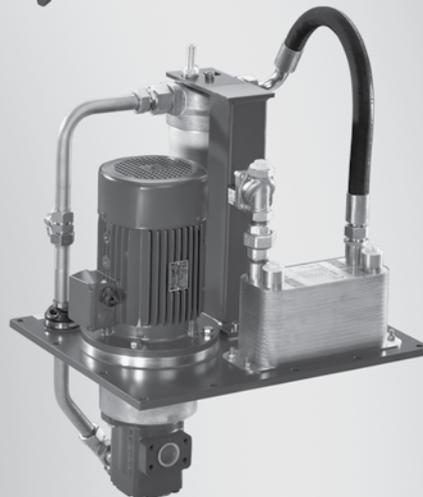
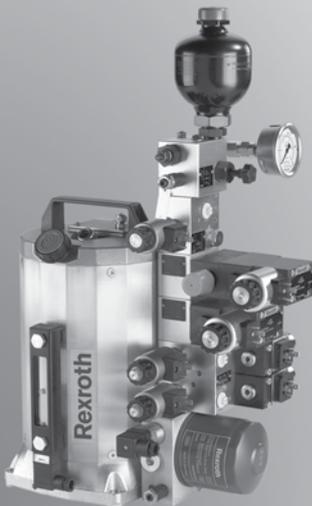
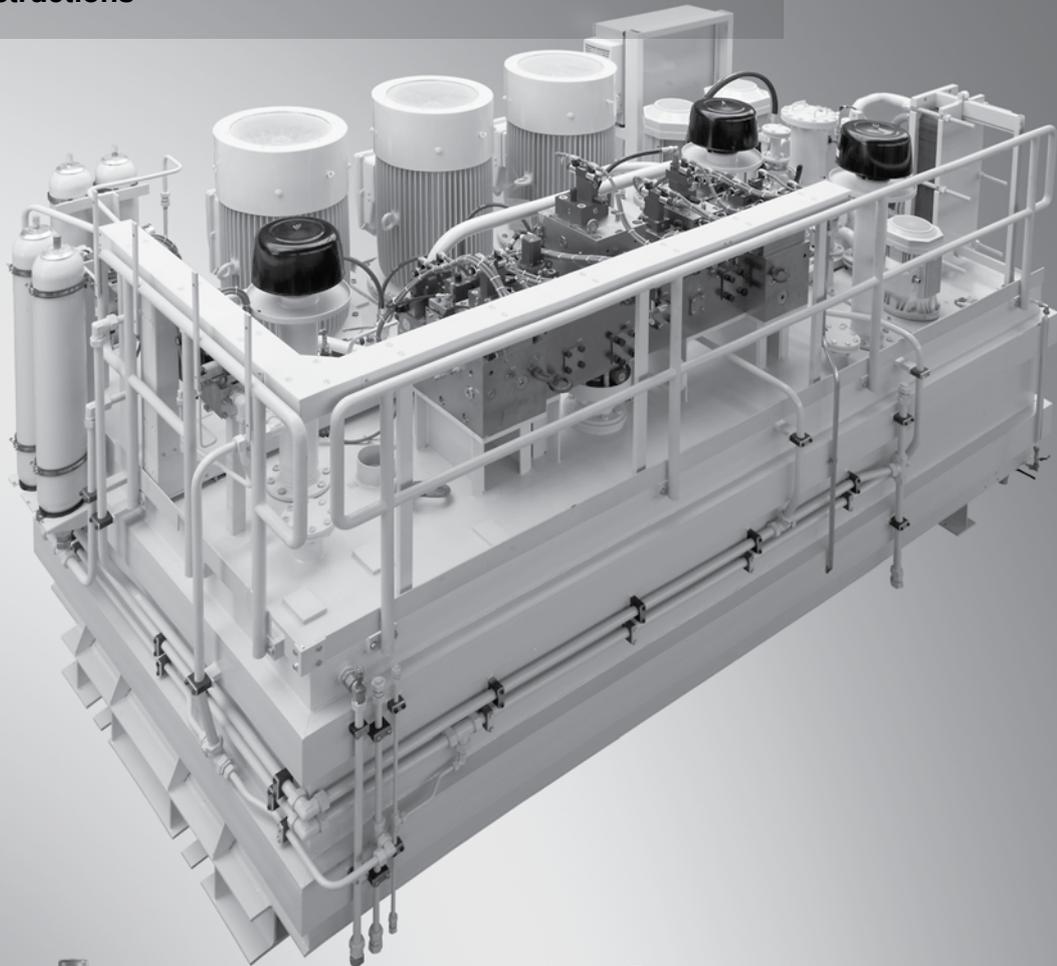


General Operating Instructions for Hydraulic Power Units and Assemblies

RE 07009-B/09.09

Replaces: --
English

Operating Instructions



The data specified below 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.

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The cover shows a sample configuration. The product supplied may therefore differ from the photo shown.

The original operating instructions were prepared in German.

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Contents

1 About this document

These instructions contain important information on the safe and appropriate transport, assembly, commissioning, maintenance, disassembly and basic troubleshooting of hydraulic power units and assemblies.

- ▶ You should read these instructions thoroughly, and in particular Chapter 2 “General safety instructions” before working with the hydraulic power unit.

These are general operating instructions pertaining to hydraulic power units and assemblies that have been developed and manufactured to customer specifications.

- ▶ For this reason you should keep the product-specific documentation to hand when reading these instructions (see Chapter 3 “Scope of delivery”).



Throughout these instructions the term “hydraulic power unit” is used synonymously for hydraulic assemblies. The information contained therein will therefore likewise apply to hydraulic assemblies, even where this is not explicitly stated. Wherever a differentiation needs to be made within the document, the terms “hydraulic power unit” and “hydraulic assembly” will be specified.

1.1 Related documents

- ▶ You should observe the documentation for the complete machine.
- ▶ You should also observe the documentation pertaining to the other components, assemblies and partly completed machinery, which form part of the complete machinery.
- ▶ You should observe the generally applicable, legal or otherwise binding European and national regulations as well as the relevant stipulations for your country pertaining to the prevention of accidents and protection of the environment.

2 General safety instructions

The hydraulic power unit was designed and manufactured considering the provisions of directives, standards and specifications relating to this technology. There is, however, still a risk of personal injury or damage to property if the following safety instructions and warnings contained in this document are not observed.

- ▶ You should read these instructions completely and thoroughly before working with the hydraulic power unit/hydraulic assembly.
- ▶ When reading these instructions you should always have the product-specific documentation to hand (see Chapter 3 “Scope of delivery”).
- ▶ These instructions, together with the relevant product-specific documentation, should be kept so as to be readily accessible to all users.
- ▶ Always include the operating instructions and the product-specific documentation when passing the hydraulic power unit/hydraulic assembly on to a third party.

Due to the interaction between the hydraulic power unit and the complete machine, the installation of the hydraulic power unit into the machinery will result in additional potential hazards. 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 complete machine to have undertaken an independent risk assessment. Furthermore, the manufacturer must on this basis have prepared operating instructions for the complete machine.



These operating instructions are no substitute for the operating instructions for the complete machine.

2.1 Intended use

As regards the specification of the intended use, explicit differentiation will be made in this document between hydraulic power units and hydraulic assemblies.

2.1.1 Hydraulic power units

The hydraulic power unit constitutes partly completed machinery in terms of EC Machinery Directive 2006/42/EC. In terms of the EC Machinery Directive the hydraulic power unit is not considered to be a ready-to-use machine. The hydraulic power unit is exclusively intended for integration into a machine or system or for assembly with other components to form a machine or a system. The product 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 hydraulic power unit is not considered to be a safety component in terms of EC Machinery Directive 2006/42/EC.

- ▶ You should observe the operating conditions and performance limits specified in the technical data.

The hydraulic power unit is a work appliance and not designed for private use. Intended use includes having fully read and understood these operating instructions, especially Chapter 2 “General safety instructions”.

2.1.2 Hydraulic assemblies

A hydraulic assembly is intended exclusively for integration into a machine or system or to be assembled with other components to form a machine or system. The product may only be commissioned if it has been integrated into the machine or system for which it is designed.



The hydraulic assembly is not considered to be a safety component or partly completed machine in terms of EC Machinery Directive 2006/42/EC.

- ▶ You should observe the operating conditions and performance limits specified in the technical data.

The hydraulic assembly is a work appliance and not designed for private use. Intended use includes having fully read and understood these instructions, especially Chapter "2 General safety instructions".

2.2 Improper use

Any use of the hydraulic power unit or the hydraulic assembly other than described in Chapter 2.1 "Intended use" is considered as being improper.

2.3 Qualification of personnel

Assembly, commissioning, service (incl. maintenance, inspection, repair) and disassembly require a basic knowledge of mechanics, electrics and hydraulics, as well as familiarity with the associated technical terms. In order to ensure operational safety, these activities may only be carried out by qualified technical personnel or an instructed person under the direction and supervision of a qualified person.

Qualified personnel are those who can recognize potential hazards 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. Qualified personnel must observe the rules/laws relevant to the specific subject area.

General safety instructions

2.4 Safety instructions in this document

These operating instructions contain warning signs followed by an instruction wherever there is a risk of personal injury or damage to the equipment. The measures described for preventing these hazards must be observed.

Safety instructions are set out as follows:

SIGNAL WORD
**Type of risk!**

Consequences

► Precautions

Warning sign (warning triangle): Draws attention to the hazard

Signal word: Identifies the degree of hazard

Type of risk: Specifies the type or source of the hazard

Consequences: Describes the consequences of non-compliance

Precautions: Specifies how the hazard can be prevented

Table 1: Meaning signal words

DANGER! 	Indicates an imminently hazardous situation which, if not avoided, will certainly result in serious injury or even death.
WARNING! 	Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or even death.
CAUTION! 	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or damage to equipment.
	If this information is disregarded, it may result in machine malfunction or breakdown.

Warning signs	Meaning
	Warning of a danger spot
	Warning of dangerous, electrical voltage

2.5 Adhere to the following instructions

- General**
- The regulations regarding accident prevention and environmental protection applicable in the country where the product is used and at the workplace must be observed.
 - The Bosch Rexroth warranty applies only to the configuration supplied. The warranty will not apply if the product is incorrectly assembled, not used as intended and/or handled improperly.
 - You should keep the manufacturer's data sheet on oil safety to hand and observe the safety information contained therein.
 - Only persons who have been authorized by the operator may be granted access to the immediate vicinity of operation. This also applies during machine standstill.
 - Only authorized personnel are allowed to operate the adjusting mechanisms of the components or parts, under the proviso that the hydraulic power unit is used as intended.
 - Persons who assemble, operate, dismantle or maintain products supplied by Bosch Rexroth must not consume any alcohol, drugs or medication that may have a detrimental affect on their reactions.
 - Please observe the specific information in the following chapters regarding the product life phases.
- Avoidance of hazards**
- Before installation, check the hydraulic power unit for visible transport damage e.g. cracks, missing lead seals, screws, protective covers.
 - Rexroth hydraulic power units should be used only if in a sound technical condition.
 - Hydraulic power units should be used only within the performance range specified in the technical data.
 - Under no circumstances should the hydraulic power unit be subjected to inadmissible mechanical loads. Do not place any objects on top of the power unit.
 - Never remove or damage lead seals that have been fitted by Bosch Rexroth.
 - Provide for sufficient stability of the hydraulic power unit.
 - In this context, observe the maximum load-bearing capacity of the foundations or ground as well as that of the attachment devices and vehicles used for transport.
 - You should use only the designated attachment points.
 - Avoid damage of any kind on the pressurized or functional components of the hydraulic power unit.
- Protective measures**
- Ensure that all associated safety devices pertaining to the hydraulic power unit are existent, have been correctly installed and are fully functional. Do not displace, bypass or disable the safety devices/equipment.
 - If it does become necessary to temporarily disable any safety equipment, e.g. for commissioning or maintenance work, always take appropriate measures to ensure that no potential injury to persons or damage to property can occur. Also observe the superordinate operating instructions for the machine or system.
 - If it does become necessary to work at height, entailing a fall hazard, suitable safety precautions must be taken (e.g. provision of gratings, handrails or harnesses).
 - The hydraulic power unit may heat up during operation. The solenoids in the hydraulic power unit become so hot during operation that you may sustain burns. You should wear heat-proof gloves or protective clothing.

General safety instructions

- Suitable measures should be taken to prevent any slip hazard caused by oily surfaces that may e.g. result from maintenance work.
- In the event of leaks, you should never allow any part of your body to come into contact with the oil jet. Never try to stop or seal the leak or the oil jet using a cloth.
- Leaks may cause an oil mist. Take special care if there are potential ignition sources in the vicinity.

2.6 Obligations of the operator

The operator of the Bosch Rexroth hydraulic power unit must provide personnel training on the following topics and on a regular basis:

- Observation and use of the operating instructions as well as the legal stipulations
- Intended use and operation of the Bosch Rexroth product
- Observation of the instructions from the factory security office as well as the operator's work instructions
- What to do in an emergency



Bosch Rexroth offers training support in specific fields. An overview of the training contents is available on the Internet via the following link
<http://www.boschrexroth.de/didactic>.

3 Scope of delivery

These operating instructions have been prepared for use with hydraulic power units and hydraulic assemblies.

In addition to the actual product itself, the scope of delivery for hydraulic power units and hydraulic assemblies also includes both general and product-specific documentation.

These documents are listed in the following table:

	Document	Power unit	Assembly
Product-specific documentation	Technical specification	x	x
	Hydraulic diagram	x	Poss. data sheet
	Component list to hydraulic diagram	x	Poss. data sheet
	Assembly drawing	x	Poss. data sheet
	EC Declaration of Incorporation	x	—
General documentation	Operating instructions (this document)	x	x
	Assembly instructions	x	—

Product description

4 Product description

The hydraulic power units or hydraulic assemblies, for which these operating instructions have been prepared, are exclusively intended for installation into machinery. As a general rule, these are products that have been developed and manufactured to customer specifications. For the specific description of your product, please refer to the relevant product-specific documentation consisting of:

Product-specific documentation

- Technical specification: Description of the operating conditions and information on the installation into the machinery
- Hydraulic diagram: Function(s) and logic mode of operation of the product
- Component list to the hydraulic diagram
- Assembly drawing: Structural design, dimensions, information regarding the center of gravity, connections, etc.

4.1 Hydraulic power units

Hydraulic power units are drive system for hydraulic machines. In this sense, they are considered partly completed machinery according to EC Machinery Directive 2006/42/EC.

Basic elements

In accordance with these operating instructions hydraulic power units consist at least of:

- Electric motor and pump
- Pump pressure-limiting device
- Tanks, piping and hose assemblies, fittings, etc.
- Fluid level gauge

Extensions

In addition, a hydraulic power unit may contain:

- Hydraulic control
- Accumulator, with separate N₂ pressure tanks, if applicable
- Additional safety devices to prevent unintended pressures
- Additional equipment for recording defined operating conditions (pressure, temperature, filling level, filter contamination)

4.2 Hydraulic assemblies

Hydraulic assemblies include e.g. valve stands, accumulator stations, drive-motor hydraulic pump unit, circulation stations for filtration and/or cooling.

4.3 Product identification

The product is unambiguously identified by:

- The nameplate
- The product-specific documentation
- The delivery note and accompanying documents

5 Transport and storage

- ▶ Observe the transport instructions, e.g. on the packaging.
- ▶ When storing and transporting the product, always observe the ambient conditions specified in Chapter 15 "Technical data".
- ▶ If the package has to be opened e.g. for inspection purposes, you should re-seal the packaging to the condition in which it was supplied.
- ▶ Wherever possible, the packaging should not be removed until directly before assembling the unit.

5.1 Transporting hydraulic power units

WARNING!**Danger to life due to tumbling, falling or uncontrolled movement of the hydraulic power unit!**

If not transported appropriately, the hydraulic power unit may lose its stability and thus be knocked over, fall or move in an uncontrolled way.

- ▶ Check the weight and also the location of the center of gravity of the hydraulic power unit.
 - ▶ Place the product on a suitable foundation / on suitable ground.
 - ▶ By means of additional suitable measures (e.g. by securing holding down points or with the use of cranes) provide for sufficient stability before removing any packing/transit materials or fixtures.
 - ▶ Only the intended locations and attachment points should be used for securing or lifting the hydraulic power unit.
 - ▶ Hydraulic power units must never be attached to or lifted at the mounted components (piping, hoses, manifolds, electric motors, accumulators, etc.).
 - ▶ Observe the maximum load-bearing capacity of the attachment devices.
 - ▶ Observe the maximum load-bearing capacity of the floor conveyors.
 - ▶ Ensure that no unauthorized persons are within the hazard zone.
-

WARNING!**Danger to life due to the ejection of high-pressure oil or machine malfunctions during operation!**

In the case of improper transport of the hydraulic power unit, pressurized or functional components may become damaged.

- ▶ Ensure that these components do not come into contact with the attachment devices or lifting tools during transport.
 - ▶ Ensure that hydraulic power units are not attached to or lifted at these components.
-

Transport and storage

5.1.1 Preparing the power unit for transport

The following preparations must be carried out before transporting the hydraulic power unit:

- ▶ Check the space required for the installation of the hydraulic power unit at the place of use.
- ▶ Check the transport route. Depending on the method of transport, allow for additional space around the hydraulic power unit.
- ▶ Check the maximum admissible load bearing capacity of the roads, bridges, crossings, etc.
- ▶ Prior to transportation of the hydraulic power unit, depressurize the installed accumulators on the oil side. If possible, reduce the pressure on the gas side to a value of 2 bar (200 kPa).



Bosch Rexroth always delivers hydraulic power units without first filling with oil. Any deviations from this rule are described explicitly in the product-specific documentation. From the factory inspection there may, however, still be oil residues in the product.

5.1.2 Determination of the center of gravity

Wherever possible, the location of the center of gravity is marked on the packaging by the following symbol.



Fig. 1: Symbol for marking the center of gravity

The location of the center of gravity is generally specified on the assembly drawing. The diagrams below demonstrate how to mark the center of gravity on drawings.

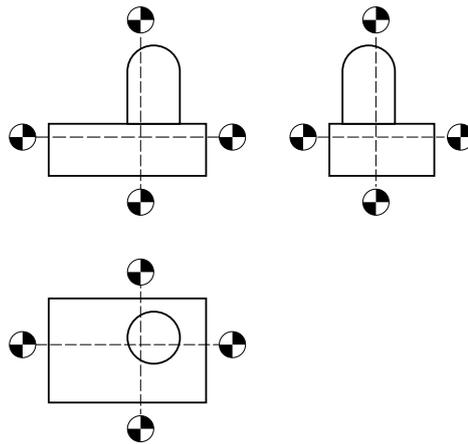


Fig. 2: Marking the center of gravity in drawings

5.1.3 Use of attachment points

WARNING!**Danger to life due to tumbling, falling or uncontrolled movement of the hydraulic power unit when using unsuitable attachment points!**

After a longer period of use, the attachment points may no longer be in place, be sufficiently stable or identifiable as such.

- ▶ You should refer to the product-specific documentation for the intended attachment points and use only the ones identified therein.
- ▶ Check the stability of the attachment points if you intend to transport the hydraulic power unit after dismantling.
- ▶ Replace missing and/or defective attachment points, if possible. This work should be carried out in a professional manner.
- ▶ Insert the screw-in attachment points into the tapped hole and hand-tighten fully.
- ▶ If necessary, mark any unrecognizable attachment points in a clearly visible color.

Attachment points are fixtures in the form of lugs, collars or shackles that are connected to the hydraulic power unit by means of welded or threaded attachment. They are designed for lifting or holding down the hydraulic power unit during transport.

Examples of attachment points of hydraulic power units are shown in Fig. 3:



Fig. 3: Examples of attachment points

- 1 Welded type
- 2 Screwed type

Transport and storage

5.1.4 Manual transport

CAUTION!**Risk of injury to persons undertaking manual lifting/handling due to overloading and incorrect posture!**

In the case of lifting/handling, there is the risk of damage to health due to overloading and incorrect posture.

- ▶ The limits of the respective persons involved in manual lifting/handling must be realistically assessed. Muscular strength and constitution differs considerably among human beings.
- ▶ Wherever possible, suitable lifting aids should be used such as e.g. carrying straps.
- ▶ Always use appropriate techniques when lifting, setting down and moving products.

5.1.5 Transport using forklifts and similar floor conveyors

WARNING!**Danger to life due to falling or uncontrolled movement of the hydraulic power unit!**

If not transported appropriately, the hydraulic power unit may be knocked, fall or move in an uncontrolled way.

- ▶ When using floor conveyors as a means of transport, ensure a stable center of gravity position.
- ▶ The hydraulic power unit must not deviate from its intended orientation.
- ▶ Secure the hydraulic power unit against any resulting acceleration forces as required.



When using floor conveyors, the hydraulic power unit may only be transported by personnel who can prove they hold the relevant qualifications, including safety training, for the respective device.

You should proceed as follows:

- ▶ Using suitable temporary protective devices e.g. wooden or plastic elements, protect the hydraulic power unit against the contact surface of the fork, so that the paintwork cannot be damaged during lifting and transport.
- ▶ Secure the hydraulic power unit at the forklift against tilting. To this purpose, fuse suitable attachment devices like e.g. tie downs.
- ▶ Carefully lift the hydraulic power unit, taking into consideration the stable center of gravity location and transport it to the desired position.
- ▶ Ensure that the built-on components of the hydraulic power unit do not come into contact with the attachment device or lifting tools during transport (see Fig. 4).
- ▶ Carefully set the hydraulic power unit down again and remove the holding down / lifting equipment and any temporary protective devices.

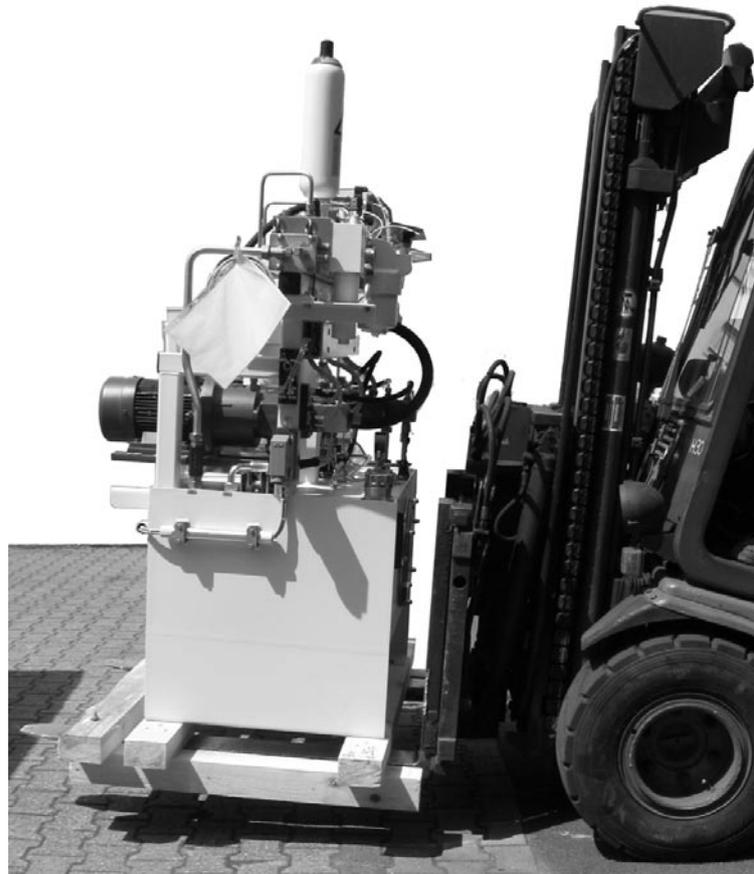


Fig. 4: Transport using forklifts

5.1.6 Transport using cranes and similar lifting tools

WARNING!



Danger to life due to falling or uncontrolled movement of the hydraulic power unit!

If not transported appropriately, the hydraulic power unit may be knocked, fall or move in an uncontrolled way.

- ▶ When using lifting tools, ensure a stable center of gravity position.
- ▶ The hydraulic power unit must not deviate from its intended orientation. If necessary, attach suitable safety and/or catch devices.

If using cranes as a means of transport, attachment device e.g. lifting straps, harnesses or chains should be used.

- ▶ Use only the intended locations and attachment points when lifting (see Fig. 5 and 6).
- ▶ Ensure that the built-on components of the hydraulic power unit do not come into contact with the attachment device or lifting tools during transport

Transport and storage



The edges of the hydraulic power unit may cause damage to the fabric lifting straps or harnesses. An edge protector should therefore be used if necessary.

When using uncovered chains, scratches in the paintwork may result. If necessary, use suitable protection for these surfaces e.g. blankets.

- ▶ Lift and lower the hydraulic power unit slowly and carefully.
- ▶ Only lift the device as far off the floor as necessary.

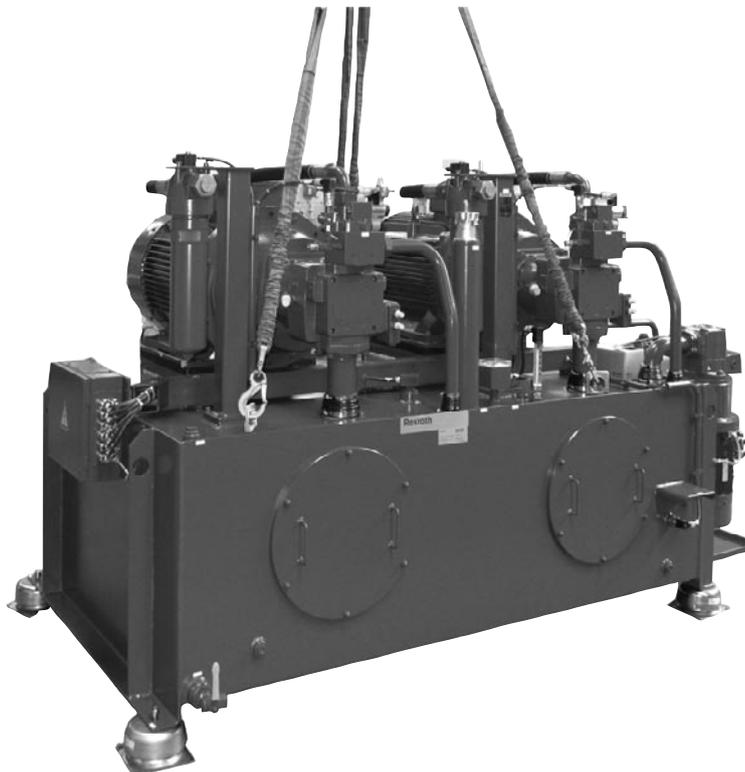


Fig. 5: Use of lifting straps and attachment points

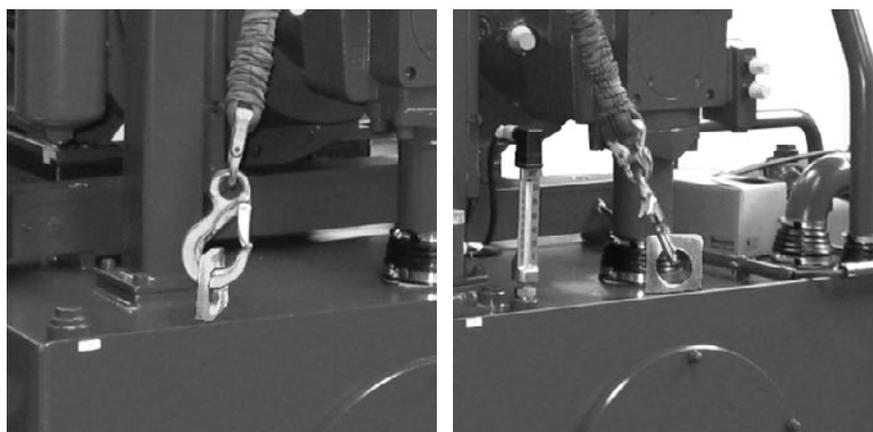


Fig. 6: Detailed view of Fig. 5

5.1.7 Freight transport

WARNING!



Danger to life due to tumbling, falling or uncontrolled movement of the hydraulic power unit!

If not transported appropriately, the hydraulic power unit may be knocked, fall or move in an uncontrolled way.

- ▶ Secure the hydraulic power unit against any resulting acceleration forces as required.



The various regulations of the assigned forwarding agents e.g. shipping companies, railway companies, forwarders, airlines must be observed.

- ▶ Secure the hydraulic power unit onto the transport vehicle, e.g. by the holding down points.
- ▶ Ensure that the built-on components of the hydraulic power unit do not come into contact with the attachment devices during transport.
- ▶ Some products need to be transported in a lying position e.g. accumulator stands. Use the intended attachment points for laying the products down and securing them.

5.2 Storing the hydraulic power units



Observe the storage times specified in Table 2.

- ▶ If the storage time exceeds the values specified, flush the hydraulic power unit before commissioning using a suitable flushing fluid. The flushing procedure should be carried out as described in Chapter 7.1.9 "Flushing the hydraulic system".
- ▶ If necessary, replace the components for which a maximum storage time is specified e.g. hoses, compensators, accumulators.

Table 2: Storage times

Storage conditions	Packaging	Protective agent	Storage time in months	
			Test with the protective agent	Filling with the protective agent
Storage in dry rooms at constant temperature	For carriage overseas	A	12	24
		B	12	24
	Not for carriage overseas	A	9	24
		B	12	24
Outdoor storage (protect the product against damage and water ingress)	For carriage overseas	A	6	12
		B	9	24
	Not for carriage overseas	A	0	12
		B	6	24
Inspection with protective agent		A = Mineral oil		
Filling with protective agent		B = Corrosion protection oil		

6 Assembly and installation

This chapter describes the assembly of the product at its place of use as well as the connection of the product to the hydraulic system, the electrical systems and the water supply of the machine.

For information regarding the installation into the complete machine, particularly regarding its overall function and logic mode of operation, please refer to the instructions and/or the documentation for the complete machine.

CAUTION!



Risk of personal injury and damage to property!

A basic knowledge of hydraulics is required for assembling the hydraulic power unit.

- ▶ Only qualified personnel (see Chapter “2.3 Personnel qualifications”) are permitted to assemble the hydraulic power unit.
-

6.1 Unpacking

- ▶ Remove the product packaging.
- ▶ Dispose of the packaging material in accordance with the national regulations in your country and/or your company-internal specifications/procedures.

6.2 Assembling the hydraulic power unit

WARNING!



Risk of injury due to tumbling, falling or uncontrolled movement of the hydraulic power unit!

You should ensure that the product is sufficiently stable.

- ▶ Observe the information on handling the product in Chapter 5 “Transport and Storage”.
 - ▶ Any packing/transit materials, straps, props or fixtures should only be removed if stability has been ensured by other means.
 - ▶ Place the hydraulic power unit on a suitable foundation. Observe the specifications of the overall weight.
-

To assemble the hydraulic power unit you should proceed as follows:

- ▶ Position the hydraulic power unit or the assembly as specified in the product-specific documentation.
- ▶ Ensure that the footprint contact associated with mounting is consistent.
- ▶ Level the hydraulic power unit so that its longitudinal and transverse axes are horizontal.
- ▶ Prevent possible bouncing by suitable means (e.g. height adjustment of the feet, insertion of shims, packers).
- ▶ Securely fix the product at the mounting positions specified in the product-specific documentation.

6.3 Installing the hydraulic system

CAUTION!**Risk of injury when assembling under pressure!**

If you fail to depressurize the product before starting the installation, you may suffer injury and also damage the unit or system components.

- ▶ Always depressurize the relevant part of the system before assembling the hydraulic power unit.

CAUTION!**Damaging the hydraulic power unit!**

When assembling hydraulic lines and hoses under mechanical stress, they are exposed to additional mechanical forces during operation, which reduces the service life of the hydraulic power unit and the complete machine or system.

- ▶ Assemble the piping and hose assemblies without mechanical stress.

CAUTION!**Wear, tear and malfunctions!**

The cleanliness of the hydraulic fluid has a considerable impact on the cleanliness and service life of the hydraulic system as a whole. Any pollution/contamination of the hydraulic fluid will result in wear and malfunctions. In particular, foreign bodies e.g. welding beads or metal swarf in the hydraulic lines may damage the hydraulic power unit.

- ▶ Always ensure absolute cleanliness
- ▶ Assemble the hydraulic power unit free from any pollution/contamination.
- ▶ Ensure that all connections, hydraulic lines and add-on units (e.g. measuring instruments) are clean.
- ▶ Ensure that no pollutants are able to penetrate when sealing the connections.
- ▶ Ensure that no detergents are able to penetrate the hydraulic system.
- ▶ Do not use cleaning rags/cotton waste or linty cloth for cleaning.
- ▶ Do not under any circumstances use hemp as a sealant.

WARNING!**Risk of injury from ejection of high-pressure oil!**

If the nominal pressure is exceeded, the component may burst.

- ▶ The connection lines should be dimensioned in accordance with the performance data in the circuit diagram.
- ▶ You should only use components that are designed for the required pressures.

WARNING!**Risk of injury from ejection of high-pressure oil!**

Fittings with metric or Whitworth threads may for certain sizes be mis-matched without this being immediately evident. Fittings with threads that are mis-matched will not withstand the specified nominal pressure.

- ▶ You should therefore ensure that there is no risk of confusion with respect to the correct screw fittings.

Assembly and installation

Preparation Remove the blanking plugs and flange covers (colored plastic) and replace them with pressure-resistant fittings or flanges.

- ▶ You should observe the manufacturer's installation instructions for the screw fittings to ensure there is no external leakage. We recommend the use of fittings with elastic seals.

Cleaning the lines ▶ Before installing, clean the connection lines to the hydraulic system, ensuring they are free from dirt, scales, chippings, etc. Welded pipes must be blank on the inside and flushed.

- ▶ Do not use cleaning rags/cotton waste for cleaning.

Hose assemblies The hose assemblies should be installed such that

- Kinking and tensile load of the hose is avoided during operation,
- The hose is not twisted or turned,
- The outer layer of the hose does not rub off through abrasion or impact,
- The weight of the hose assembly does not cause inadmissible loading.



If a hose assembly becomes detached and there is a risk of whipping, it is advisable to fit a hose safety catch. If the hose assemblies are equipped with loosening-resistant fittings, no safety catch is required.

6.4 Connecting to the water supply

- ▶ The fittings must be tightened according to manufacturer specifications!
- ▶ Lay the lines to the water connections provided and connect them according to the circuit diagram.

6.5 Installing the electrical system

CAUTION!



Risk of injury when assembling under voltage!

If you fail to switch off the power supply before assembling the product, you may suffer injury, destroy the product or damage system components.

- ▶ Always switch off the power supply to the relevant system component before assembling the product.

6.5.1 Earthing and potential equalization

Hydraulic power units from Bosch Rexroth are supplied with connection for the external earthing system. Potential equalization within the hydraulic power unit will only occur if the electrical wiring of the components is included in the scope of delivery. If this is not the case, potential equalization must be carried out by the machine manufacturer when wiring the hydraulic power unit to the machine.



The hydraulic power units must be earthed!

The earthing line and the lines for the potential equalization must have the minimum cross-section as per VDE regulations and a yellow-green sheath or labeling.

- ▶ Before connecting the cables, you should earth the devices that are to be connected and provide for potential equalization via a common equalizing bar.

6.5.2 Laying the power supply and control cables and connecting the electricity supply

- ▶ The electrical installation must be performed in accordance with the currently applicable rules of electrical engineering.
- ▶ You must ensure that the power supply is disconnected and also safeguarded against being switched on unintentionally.
- ▶ You should prevent this by e.g. using a warning sign to draw attention to issues regarding working on the electrics.

6.5.3 Installing the electrical control and monitoring equipment

Connect the control and monitoring equipment (switching devices, open-loop or closed-loop equipment or frequency converters) according to the relevant instructions, taking into account the appropriate safety precautions.

7 Commissioning

According to EC Machinery Directive 2006/42/EC, commissioning must not be undertaken until it has been determined that the machinery into which the hydraulic power unit is to be installed complies with the provisions of all relevant guidelines/directives.

The combination of components may give rise to other types of hazard. It is therefore essential that the information in the operating instructions for the complete machine be observed.

This applies in particular to "Mechanical hazards" that may result from mechanical movements of the machine initiated by the hydraulic power units and drives (cylinders, motors).

WARNING!



Risk of personal injury and damage to property!

If the hydraulic power unit is not assembled correctly, persons could be injured and the power unit or system damaged while commissioning the hydraulic power unit.

- ▶ Ensure that the hydraulic power unit has been assembled correctly by qualified personnel before commissioning.
-

CAUTION!



Damaging the hydraulic power unit!

Polluted oil can result in wear and malfunctions. In particular, foreign bodies e.g. welding beads or metal swarf in the suction line may damage the hydraulic power unit.

- ▶ When commissioning you should ensure absolute cleanliness.
 - ▶ Ensure that no pollutants are able to penetrate when sealing the measuring connections.
-

CAUTION!



Risk of personal injury and damage to property from leaking oil!

Hydraulic fluid may leak out if the blanking plugs have not been removed and there is oil at the blanking plugs.

- ▶ Before commissioning, remove all plastic plugs and replace them with pressure-resistant fittings/flanges.
-

CAUTION!



Damaging the hydraulic power unit!

If you commission the hydraulic power unit either without oil or with insufficient oil, the unit will be damaged.

- ▶ When commissioning or re-commissioning a machine or system, you should ensure that the tank, as well as the suction and work lines of the hydraulic power unit and the components are filled with oil according to the manufacturer's specifications and that they remain filled with oil during operation.
-

7.1 First commissioning

7.1.1 Before commissioning

- ▶ Ensure that the line system is in good, work-safe condition.
- ▶ Open the taps in the cooling water line (if present).
- ▶ Open the taps in the suction line (if present).
- ▶ Open the pressure gauge air relief to prevent measuring errors (change from “Closed” position to “Open”).
- ▶ Adjust the electrical level monitoring and/or temperature-measuring device (if present) as required for operation of the machine.

7.1.2 Valve settings

- ▶ Set operating pressure valves and flow control valves to the lowest settings possible.
- ▶ Bring directional valves into the basic position.
- ▶ Do not energize proportional valves to the command value.



Do not make any changes on sealed valves.



Do not change the factory settings. Do not set or adjust valves that, according to the technical specifications (circuit diagram or parts list), have been provided with a fixed factory setting.

7.1.3 Safe handling of pressure tapping points

When setting pressure valves the respective pressures must be displayed. This can be done by using fixed installed pressure gauges, digital pressure displays or by connecting external measuring equipment. To this purpose, measuring couplings have been installed within the hydraulic power unit. As the measuring points can be operated while under pressure, extreme caution is required!

WARNING!**Risk of injury from inappropriate installation with system under pressure!**

Measuring hoses have no blocking or closing function.

- ▶ Before connecting the measuring hose to the measuring coupling ensure that the other end of the hose has been connected to the measuring equipment (pressure gauge, pressure transducer) and that it is pressure-tight.
-

Commissioning

If the scope of delivery includes a measuring device that is connected to both measuring hose and coupling, the connection may only be opened on the coupling side.

The following diagram (see Fig. 7) shows the position for safe separation of the measuring equipment from the pressurized measuring coupling of the hydraulic power unit.

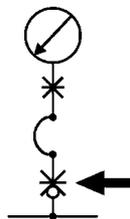


Fig. 7: Position for safe separation of the measuring equipment (arrow)

WARNING!**Risk of injury from inappropriate installation with system under pressure**

Measuring connections may also be assembled with a hexagon bolt fitting in the hydraulic power unit. These are not designed for assembly under pressure.

- ▶ They should not be dismantled until the connected hydraulic circuit has been depressurized.

7.1.4 Accumulator

If the hydraulic power unit includes accumulators, the instructions applicable at the place of installation are to be complied with before commissioning as well as during operation. "Product-specific Operating Instructions" are supplied with each accumulator.

- ▶ You should ensure that these documents are kept together with the accumulator. Experts will need these for subsequent inspections.
- ▶ On the oil side, the hydraulic power unit must be sealed tightly, bled (see Chapter 7.1.7 "Bleeding the complete hydraulic system of the machine") and depressurized.
- ▶ Fill the accumulator according to the information in the circuit diagram to the prescribed pre-set gas pressure.
- ▶ The filling and measuring procedures are undertaken using a testing and filling device (in this connection see "Product-specific operating instructions" for this device).



Affix a label to the accumulator specifying the accumulator filling pressure and note this value in the circuit diagram. This will enable you to perform a comparative control at a later date.

CAUTION!**Filling with gas**

Only nitrogen should be used as gas! (Nitrogen Class 4.0 purest; N₂ 99.99 vol. -%).

- ▶ The operator will have sole responsibility for complying with the inspection to be carried out before commissioning as well as for subsequent inspections.

7.1.5 Filling the hydraulic system

Fill the hydraulic system with suitable oil as specified, proceeding as follows:

- ▶ When filling the hydraulic system you should ensure absolute cleanliness.
- ▶ If, after transport or storage, the hydraulic power unit is seen to be contaminated, you should clean the filter inlets on the tank before opening.
- ▶ Under no circumstances should you remove filter screens at the filler neck and/or the filter insert while filling.
- ▶ With longer transport or storage times, check the tank for any water present and remove via the drain cock.



Recommendation: Experience has shown that the cleanliness class required for operation of the machine is already exceeded in the case of new oils in the original container.

If you wish to ensure that the cleanliness class is acceptable, use a special filter unit for filling the hydraulic power unit if necessary, or use a filter station with fine filter.

When filling the pump housing you should proceed as follows:

- ▶ For pumps with drain line, fill the housing with oil (see also “Product-specific operating instructions”).
- ▶ Observe the maximum/minimum fluid levels, taking into consideration tank volumes, line system, drives, etc.

7.1.6 Activating the electrical supply

See machine manufacturer’s operating instructions.

7.1.7 Bleeding the complete hydraulic system of the machine

See machine manufacturer’s operating instructions.

The hydraulic system should be bled at the hydraulic components at the highest point.

Commissioning

7.1.8 Commissioning

The following steps are to be performed unless superordinate commissioning instructions applicable at machine level are to be observed.

DANGER!**Risk of personal injury and damage to property**

Commissioning will activate machine functions.

- ▶ Ensure that the existing safety devices are activated.
- ▶ Start the electric motor in inching mode. Check the direction of rotation.
- ▶ Flush the hydraulic system as described in Chapter 7.1.9.
- ▶ Operate the directional valves and extend and retract the actuators several times. Repeat the bleeding processes. (Bleeding is ensured if there is no oil foam in the tank, no jerky movements at the actuator and no abnormal noises).
- ▶ Operate the system at low pressure until the hydraulic power unit is completely bled. Increase the load in steps.
- ▶ Observe the fluid level in the tank and refill if necessary.
- ▶ Monitor the operating temperature as it sets itself, if the machine has been in full operation for several hours.
- ▶ Check the connection points for tightness, seal any leakage points; check the connection points again for tightness after a few hours.

Commissioning problems

The matrix for “Causes of faults and their consequences in hydraulic power units” is available as a support mechanism in the systematic search and/or localization of faults, (see Chapter 14).

7.1.9 Flushing the hydraulic system

Flushing the hydraulic system to attain a specified oil cleanliness class prevents faults and simultaneously increases the service life of the components. After installing the hydraulic power unit into the machine and/or after installing with the hydraulic system, it must be ensured that the minimum requirements are met with respect to the cleanliness class of the components. Hydraulic systems in general industrial applications require a cleanliness class of 20/18/15 according to ISO 4406, whereas hydraulic systems with servo valves or control valves of higher quality demand a higher cleanliness class e.g. 19/16/13.



You must take into consideration the cleanliness requirement for the components as specified on the manufacturers' data sheets, when determining the flushing target.

Materials required**Preparation:**

- Supply of replacement or flushing filter elements
- If required: Supply of additional material for piping and hose assemblies for establishing flushing and/or shorting links
- Supply of flushing plates or directional valves
- On a case-by-case basis: Flushing fluid (see following note)

Information on flushing fluid

You can use the same medium as the one that is also to be used later when operating the hydraulic system. When using another oil, this must be compatible with the operating medium intended for use with the hydraulic system, as well as with the materials, particularly seals, used in the hydraulic system. A maximum admissible residual amount of flushing liquid in the operating medium (e.g. 0.5 volume %) may be specified in certain circumstances (see manufacturer's specification); in this case, this has to be assured by carefully draining the flushing liquid before filling with the operating medium.



For more complex hydraulic systems with ring and branch lines, the flushing process must be planned in detail and undertaken with care.

This is imperative if piping within the system have been welded and maybe also pickled.

The following statements assume that the flushing process is undertaken using the hydraulic power unit described in these operating instructions. When using a separate flushing unit, it is imperative to observe the operating instructions pertaining to this unit!

Flushing temperature

For the flushing operation the hydraulic power unit must be brought to operating temperature, if possible, and is to be operated with reduced pressure settings. Remember either to deactivate any existing pressure monitoring circuits for the flushing phase or to adjust them to the lower flushing pressures.

Flushing duration

As far as the duration of flushing is concerned, no generalization can be made. It is recommended that oil samples be taken at periodic intervals during the flushing process and then analyzed for cleanliness. Suitable sampling points include e.g. the return line downstream from any existing return line filter. Depending on these results the decision then has to be made as to whether the flushing operation should be stopped (once the target cleanliness level has been attained) or continued.



The operating pressure must only be set at the pressure valves intended for that purpose.

Never change the setting of sealed valves or valves with a fixed factory setting.

After flushing

After completing the flushing process care should be taken to ensure that the operating settings of the hydraulic power unit have been restored, that any flushing connections have been dismantled and connection lines sealed so as to be pressure-tight. When replacing the flushing plates with original valves, these are to be assembled according to manufacturer specification.

Commissioning

7.1.10 The most frequent errors during commissioning

- The fluid tank is not being checked.
- The system is being filled with unfiltered oil.
- The fluid tank is not being checked.
- Pressure relief valves are being set too close to the working pressure (closing pressure difference is not being observed).
- Pressure controllers of hydraulic pumps are being set higher than or equal to that of the pressure relief valve.
- Abnormal pump noises are not being observed (cavitation, leaky suction line, too much air in the oil)
- The switching hysteresis of pressure switches is not being considered in the setting
- Before commissioning, the hydraulic pump and hydraulic motor housings are not being filled with oil
- The settings are not being documented
- During commissioning, uninvolved personnel are staying in the vicinity of the machine

7.2 Re-commissioning after extended standstill

When re-commissioning the system after an extended standstill period, you should proceed as follows:

- ▶ Check:
 - the oil level
 - the accumulator pressure on the gas side
 - the tightness of the hydraulic components and the line system
- ▶ Perform switch-on procedures with increased caution.
- ▶ Bleed the hydraulic system.
- ▶ Observe the information in the operating instructions of the machine manufacturer.

8 Operation

As partly completed machinery, the hydraulic power unit is intended for installation into machinery.

Information on operating the hydraulic power unit can only be provided in connection with the [complete] machine. For this information, please refer to the operating instructions of the machine manufacturer.

Information on the functional operation and logic of the hydraulic power unit can be obtained either from hydraulic experts or from the product-specific documentation.

9 Maintenance

Bosch Rexroth offers a wide range of repair services for maintenance of the hydraulic power unit. Please send any enquiry to your nearest Bosch Rexroth service center or contact headquarters direct. For the addresses please refer to www.boschrexroth.com.

Maintenance tasks (inspection, service, repair) must be defined in terms of component-specific requirements, operating conditions (pressures, temperatures, ambient conditions) and use (duty cycle, cycle times, shift operation). Please refer to the operating instructions of the machine manufacturer.

Within this framework, a visual inspection is to be undertaken to detect obvious faults:

- Incomprehensible notes or warning signs
- Leaks
- Loose and/or missing components
- Indication of the application of external force

9.1 Maintenance documentation

It is recommended that the results of the inspections and the derived measures required be documented,

- so that considering functionality and economy, the service intervals can be adjusted to the actual operating conditions,
- as they offer the possibility of early fault recognition thanks to comparative evaluation (preventive maintenance).



Any negative trend of the test parameters e.g. oil temperature, replacement intervals of the filter elements or noise may be an indication of changes. The troubleshooting matrix (see Chapter 14) may provide help in minimizing this problem.



Gradual temperature increases and/or shorter filter replacement intervals may be an indication of possible wear at pumps, control edges, seals and aging of the oil and means that an inspection should be undertaken of all components under consideration.

An immediate high temperature increase is an alarm signal and requires an immediate inspection of the machine.

9.2 Cleaning and care (maintenance)

CAUTION!



Penetrating dirt and liquids will cause faults!

Safe function of the hydraulic power unit/components is then no longer ensured.

- ▶ Always ensure absolute cleanliness when working on the hydraulic power unit.

CAUTION!



Damage to the surface from solvents and aggressive cleaning agents!

Aggressive detergents may damage the seals on the hydraulic power unit and make them age faster.

- ▶ Never use solvents or aggressive detergents.

CAUTION!



Damage to the hydraulic system and seals!

The water pressure of a high-pressure cleaner can damage the hydraulic system and seals of the hydraulic power unit.

- ▶ Do not use a high-pressure cleaner.
- ▶ Cover all openings with the appropriate protective devices in order to prevent detergents from penetrating the hydraulic power unit.
- ▶ Check that all seals and electrical plug connections are firmly fitted to prevent the penetration of detergents.

9.3 Inspection, maintenance, repair

Recommendations are based on the following: A Central European climate and an environmental load as is usual in metal-processing companies.



Before commencing the inspection, cleaning should be undertaken if necessary. Always ensure cleanliness when working on the hydraulic power unit.

9.3.1 Filling level

The filling level should be checked at intervals of 8 operating hours.

Oil level

While the hydraulic power unit is in operation, the oil level will not remain constant. Level changes result from the different volume requirements of plunger and differential cylinder and/or the absorption/delivery of oil in hydraulic accumulators during a working cycle.

Due to the variable conditions mentioned above a complete working cycle of the machine must be observed when undertaking the visual inspection of the oil level. This will enable you to determine whether the oil needs to be refilled or topped up, and if so, by how much.

During operation, the oil level must neither exceed the upper mark nor fall below the lower mark. If the minimum filling level is undershot, there is a risk of pump failure due to cavitation.

If the maximum filling level is exceeded, this may have been caused by the thermal expansion of the oil or by fluid entry (e.g. water in the case of internal leaks of the oil/water heat exchanger).

Maintenance

Fluid level indicator The hydraulic power unit can also be equipped with an electrical fluid level indicator. The switching points can be seen from the technical specification and the circuit diagram.

- Maintenance, repair** **Measures to be taken if the maximum filling level is exceeded:**
- Expansion due to temperature increase
(Approximate determination: $\Delta V = \text{Thermal expansion coefficient} \times \Delta T$)
 - Correcting the filling level
 - Exceeding the maximum filling level due to suspected water ingress
 - Close the water valves (shut-off the cooling water supply)
 - Draw an oil sample at the lowest point of the tank and check for water content
 - If the suspected water ingress is confirmed, you should complete the machine working cycle and then shut down safely.
 - Repair the oil/water heat exchanger according to the manufacturer's specifications or replace if necessary
 - Perform more extensive control measures and implement the following measures depending on these results:
 - Clean or drain and change the oil
 - Undertake a flushing process, if necessary
 - Check the oil for admissible water content
- Measures to be taken if the minimum filling level is undershot:**

CAUTION!**Risk of personal injury and damage to property from oil loss!**

An oil loss is always associated with leakage.

- ▶ First identify and remedy the actual cause of the leakage.
- ▶ Only then should you top up the oil to the correct level.

9.3.2 Oil temperature (optional)

The oil temperature should be checked at intervals of 8 operating hours.

The hydraulic power unit may be equipped with an optical thermometer or electrical temperature-measuring device, depending on the order specification. The switching points can be seen from the technical specification and the circuit diagram.

- Possible causes of temperature increase** Possible causes of a temperature increase include:
- Malfunctioning of the heat exchangers
 - A change in the cooling water conditions
 - Malfunctioning or incorrect setting of the pressure valves
(e.g. maximum pressure limitation, pump controller, pressure relief valve)
 - Malfunctioning of the heating system
 - Fault at the pump (wear, increased leakage)
 - A change in ambient conditions (e.g. increased ambient temperature)
 - A change in load conditions at the drives

In the case of an inadmissible temperature increase, the causes are to be determined and rectified.

9.3.3 Filter clogging indicator (optional)

The contamination level of the filters should be checked at intervals of 8 operating hours.

Bosch Rexroth filters will be used as standard.

With these filters, if the admissible back/differential pressure is exceeded, an optical signal is output, i.e. a red pin becomes visible.

Cold start

After a cold start, the red pin on the filter clogging indicator is to be pushed in after the operating temperature has been reached (check function). With this control, if the pin jumps out again immediately, the filter element must be replaced at the end of the shift at the latest.

In addition, the monitoring equipment may be electrical for evaluation at control level. The switching points can be seen from the technical specification and the circuit diagram.

When using filters from other manufactures, different optical or electrical filter clogging indicators may be installed. In individual cases and depending on the order specification, this control may have been dispensed with.



You should be wary if the filter clogging indicator still does not indicate that a replacement is necessary after several inspection intervals. Of course, this may be an indication that the oil is clean. It may, however, also be due to the following reasons:

- The filter clogging indicator is defective.
- The filter element is defective.
- A bypass valve, if present, does not close properly (e.g. due to penetration of dirt particles).

Maintenance, repair

Measures: Plan and carry out a filter replacement at the end of the shift.

If the intervals between necessary replacement of the filter elements become shorter, the reason for the increased deposition of dirt is to be identified and remedied.

WARNING!



Risk of injury from falling parts!

Depending on filter size, the filter housings may be quite heavy.

- ▶ If necessary, ask a second person for help.

Before commencing the work, prepare receptacles for oil, as well as for filter housing and filter element.

When dismantling and assembling the filter element, please refer to the operating instructions of the filter manufacturer.

You should dispose of the filter elements according to the national or operator-specific regulations.

Maintenance**9.3.4 Pressure values**

The pressure values must be checked if the behavior of the drives changes (e.g. cycle time extension, end product quality, etc). Otherwise, one control at least every six months is recommended.

We recommend recording the pressure values within the scope of the maintenance documentation.

Lead seals Lead seals, e.g. on the accumulator safety valves provide information that the original pressure setting has not been changed. Without attaining the set pressure, the sealed valves cannot be checked within the scope of a normal inspection. The inspection here comprises a check to ensure the lead seals are intact.

If the lead seals defective, contact the manufacturer.

9.3.5 Oil maintenance

An oil analysis should be performed at least once per year.

An oil analysis entails drawing a sample of oil in a professional manner. The oil sample must be checked in a suitable laboratory in accordance with the oil manufacturer's specifications.

Maintenance, repair Depending on the result, it may be necessary to implement more measures, e.g.:

- Filtration (measures)
- Dehydrogenation
- Changing the oil



The use of recycled oil (recovered oil) is to be avoided.

- ▶ If the oil is changed, it must be drained completely (in this connection see also Chapter 10.1 "Preparing for decommissioning").

You must also ensure that the lines and actuators have been completely drained. You may also have to carry out bleeding measures, if necessary.

As with the initial filling, the hydraulic system must be bled after each subsequent refill.

9.3.6 Hydraulic accumulators

WARNING!



Risk of personal injury and damage to property!

Accumulators are a potential source of hazards. Leaking pressurized gas may result in serious injury or even death.

Particular care must be taken when working on hydraulic systems with accumulators, as inappropriate behavior may result in serious injury.

- ▶ Never perform welding or soldering work or any mechanical processing on accumulators!

WARNING!



Risk of personal injury and damage to property!

If air or oxygen is used as an accumulator medium, there is a high risk of explosion!

If uncleaned gases are used, the contaminating substances contained therein or the water content may lead to unforeseeable and uncontrollable behavior of the device.

- ▶ Only use nitrogen as gas in the accumulator (Nitrogen Class 4.0 purest; N₂: 99.99 Vol-%)!

WARNING!



Risk of personal injury and damage to property!

When draining the nitrogen from the accumulator, the atmospheric oxygen will be displaced. In very small rooms, this may result in fainting or even suffocation.

- ▶ Before discharging the nitrogen accumulator pressure, the doors and windows of the room in which the accumulator is located must be opened.

WARNING!



Risk of personal injury and damage to property!

The draining of the nitrogen from the accumulator may result in an excessive increase in pressure.

- ▶ Before discharging the nitrogen accumulator pressure, the doors and windows of the room in which the accumulator is located must be opened.



There are legally prescribed inspections for accumulators, which have to be undertaken at defined intervals. This is the responsibility of the operator.

In order for the accumulator to function as intended, the gas pre-charge is to be checked periodically according to the information in the circuit diagram.

CAUTION!



Risk of injury!

Due to the fast discharge of the gas pressure, the components and component parts affected will be subjected to extreme cooling. In extreme cases, contact with unprotected skin may even result in supercooling in the form of burns!

- ▶ You should wear thermal gloves and avoid contact with the supercooled components. Wait for a reasonable period of time until the supercooled components have reached ambient temperature once more!

Maintenance

Regarding the maintenance of hydraulic accumulators, you should observe the relevant stipulations of ISO 4413 (Chapter 7.3.2.2) in its current version, as well as those in the operating instructions of the accumulator manufacturer.

Gas filling pressure

The essential maintenance required for hydraulic accumulators entails the verification and setting of the gas filling pressure.

To this purpose, only those testing and filling devices and procedures may be used, which are recommended by the manufacturer for filling accumulators.

Please note that the gas filling pressure must be selected according to the gas temperature.

In this connection, it must be ensured that the admissible accumulator pressure is not exceeded. Ensure that the gas valve is securely closed after each inspection or adjustment.

Dismantling from the system

Before dismantling hydraulic accumulators, the liquid pressure in the accumulator must be reduced to ambient pressure (i.e. be in a depressurized condition).

Maintenance instructions for hydraulic accumulators

Service, maintenance and/or replacement of hydraulic accumulator components may only be carried out by sufficiently trained personnel (see Chapter 2.6 "Obligations of the operator") on the basis of written instructions and by using parts and materials, the manufacture of which has been certified as being in accordance with current specifications.



Before dismantling an accumulator, it must be completely depressurized on both the liquid and the gas side.

9.3.7 Hose assemblies and compensators

Hose assemblies and compensators consist of an elastic part (hose/diaphragm) and fittings mounted on both sides.

Optional components

- Hose assemblies are optionally available with:
- Abrasion protection (only apply at the places where there really is abrasion)
- Hose safety catch
- Splash guard (also possible with hose safety catch)
- Fire protection (only possible with hose safety catch)



Hose assemblies and compensators are components requiring constant monitoring.

- Maintenance, repair**
- ▶ They should be replaced if one of the following conditions is determined during inspection:
 - Damage of the outer layer down to the core (e.g. abrasion points, cuts or cracks).
 - Visible traces of overheating, fire: Carbonization, blistering or fouling due to partial heat impact (hot spots).
 - Embrittlement of the outer layer (formation of cracks in the elastic part).
 - Deformation not corresponding to the original shape of the components in both depressurized and pressurized condition.
 - Leaks.
 - Damage or deformation of the fitting (sealing function impaired).
 - Corrosion of the fitting reducing function and stability.
 - Hose working loose from the fitting.
 - Storage time and service life exceeded.

9.3.8 Piping

The piping consists of the pipes and the connection elements.

Connection types:

- Form-type fitting
- Flare-type fitting
- Welded conical fitting
- Compression joint
- Flange connection

The piping must be checked at least once every six months (or more frequently depending on operating conditions and use).

In order to allow for a visual inspection, prior cleaning may be required.

There is an inspection for:

- Corrosion
- Crack formation
- Leaks
- Indication of the application of external force

Maintenance, repair **In the case of leaks at fittings**, the latter are to be re-tightened once and this then recorded. If there are still leaks at these fittings, these must be carefully checked for the cause of the leakage. Depending on the findings, the seals may need to be renewed and/or the fitting replaced with a pipe section. In the case of leaks at flanges, you should proceed in a similar manner.

In the case of crack formation or leaks at welded seams, the cause has to be determined and remedied. Afterwards, the components concerned are to be replaced or repaired in a professional manner.

If there are signs of an application of external force the cause must be determined and remedied. Afterwards, the component and also adjacent pressurized components are to be checked for damage and assessed with respect to further reliable use. If necessary, these components are to be replaced or repaired in a professional manner.

If there are signs of corrosion the component is to be checked for damage and assessed with respect to further reliable use. If necessary, this component is to be replaced or repaired in a professional manner. You must in all cases provide for corrosion protection.

Maintenance

9.3.9 Heat exchanger

The following may be installed, depending on the order:

- Oil-vacuum heat exchangers
- Oil-water heat exchangers

In case of reduced cooling power

If the cooling power of the heat exchanger is reduced, you should follow the manufacturer's operating instructions.

When using water filters in the cooling water circuit, the water filter elements are to be checked at least once every six months and cleaned if necessary.

When using oil-vacuum heat exchangers, the lamellae must be checked regularly for contamination and cleaned if necessary.

9.3.10 External inspection of tanks and steel components

The external inspection is a visual one and must be undertaken at least once every six months (or more frequently depending on operating conditions and use). In order to allow for a visual inspection, prior cleaning may be required.

Visual inspection

There is a visual inspection for:

- Leaks
- Crack formation
- Corrosion
- Dents due to the application of external force

Maintenance, repair

In the case of leaks at components screwed into the tank the latter are to be re-tightened once and this then recorded. If there are still leaks at this point, the contact point must be carefully checked for the cause of the leakage. Depending on the result, seals are to be renewed and/or the component replaced. In the case of leaks at flange-mounted components, you should proceed in a similar manner.

In the case of crack formation or leaks at welded seams, the cause must be determined and remedied. Afterwards, the components concerned are to be replaced or repaired in a professional manner.

If there are signs of an application of external force the cause must be determined and remedied. Afterwards, the component and also adjacent components are to be checked for damage and assessed with respect to further reliable use. If necessary, these components are to be replaced or repaired in a professional manner.



If there are signs of an application of external force on the tank, an internal inspection of the tank should be undertaken.

If there are signs of corrosion the component is to be checked for damage and assessed with respect to further reliable use. If necessary, this component is to be replaced or repaired in a professional manner. You must in all cases provide for corrosion protection.

9.3.11 Internal inspection of the tank

The internal inspection is a visual inspection of the tank on the inside and is generally performed when the oil is changed. Oil change will depend on the result of oil samples taken.

In order to perform the visual inspection, you must first of all completely drain the oil (in this connection see also Chapter 10.1 "Preparing for decommissioning"). If there is any contamination, internal cleaning must also be carried out.

There is a visual inspection/inspection for:

- Corrosion
- Crack formation
- Foreign bodies
- In the case of screw connections, you must ensure that they are sitting correctly

Particular characteristics with walk-in tanks

Prerequisite: The inspector must not suffer from claustrophobia and must be physically fit enough to move around in a confined space!

Recommendation: Before commencing the work inside a tank, you should inform the fire department and/or a first aider/paramedic or ensure that they are on standby.

If the inspector has to move his whole body completely into the oil tank, he must be suitably harnessed and secured by at least a second person outside the oil tank.

Preparation

Preparation For his own safety, the inspector must:

- Prepare a means of rescue before entering the tank,
- Take off watch and jewelry,
- Wear a cap or a hair net,
- Wear protective clothing (tight-fitting overall with zips and no outside pockets),
- A lamp suitable for explosive atmospheres must be used

DANGER!



Risk of personal injury and damage to property!

There is a risk of suffocation inside tanks.

The breathable air in a tank must contain sufficient oxygen for it to remain breathable for the relevant personnel without posing any risks.

- ▶ Before entering the tank, open all manholes and access openings.
 - ▶ Ensure sufficient ventilation with breathable air, if necessary by means of forced ventilation.
-

Maintenance, repair

In the case of crack formation at welded seams, the cause must be determined and remedied. Afterwards, the welded seams concerned are to be repaired in a professional manner.

If foreign bodies are detected they are to be removed from the tank. Their origin and the cause of their presence must be established. Depending on the cause established, suitable measures must be introduced to ensure safe operation of the hydraulic power unit.

If there are signs of corrosion the location concerned is to be checked for damage and assessed with respect to further reliable use. If necessary, the tank must be replaced or repaired professionally. You must in all cases provide for medium-resistant corrosion protection.

If piping and hose fittings are loose the former must be tightened professionally.

If screw connections are loose the parts to be secured must sit correctly and the screw connection tightened professionally.

9.4 Spare and wear parts

WARNING!**Risk of personal injury and damage to property due to the use of incorrect spare parts!**

Spare parts not complying with the ones listed in the product-specific documentation may cause mechanical hazards or malfunctioning of the machine.

- ▶ Only use components listed in the product-specific documentation (parts list).
- ▶ Only use new seals with the required resistance to media.
- ▶ As the sealing material may differ despite being of identical appearance, the material number should be checked.

Please send your spare part orders to your nearest Bosch Rexroth service center or directly to the headquarters. For the addresses, please refer to www.boschrexroth.com.

Ordering spare parts

- ▶ Spare parts should be ordered in writing. In urgent cases you can also order by phone, but you are kindly requested to confirm your order in writing e.g. by fax.
- ▶ Please provide the following information when ordering spare parts:
 - Material number and order number of the hydraulic power unit (nameplate)
 - Material number of the respective component
 - Required quantity
- ▶ The required type of dispatch (e.g. as parcel, freight, air freight, by courier etc.).

10 Decommissioning

10.1 Preparing for decommissioning

You must provide a collecting tank that is large enough to accommodate the total oil volume.

The total volume of the hydraulic power unit comprises the volumes of the tank, the line system, the drives, etc.

Ensuring safety

As a basic principle you should observe the related instructions for the complete machine. Unless otherwise specified in these operating instructions, you should complete the following steps:

- ▶ Avoid dangers caused by adjacent machines.
- ▶ Do not allow uninvolved persons to remain in the area concerned.
- ▶ Loads should be lowered or safely supported

10.2 Decommissioning the hydraulic power unit

- ▶ Switch off the electrical power and ensure that it cannot be switched on (short-circuit - bridge the supply side)
- ▶ Switch off and secure the hydraulic pressure supply.
- ▶ Depressurize the accumulator on the oil side
- ▶ Drain the oil into the collecting tank provided. In this connection, ensure complete draining of the lines and actuators. If necessary, carry out bleeding measures.
- ▶ Decommission the machine as described in the overall machine instructions.

11 Disassembly



Only disassemble the component parts as far as is necessary to undertake the required work. As a basic principle, all disassembled parts should be professionally reassembled at the intended place.

11.1 Preparing for disassembly

DANGER!



Serious injury due to the hydraulic power unit falling over or from uncontrolled movements!

- ▶ Ensure sufficient stability of the hydraulic power unit.
- ▶ Regarding the question as to whether the stability is sufficient, please refer to the product-specific documentation.
- ▶ Only loosen the fixings of the hydraulic power unit, if applicable, if stability has been ensured in another way.

DANGER!



Serious injury or even death when undertaking the disassembly under pressure and with electrical voltage applied!

If the hydraulic system is not depressurized, high-pressure oil will leak while dismantling. If the electrical voltage of the system is not switched off, there is a risk of electric shock.

- ▶ Ensure that the relevant parts of the hydraulic system are depressurized and de-energized.

DANGER!



Serious injury due to the hydraulic power unit falling over or from uncontrolled movements!

When the unit is full, movements of the oil will cause displacement of the center of gravity, which may result in the hydraulic power unit losing its stability.

- ▶ Before dismantling, drain the oil from the hydraulic power unit as described in Chapter 10. "Decommissioning".

WARNING!



Danger to life due to tumbling, falling or uncontrolled movement of the hydraulic power unit when using unsuitable attachment points!

After a longer period of use, the attachment points may no longer be in place, or sufficiently stable or no longer identifiable as such more.

- ▶ Refer to the product-specific documentation for the intended attachment points and only use the ones mentioned there.
- ▶ Check the stability of the attachment points if you intend transporting the hydraulic power unit after dismantling.
- ▶ Replace missing and/or defective attachment points, if possible. This work should be carried out in a professional manner.
- ▶ Insert the screw-in attachment points into the tapped hole and hand-tighten fully.
- ▶ If necessary, mark the unrecognizable attachment points using easily visible color.

Ensuring safety:

As a basic principle you should observe the related instructions for the complete machine. Unless otherwise specified in these instructions, complete the following steps:

- ▶ Complete the decommissioning as described in Chapter 10 of these operating instructions.
- ▶ Do not allow uninvolved persons to remain in the area concerned.

11.2 Disassembling the hydraulic power unit**Residual oil flow**

- ▶ When disassembling you should perform the work steps described in Chapter 6 "Assembly" but in reverse order.
- ▶ Despite prior draining of the oil, some oil will still seep out of the hydraulic line system of the hydraulic power unit and/or the hydraulic system. All line outlets should therefore be closed using suitable plugs.



After disassembly is complete, you should observe the information in Chapter 5 regarding safe transportation of the product.

12 Disposal

Careless disposal of the hydraulic power unit, its components and the oil can lead to pollution of the environment. Please therefore observe the following points:

- ▶ Dispose of the product/components in accordance with the national regulations in your country and/or your company-internal specifications.
- ▶ Dispose of oil according to the currently applicable safety data sheets.

13 Extension and conversion

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

Declarations become invalid

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



For hydraulic power units this means the following:

Hydraulic power units are partly completed machinery in terms of EC Machinery Directive 2006/42/EC. Together with the product-specific documentation, you have received a declaration of incorporation for these products. In the case of extension to or conversion of the hydraulic power unit, this declaration will become invalid.

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 www.boschrexroth.com.

14 Troubleshooting

DANGER!



Risk of personal injury and damage to property!

Depending on the system, troubleshooting may give rise to a wide range of potential hazards.

- ▶ Troubleshooting must only be undertaken when the safety equipment is active!
- ▶ You must proceed with extreme caution if you have to deactivate this safety equipment in order to search for errors/faults. If possible, you should operate the machine in set-up mode with reduced performance data when identifying faults!

Successful troubleshooting within a hydraulic power unit requires precise knowledge of the set-up and the mode of operation of the individual components. The combination of hydraulic and electrical systems and electronics makes the troubleshooting even more complex.

For effective troubleshooting, the circuit diagrams (hydraulic and electrical, if applicable), parts lists, any functional diagrams and other documents must be available.

14.1 How to proceed with troubleshooting

- ▶ Always work systematically and focused, even when under time pressure. Random and imprudent disassembly and readjustment of settings can, in the worst-case scenario, result in the inability to determine the original cause of the fault.
- ▶ You should first get a general idea of how the hydraulic power unit works in conjunction with the entire system.
- ▶ Try to establish whether the hydraulic power unit was working properly in conjunction with the entire system before the problem first occurred.
- ▶ Try to determine any changes within the entire system into which the hydraulic power unit is integrated:

Control questions

- Were any changes made to the operating conditions or operating range of the hydraulic power unit?
 - Were any changes or repair work undertaken on the entire system (machine/ system, electrics, control) or on the hydraulic power unit?
 - If so: What were they?
 - Was the hydraulic power unit or machine used as intended ?
 - How did the malfunction become apparent?
- ▶ Try to get a clear idea of the cause of the fault.
If necessary, ask the actual (machine) operator

14.1.1 Overview of the impact of defects

The following tables contain errors/faults and their consequences, the causes of which are not exclusively attributable to the hydraulic power unit. The listed error sources, possible causes and remedies refer exclusively to the hydraulic power unit. You will also frequently have to look at the control system or connection technology when seeking the causes of faults.

The following list is meant as an aid, but does not claim to be comprehensive.

Tabular classification of the impact of defects:

“A” Excessive / abnormal noises

“B” Insufficient power / torque / pressure in the drives

“C” Irregular drive movements (pressure and volume fluctuations)

“D” Operating or oil temperature too high

“E” Contaminated oil

Table 3: Impact of defect “A”: Excessive / abnormal noises

Malfunction	Possible causes	Remedy
1 Mechanical drive section	Coupling: Incorrectly aligned, loose, defective	Align, tighten, exchange coupling
	Pump and/or motor fastening loose	Tighten the fastening according to manufacturer specifications
	Pump or motor defective	Replace pump / motor
	Wrong direction of rotation	Change around the electrical connections of the energy supply
2 Suction conditions	Oil level in the tank is too low	Check and remedy the cause of the oil loss, top up the oil (see also A5)
	Breather filter contaminated or too small	Clean or replace breather filter
	Tap in the suction line is only partially open	Fully open the tap Note: Check the electrical spool position monitoring
	Suction line plugged, not tight	Clean, seal the suction line
	Suction filter plugged or too small	Clean or replace suction filter Note: In compliance with E DIN EN ISO 4413:2008-07, the use of suction filters is not recommended.
	Location over 1000 m above sea level	Provide for structural changes after consultation with Bosch Rexroth
3 Pump	Pump seals or pump defective	Replace pump seals or pump according to the manufacturer specifications
	Vibrating controller system, e.g. pressure controller	Check for sufficient bleeding and correct basic setting of the controller according to the manufacturer specifications.
4 Pressure valves	Flow noises and vibrations due to wrong setting	Check and, if necessary, correct the settings according to the specifications in the circuit diagram
5 Oil	1. Viscosity too high (temperature too low)	1. Before starting the machine function, temper the hydraulic power unit; if necessary, use oil of a lower viscosity class.
	2. Oil foams (proportion of air too great)	2. Check and remedy the cause of the ingress of air.

Troubleshooting

Table 4: Impact of defect "B": Insufficient power, torque or pressure at the drives

	Fault	Possible causes	Remedy
1	Pressure valves	Operating pressure setting too low	Control of the setting according to the specifications in the circuit diagram
2	Directional valves	Incorrect spool position (e.g. pressureless circulation; valve does not switch)	Check for jammed plug-in connection and correct current feed of the solenoid
3	Piping and hose assemblies to the drive	Pressure loss too high due to incorrect dimensioning	Replace the piping and hose assemblies with larger nominal widths
4	Other	Total values for flow- and load resistance and/or leaks too large	Check the hydraulic design after consulting with Bosch Rexroth

Table 5: Impact of defect "C": The pump is switched on or off too frequently

	Fault	Possible causes	Remedy
1	Pump	For machines with accumulators, the pump delivery volume is too low.	Check the design of the pump/accumulator circuit; enlarge the pump or accumulator, if necessary
2	Accumulator	<ul style="list-style-type: none"> • Tap to the accumulator is closed • The preset gas pressure is not correct • The operating and set pressures (e.g. pressure switches) do not comply with the requirements. 	Check the spool position at the accumulator control block, the gas pre-load and the settings according to the circuit diagram

Table 6: Impact of defect "D": Oil temperature too high

	Fault	Possible causes	Remedy
1	Pump	Partial load operation of the machine, pump delivery volume cannot be adjusted in the case of fixed displacement pumps	Check the hydraulic design after consulting with Bosch Rexroth
2	Pressure valve	Incorrect setting of pressure valves - usually too low. One part of the pump delivery volume flows back to the tank via the pressure relief valves.	Check and, if necessary, correct the settings according to the circuit diagram
3	Heat radiation	Insufficient heat dissipation due to: <ol style="list-style-type: none"> 1. Too little oil in the tank 2. Insufficient heat radiation due to encapsulation/ lack of ventilation 	<ol style="list-style-type: none"> 1. Check the oil level in the tank 2. Provide for forced ventilation, if necessary
4	Heat exchanger	<p>For oil/water heat exchangers: Too little flow of cooling water, temperature of cooling water too high, too little cooling water in the system, inlet pressure too low or deposits in the heat exchanger</p> <p>For oil-vacuum heat exchangers: The air flow is impaired, ambient temperature too high</p>	Check whether the coolants (water, air) comply with the requirements of the technical specification.
5	Other	Increased reduction in efficiency due to changed conditions, also wear, if applicable	Perform maintenance work, replace components, if necessary

Table 7: Impact of defect "E": Contaminated oil

	Fault	Possible causes	Remedy
1	Particulate contamination	<ol style="list-style-type: none">1. Deposition of dirt due to insufficiently cleaned components (e.g. piping) during installation2. Deposition of dirt during the filling of oil3. Deposition of dirt due to improperly undertaken maintenance and repair work4. Ingress from the environment, e.g. via piston rods, breather filters5. Abrasion of components	Determination of the causes Rectification of the causes Flushing the hydraulic system
2	Water in the oil	<ol style="list-style-type: none">1. Corrosion of the oil/water heat exchanger due to water quality deviating from the material specification of the heat exchanger2. Pressure surges on the cooling water side	<ol style="list-style-type: none">1. Examination of the water quality, replacement of the heat exchanger if necessary2. Solenoid water lock valves must only be arranged in the supply line!

15 Technical data

Please refer to the product-specific documentation for the technical data of the product.

16 Appendix

16.1 Address directory

Please refer to www.boschrexroth.com for addresses of foreign subsidiaries

17 Glossary

Assembly

An assembly comprises two or more components and/or assemblies that are preassembled in a suitable form (also see hydraulic assembly).

Attachment points

Attachment points are fixtures in the form of lugs that are connected to the load by means of welded or screw connections. They are used to lift or secure the load during transport.

Attachment devices

Attachment devices are separate devices used to bridge the connection between a crane and a load in order to lift the latter. Attachment devices are e.g. lifting straps, belts or chains.

Component

Any part with a (partial) function in the sense of the technical overall system. Components in the hydraulic system include e.g. valves, filters, cylinders, hydraulic connection elements.

Danger

Potentially occurring event having a detrimental impact on life and/or body.

Danger area, hazard area

Any area in a machine and/or around a machine, in which a person may be exposed to a hazardous situation.

Decommissioning

Preparation for an extended standstill of the device/system with the options for re-commissioning or disassembly.

Drive (actuator), hydraulic

Component converting the hydraulic energy of the oil into mechanical energy (e.g. hydraulic motors, cylinders).

Extended standstill

e.g. shutdown for several weeks

Floor conveyors

Floor conveyors are means of transport for the horizontal transport that are mostly used within the company at ground level.

Hazard

Potential source of damage

Hydraulic accumulator

Gas pressure tank: Bladder-type accumulator, diaphragm-type accumulator and piston-type accumulator

Hydraulic assembly

Hydraulic assemblies include e.g. valve stands, accumulator stations, drive-motor hydraulic pump unit, circulation stations for filtration and/or cooling.

Hydraulic assemblies are not covered by the scope of EC Machinery Directive 2006/42/EC and therefore do not constitute partly completed machinery.

Hydraulic fluid

Generally valid designation for hydraulic fluids in hydraulic systems; in these operating instructions, the term "oil" is used in line with actual practice.

Hydraulic power unit

A hydraulic power unit is the drive system for hydraulic machines.

The hydraulic power unit constitutes partly completed machinery in terms of the EC Machinery Directive 2006/42/EC. Drives are explicitly not regarded as components of the hydraulic power unit.

Hydraulic system

The term "hydraulic system" describes a combination of hydraulic power units, assemblies or components that are only set up and connected hydraulically at the place of use.

A hydraulic system is basically part of a machine. A hydraulic system itself, however, does not constitute a machine.

Hydraulics (Fluid technology)

Transfer, control and distribution of energy using a pressurized, fluid medium.

Injury

Physical injury or damage to health

Leak

A leak is the unwanted outflow of any liquid from the closed hydraulic line system and/or the pressurized components, which is sufficient to form a drop.

Lifting tool

Devices and equipment for lifting loads, e.g. bridge cranes, gantry cranes, winches.

Line system

Any combination of lines (hoses, piping or bores) and hydraulic connection elements allowing for the intended flow of the oil between tanks, pumps, valves, accumulators, actuators, filters, etc.

Machinery

"Machinery" is *"an assembly of linked parts or components, at least one of which moves, joined together for a specific application."*

For the complete definition of the term "machinery", please refer to EC Machinery Directive 2006/42/EC.

Maximum operating pressure

The maximum pressure with which the hydraulic system or parts of the system may be operated under uniform (constant) conditions.

Nominal pressure

Nominal pressure is a certain pressure value assigned to a component, a hydraulic line system or a hydraulic system as designation, specifying that it belongs to a certain pressure level.

Oil

Generally valid designation for hydraulic media in hydraulic systems; in these operating instructions, the term "oil" is used in the practical sense.

Partly completed machinery

Definition taken from the EC Machinery Directive 2006/42/EC:

"Partly completed machinery" is an "assembly which is almost machinery but which cannot in itself perform a specific application. A drive system is partly completed machinery. Partly completed machinery is only intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment, thereby forming machinery to which this Directive applies."

Pressure

Physical unit: Force per unit area [$\text{N} / \text{m}^2 = \text{Pascal}$]; [1 bar = 100 kPa]

Glossary

Product-specific documentation

The product-specific documentation complements the “General operating instructions for hydraulic power units and hydraulic assemblies” (this document) by adding specific information pertaining to your product.

The product-specific documentation consists of:

- Technical specification: Description of the operating conditions and information on the installation into the machinery
- Hydraulic diagram: Function(s) and logic mode of operation of the product
- Component list to the hydraulic diagram
- Assembly drawing: Structural design, dimensions, information regarding the center of gravity, connections, etc.

Safety equipment

Safety equipment means components of machinery that serve the protection of human beings from all potential dangers resulting from the machine.

System

In this document, the term “system” in terms of the EC Machinery Directive 2006/24/EC is used synonymously with the term “machine”.

Tank

The component in a hydraulic system that collects all the oil during operation and standstill. It is not used for storing hydraulic energy.

Glossary

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
97816 Lohr am Main
Germany

Phone +49 (9352) 18-0
Fax +49 (9352) 18-40

documentation@boschrexroth.de
www.boschrexroth.de