.

10 Maintenance and repair

Maintenance tasks (inspection, maintenance, repair) must be defined according to system-specific requirements, operating conditions (pressures, temperatures, environmental conditions) and the operating life (duty cycle, cycle times, shift operation).
The declarations made in this chapter are based on climate conditions in Central Europe and common environments in the metal-processing industry.
A negative trend of test parameters like hydraulic fluid temperature or noise indicates changes. If necessary, the fault table, see chapter 14.2, provides support for the identification of the problem. Slow increase in temperature and/or irregular noise indicate potential wear at the axial piston variable displacement pump A4VZA, the synchronous servo motor MS2N, the seals as well as aging of hydraulic fluid and should initiate inspection of all relevant components. Immediate strong increases in temperature are alarming and require immediate inspection of the machine/system.

For further information on the scope and time intervals for maintenance and repair of the overall machinery/system, please refer to the operating instructions of the machine/system manufacturer.

10.1 Cleaning and care

For cleaning and care of the SHP4V, please observe the following points:

- Make sure that all seals and electric plug-in connections are firmly fitted to prevent the penetration of cleaning agents and/or humidity into the SHP4V.
- Do not use aggressive cleaning agents for cleaning. Clean the SHP4V with a suitable cleaning liquid.
- Do not use high-pressure washers.
- Do not use compressed air for the cleaning at functional interfaces.
- Remove external coarse dirt and keep sensitive and important parts like electrical connections clean.
- For the cleaning, use a damp, non-linting cloth or residue-free industrial wipes.

10.2 Inspection

Bosch Rexroth recommends documenting the inspection results

- so that considering functionality and economy, the inspection and maintenance intervals can be adjusted to the actual operating conditions,
- by comparing the documented values, you can identify faults at an early point in time.

▶ If necessary, clean the SHP4V before starting the inspection work.
▶ Carry out the following visual inspections for clearly apparent defects:
  – Illegible notices or warning signs
  – Leakage
  – Loose and/or missing parts
  – Indications of external force effects

10.3 Maintenance

The SHP4V requires little maintenance when used as intended.

Hydraulic fluid

The service life of the SHP4V decisively depends on the hydraulic fluid quality. Bosch Rexroth therefore recommends exchanging the hydraulic fluid at least once per year or every 2000 operating hours (whichever occurs first) or to have it analyzed for further usability by the hydraulic fluid manufacturer or a laboratory.

Contamination

Dirt, dust or chips can have a negative effect on the function of the SHP4V and, in extreme cases, can also lead to failure of the synchronous servo motor MS2N. At regular intervals (after expiry of one year at the latest), you should therefore clean the surface of the synchronous servo motor MS2N of the SHP4V in order to achieve a sufficiently dimensioned heat radiation surface. If cooling ribs are partly covered with dirt, sufficient heat dissipation via the ambient air is no longer possible. Insufficient heat radiation may have undesired consequences. The bearing life cycle is reduced by operation at inadmissibly high temperatures (bearing grease decomposition). An overtemperature shutdown occurs despite operation according to selection data because the corresponding cooling is missing.

Electrics

Check the connection cables at regular intervals for damage and exchange them, if necessary.

10.4 Repair

Bosch Rexroth offers a wide range of repair services for Rexroth products.
The SHP4V and its components may only be repaired by Bosch Rexroth certified service centers.

- Exclusively use Rexroth original spare parts to repair the SHP4V. Otherwise, the functional safety of the SHP4V is no longer ensured and you lose your claim to warranty.

For questions regarding repair, contact your local Bosch Rexroth service or the service department of the SHP4V manufacturer.

10.5 Spare and wear parts

NOTICE

Malfunction of the SHP4V due to use of incorrect wear/spare parts!
Damage to property!

- Only use components listed in the wear and spare part list, see Table 8.
- Only use new seals with the required media compatibility.
- As the sealing material may differ despite being of identical appearance, the material number should be checked.
- For fastening, use only new hexagon socket head cap screws that correspond to the required property class.

- Address spare/wear part orders to the Bosch Rexroth branch office located near you or directly to the headquarters. For the addresses, please refer to chapter 16.1 "List of addresses" and www.boschrexroth.com.

Order spare/wear parts

- Place any orders for spare/wear parts in writing. In urgent cases you can also order by phone, but you are kindly requested to confirm your order in writing.
- Please provide the following information when ordering spare parts:
  - Material number and order number of the SHP4V (name plate)
  - Material number of the respective component
  - Required quantity
  - The desired type of dispatch (e.g. as parcel, freight, air freight, by courier service, etc.).

Table 8: Spare and wear parts

Material number	SAP designation	Comment
R961015274	SEAL KIT SHP4V-1X/071	Seal kit for SHP4V to the control block
R961015275	SEAL KIT SHP4V-1X/180	Seal kit for SHP4V to the control block

11 Disassembly and replacement

- Only disassemble machine/system parts if it is required to carry out the necessary work.

In general, all disassembled parts should be reassembled properly at the intended position.

11.1 Preparing for disassembly

- Decommission the overall machinery/system as described in the overall machinery/system operating instructions.
- Before carrying out any work on the SHP4V, make sure that the relevant system parts are depressurized and de-energized.
- Drain the hydraulic fluid from the SHP4V/hydraulic system before disassembly.
- Do not loosen the mounting elements, e.g. hexagon socket head cap screws, of the SHP4V until sufficient fastening is ensured, e.g. with lifting gear (sling/eyebolt) to prevent unintended tipping of the SHP4V.

11.2 Disassembly process

- For disassembly, carry out the work steps described in chapter 7 "Assembly" in reverse order.
- Hydraulic fluid will run out of the hydraulic line system of the SHP4V or hydraulic system even after draining. For this reason, close all outlets of lines with suitable blanking plugs.

After disassembly, observe the information on safe transport of the product in chapter 6 "Transport and storage".

12 Disposal

For disposal of the SHP4V, observe the following:

- Empty the SHP4V completely before disposal.
- Disassemble the SHP4V into its individual components for recycling.
- Separate for example:
  - Cast iron
  - Steel
  - Non-ferrous metal
  - Plastic
  - Seals

12.1 Environmental protection

Careless disposal of the SHP4V, its components, the hydraulic fluid and the packaging material can lead to environmental pollution.

- Dispose of the SHP4V in accordance with the currently applicable national regulations in your country.
- Dispose of hydraulic fluid according to the applicable safety data sheet of the hydraulic fluid.

13 Extension and modification

You will be considered responsible for any extensions to or modifications of the product.

Any declarations shall become invalid

If you undertake any extensions to or modifications of the product marketed by Bosch Rexroth, this means you are changing the condition as supplied.
Any statements made by Bosch Rexroth regarding this product will then become invalid.

For servo-hydraulic pump units this means the following:
Servo-hydraulic pump units are partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC. For this product, a declaration of incorporation was received with the product-specific documentation.
This becomes invalid when the servo-hydraulic pump units are extended or modified. Please send any queries you may have to your nearest Bosch Rexroth service center or directly to the headquarters.
For the addresses, please refer to chapter 16.1 "List of addresses" and www.boschrexroth.com.

Adjustment of the setscrews of the swivel angle adjustment of the axial piston variable displacement pump A4VZA will void the warranty. If you require the settings to be adjusted, contact your local Bosch Rexroth service.
For the addresses, please refer to chapter 16.1 "List of addresses" and www.boschrexroth.com.

14 Troubleshooting

Successful troubleshooting within the SHP4V requires precise knowledge on the set-up and the mode of operation of individual components. The combination of hydraulics with electrics and electronics makes troubleshooting very complex. Circuit diagrams (hydraulic and electric), parts lists, functional diagrams as applicable and other documentation must be available for effective troubleshooting.

14.1 How to proceed for troubleshooting

- Always work systematically and purposefully, even when under time pressure. Random, thoughtless disassembly and changing of settings might in the worst case result in the inability to restore the original cause of error.
- First, get a general idea of the function of the SHP4V in connection with the overall machinery/system.
- Try to find out whether the SHP4V has worked properly in combination with the overall machinery/system before the error occurred first.
- Try to determine any changes of the overall machinery/system, in which the SHP4V is integrated:

Control questions

- Were there any changes to the application conditions or area of application of the SHP4V?
- Have any changes (e.g. refittings) or repairs been carried out at the overall system (machine/system, electrics, control unit) or at the SHP4V?
- If so: What were they?
- Was the SHP4V or the machine/system operated as intended?
- How did the fault become apparent?

- Try to get a clear idea of the cause of error.
- If necessary, ask the actual (machine) operator.
- Document all work done.
- If the error could not be remedied, please contact one of the contact addresses provided in chapter 16.1 "List of addresses" and under www.boschrexroth.com.

14.2 Fault table

14.2.1 Fault table for axial piston variable displacement pump A4VZA

Table 9: Fault table for axial piston variable displacement pump A4VZA

Fault	Possible cause	Remedy
Irregular noise	Drive speed too high	▶ Contact the machine/system manufacturer.
	Wrong direction of rotation	▶ Observe the correct direction of rotation.
	Insufficient suction conditions, e.g. air in the lines, insufficient diameter of the lines, excessive viscosity of the hydraulic fluid, suction height too high, suction pressure too low, foreign particles in the lines	▶ Contact the machine/system manufacturer (e.g. optimization of feed conditions, use of suitable hydraulic fluid).
		▶ Fully bleed the axial piston variable displacement pump A4VZA. ▶ Fill the lines with hydraulic fluid. ▶ Check the feed pressure.
		▶ Remove foreign particles in the lines.
	Insufficient supply at ports A and/or B (oil filling and bleeding)	▶ Examine the feed oil supply, e.g. ensure correct function of the feed pump, check the filter.
	Improper mounting of the axial piston variable displacement pump A4VZA	▶ Check the mounting of the axial piston variable displacement pump A4VZA according to the specifications of the machine/system manufacturer. ▶ Observe the tightening torques.
	Improper fastening of attachment parts, e.g. hydraulic lines	▶ Secure the attachment parts according to the instructions of the valve manufacturer.
	Mechanical damage to the axial piston variable displacement pump A4VZA (e.g. bearing damage)	▶ Contact Bosch Rexroth service.
No or insufficient flow	Faulty mechanical drive (e.g. defective motor-pump connection)	▶ Contact the machine/system manufacturer.
	Drive speed too low	▶ Contact the machine/system manufacturer.
	Insufficient suction conditions, e.g. air in the lines, insufficient diameter of the lines, excessive viscosity of the hydraulic fluid, suction height too high, suction pressure too low, foreign particles in the lines	▶ Contact the machine/system manufacturer (e.g. optimization of feed conditions, use of suitable hydraulic fluid).
		▶ Fully bleed the axial piston variable displacement pump A4VZA. ▶ Fill the lines with hydraulic fluid. ▶ Check the feed pressure.
		▶ Remove foreign particles in the lines.
	Insufficient supply at ports A and/or B (oil filling and bleeding)	▶ Examine the feed oil supply, e.g. ensure correct function of the feed pump, check the filter.
	Hydraulic fluid not in optimum viscosity range	▶ Use suitable hydraulic fluid (machine/system manufacturer).

Fault	Possible cause	Remedy
No or insufficient flow	Control/set pressure too low	▶ Check the control/set pressure. ▶ Contact Bosch Rexroth service.
	Malfunction of the adjustment device or the controller of the axial piston variable displacement pump A4VZA	▶ Contact Bosch Rexroth service.
	Wear of the axial piston variable displacement pump A4VZA	▶ Contact Bosch Rexroth service.
	Mechanical damage of the axial piston variable displacement pump A4VZA	▶ Contact Bosch Rexroth service.
No or insufficient pressure	Faulty mechanical drive (e.g. defective motor-pump connection)	▶ Contact the machine/system manufacturer.
	Drive power too low	▶ Contact the machine/system manufacturer.
	Insufficient suction conditions, e.g. air in the lines, insufficient diameter of the lines, excessive viscosity of the hydraulic fluid, suction height too high, suction pressure too low, foreign particles in the lines	▶ Contact the machine/system manufacturer (e.g. optimization of feed conditions, use of suitable hydraulic fluid). ▶ Fully bleed the axial piston variable displacement pump A4VZA. ▶ Fill the lines with hydraulic fluid. ▶ Check the feed pressure. ▶ Remove foreign particles in the lines.
	Insufficient supply at ports A and/or B (oil filling and bleeding)	▶ Examine the feed oil supply, e.g. ensure correct function of the feed pump, check the filter.
	Hydraulic fluid not in optimum viscosity range	▶ Use suitable hydraulic fluid (machine/system manufacturer).
	External control of the adjustment device defective	▶ Check the external control (machine/system manufacturer).
	Control/set pressure too low	▶ Check the control/set pressure. ▶ Contact Bosch Rexroth service.
	Malfunction of the adjustment device or the controller of the axial piston variable displacement pump A4VZA	▶ Contact Bosch Rexroth service.
	Wear of the axial piston variable displacement pump A4VZA	▶ Contact Bosch Rexroth service.
	Mechanical damage to the axial piston variable displacement pump A4VZA (e.g. bearing damage)	▶ Contact Bosch Rexroth service.
	Output unit defective (e.g. hydraulic motor or cylinder)	▶ Contact the machine/system manufacturer.

Fault	Possible cause	Remedy
Pressure/flow fluctuation	No or insufficient bleeding of the axial piston variable displacement pump A4VZA	▶ Fully bleed the axial piston variable displacement pump A4VZA.
	Insufficient suction conditions, e.g. air in the lines, insufficient diameter of the lines, excessive viscosity of the hydraulic fluid, suction height too high, suction pressure too low, foreign particles in the lines	▶ Contact the machine/system manufacturer (e.g. optimization of feed conditions, use of suitable hydraulic fluid).
		▶ Fully bleed the axial piston variable displacement pump A4VZA. ▶ Fill the lines with hydraulic fluid. ▶ Check the feed pressure.
		▶ Remove foreign particles in the lines.
	Insufficient supply at ports A and/or B (oil filling and bleeding)	▶ Examine the feed oil supply, e.g. ensure correct function of the feed pump, check the filter.
Temperature of the hydraulic fluid and the housing too high	Input temperature at axial piston variable displacement pump A4VZA too high	▶ Contact the machine/system manufacturer (system check, e.g. cooler malfunction, insufficient hydraulic fluid in the tank).
	Malfunction of the pressure control valves (e.g. high-pressure relief valve, pressure cut off, pressure controller)	▶ Contact Bosch Rexroth service.
	Malfunction of the flushing valve	▶ Contact Bosch Rexroth service.
	Wear of the axial piston variable displacement pump A4VZA	▶ Contact Bosch Rexroth service.
Instability/vibrations	Command value not stable	▶ Contact the machine/system manufacturer.
	Resonances in the tank line	▶ Contact the machine/system manufacturer.
	Malfunction of the adjustment device or controller	▶ Contact Bosch Rexroth service.

14.2.2 Fault table for synchronous servo motor MS2N

Table 10: Fault table for synchronous servo motor MS2N

Fault	Possible cause	Remedy
Motor does not run	Controller release missing	▶ Activate the controller release.
	Controller error	▶ Correct the errors according to the documentation of the controller.
	No voltage supply	▶ Check the voltage supply.
Vibrations	Loose mounting screws	▶ Secure the screw connections as specified.
Operational noises	Foreign particles in synchronous servo motor MS2N	▶ Shut down the synchronous servo motor MS2N. ▶ Contact Bosch Rexroth service for repair.
	Bearing defective	▶ Shut down the synchronous servo motor MS2N. ▶ Contact Bosch Rexroth service for repair.

Fault	Possible cause	Remedy
High motor temperature, motor temperature monitoring responds	Operation outside the nominal data	▶ Reduce load, check design if necessary.
	Heat dissipation hindered	▶ Clean the synchronous servo motor MS2N. ▶ Clean the fan grid of the fan units. ▶ Check the fan function. ▶ In case of liquid cooling, check the cooling circuit. ▶ Check the motor cooling. ▶ Check the coolant temperature within the specification.
Incorrect or faulty temperature display	Temperature sensor not connected	▶ Connect the temperature sensor.
	Temperature sensor defective	▶ Shut down the synchronous servo motor MS2N. ▶ Contact Bosch Rexroth service for repair. ▶ Replace the temperature sensor. ▶ Connect the replacement temperature sensor, if available.

14.2.3 Fault table for control valve

Table 11: Fault table for control valve

Fault	Possible cause	Remedy
Control valve does not switch	Insufficient pilot pressure	▶ Check or restore the pressure at the connections.
	Spool is jammed due to contamination	▶ Try to release the spool, if available, by operating the manual override. ▶ If the manual override is slow, remove the control valve and replace it with a new control valve.
External leakage	Seals at connection surface damaged	▶ Disassemble the hydraulic component and replace the seals.
	Other leakage	▶ Replace the control valve.

Following faults due to contamination, it is – in addition to the repair – essential to check the hydraulic fluid quality and improve it, if necessary, by suitable measures such as flushing or the installation of additional filters.

15 Technical data

You can find the technical data in the data sheet 51195, see chapter 1.2 "Required and amending documentation".

16 Appendix

16.1 List of addresses

Contacts for service and spare parts:

Bosch Rexroth AG
Industrial Hydraulics Service
Bürgermeister-Dr.-Nebel-Straße 8
97816 Lohr am Main
Germany

Phone: +49 (0) 9352/40 50 60
Email: service@boschrexroth.com

For service representatives in your area outside of Germany, please refer to www.boschrexroth.com.

Headquarters:

Bosch Rexroth AG
Zum Eisengießer 1
97816 Lohr am Main
Germany

Phone: +49 (0) 9352/18 0

For questions about the product:

Bosch Rexroth AG
Online Customer Support

Phone: +49 (0) 9352/40 30 20
Email: my.support@boschrexroth.com

The addresses of our sales and service network and sales organizations can be found at www.boschrexroth.com/adressen.

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