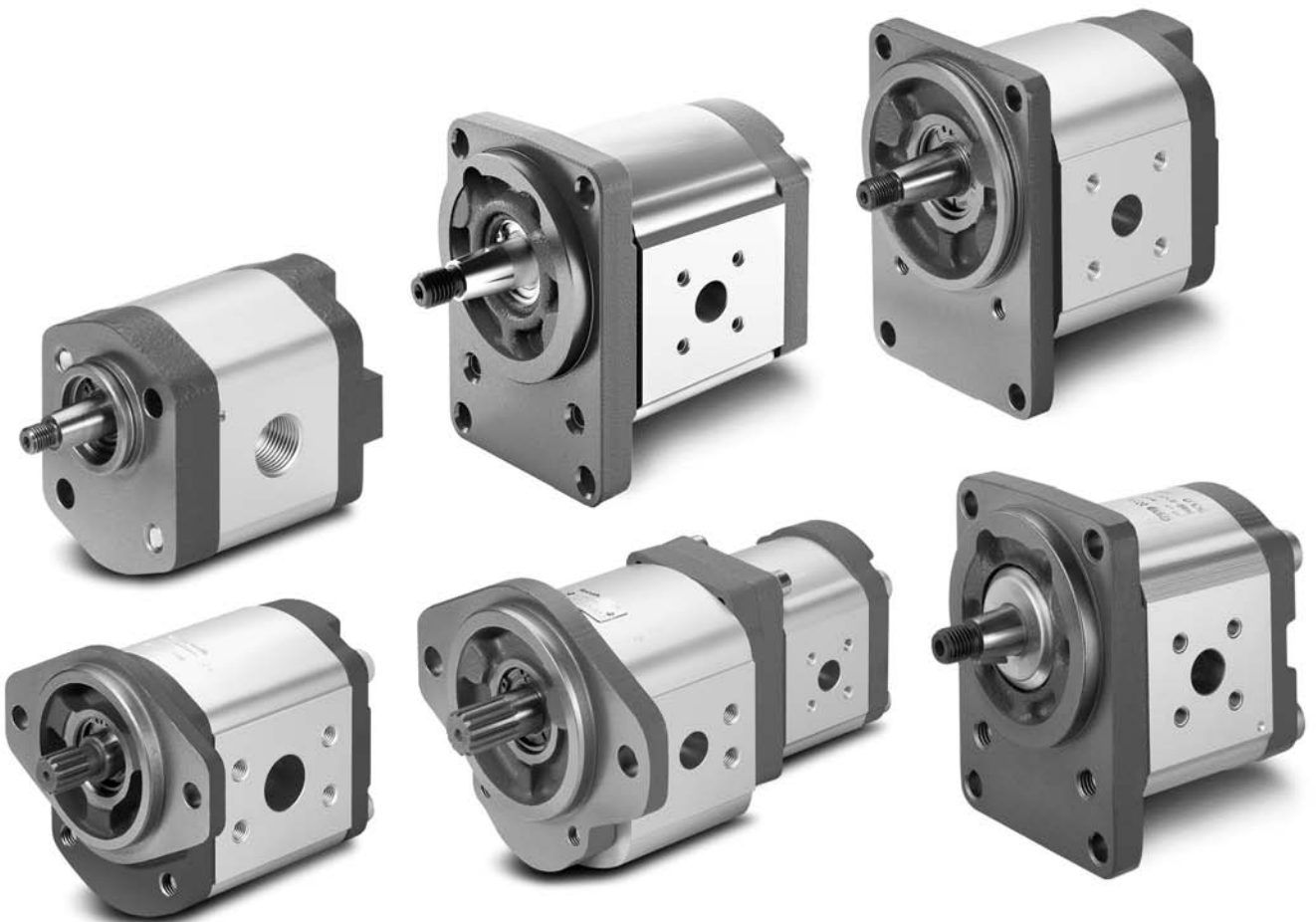


# General instruction manual for external gear units

**Instruction manual**  
**RE 07012-B/01.2016**

Replaces: 06.07  
English



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

The original instruction manual was created in the German language.

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# 1 About this documentation

## 1.1 Validity of the documentation

This documentation is valid for the following products:

External gear units from Bosch Rexroth, which include:


- External gear pumps
- External gear motors

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





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





- ▶ Read this documentation completely and in particular chapter 2 “Safety instructions” on page 11 and chapter 3 “General instructions on property damage and product damage” on page 18 before you start work with the external gear unit.

## 1.2 Required and supplementary documentation

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

**Table 1: Required and supplementary documentation**

	Title	Document number	Document type
	<b>Order confirmation</b> Contains the order-based technical data of your external gear units AZP and AZM.	–	Order confirmation
	<b>Offer drawing</b> Contains the permissible technical data. The external gear unit may only be operated under the values and conditions specified in the offer drawing.	Please request the offer drawing from your contact at Bosch Rexroth.	Offer drawing
	<b>Technical data sheet</b> Contains, among other things, the permissible technical data for the external gear unit. Also observe the information contained in the offer drawing. Please bear in mind that different technical data sheets apply depending on the external gear unit: External gear pump High Performance AZPB External gear pump High Performance AZPF External gear pump SILENCE AZPS External gear pump SILENCE AZPT External gear pump SILENCE PLUS ASPJ External gear pump High Performance AZPN External gear pump High Performance AZPG External gear pump SILENCE AZPU External gear pump Standard AZPW External gear motor High Performance AZMB External gear motor High Performance AZMF External gear motor High Performance AZMN External gear motor High Performance AZMG	10088 10089 10095 10092 10094 10091 10093 10098 10090 (In preparation) 14027 14026 14026 14026	Data sheet
	<b>Mineral oil-based hydraulic fluids and related hydrocarbons (HL, HLP)</b> Describes the requirements for a mineral oil-based hydraulic fluid (HL, HLP) and related hydrocarbons for operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your hydraulic system.	90220	Data sheet

Title	Document number	Document type
 <b>Environmentally compatible hydraulic fluids (HEPG, HEES, HEPR, HETG)</b> Describes the requirements on an environmentally friendly hydraulic fluid (HEPG, HEES, HEPR, HETG) for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90221	Data sheet
 <b>Fire-resistant, water-free hydraulic fluids (HFDR/HFDR)</b> Describes the requirements on fire-resistant, water-free hydraulic fluids (HFDR/HFDR) for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90222	Data sheet
 <b>Flame-resistant, water-free hydraulic fluids (HFAE, HFAS, HFB, HFC)</b> Describes the requirements on fire-resistant, water-containing hydraulic fluids (HFAE, HFAS, HFB, HFC) for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90223	Data sheet
 <b>Y sheet</b> Please bear in mind that different technical data sheets apply depending on the external gear unit:		Data sheet
AZPB	Y 510 100 172	
AZPF	Y 510 201 598	
AZPS	Y 510 201 777	
AZPJ	Y 518 400 019	
AZPN/AZPT	Y 510 300 033	
AZPG/AZPU	Y 510 400 419	
AZPW (NBR seal)	Y 510 202 148	
AZPW (FPM seal)	Y 510 202 154	
AZMB	Y 511 100 032	
AZMF	Y 511 200 028	
AZMN	Y 511 300 001	
Information tightening torque	Y 510 202 040	

### 1.3 Display of information

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

#### 1.3.1 Safety instructions

This documentation includes safety instructions in chapter 2.6 “Validity of the documentation” on page 14 and in chapter 3 “Alphabetical index” on page 18 and before a sequence of actions or an instruction for action involving a risk of personal injury or damage to equipment. The described danger prevention measures must be observed.




The safety directives in this manual are for the external gear unit only. Please also take into account the safety directives from the machine/system manufacturer.

Safety instructions are set out as follows:

 <b>SIGNAL WORD</b>
<p><b>Type and source of danger!</b> Consequences of noncompliance ▶ Measures to prevent danger</p>

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


**Table 2: Hazard classes as defined in ANSI Z535.6**

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

### 1.3.2 Symbols

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

**Table 3: Meaning of the symbols**

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

### 1.3.3 Designations

This documentation uses the following designations:

**Table 4: Designations**

Designation	Meaning
AZ	External gear unit
AZP	External gear pump
AZM	External gear motor
Threaded plug	Metal screw, pressure-resistant
Protection plug	Made out of plastic, not pressure-resistant, only for transportation

### 1.3.4 Abbreviations

This documentation uses the following abbreviations:

**Table 5: Abbreviations**

<b>Abbreviation</b>	<b>Meaning</b>
ATEX	EC directive on explosion protection ( <b>A</b> tmosphère <b>e</b> xplosible)
DIN	<b>D</b> eutsche <b>I</b> ndustrie <b>N</b> orm (German Institute for Standardization)
ISO	<b>I</b> nternational <b>O</b> rganization for <b>S</b> tandardization
JIS	<b>J</b> apan <b>I</b> ndustrial <b>S</b> tandard
RE	<b>R</b> exroth document in the <b>E</b> nglish language
VDI 2230	Directive for the systematic calculation of high duty bolted joints and joints with one cylindrical bolt from the VDI (Verein <b>D</b> eutscher <b>I</b> ngenieure - Association of German Engineers)

## 2 Safety instructions

### 2.1 About this chapter

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

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

### 2.2 Intended use

External gear units are hydraulic components, meaning that in their application they are classified neither as complete nor as partially completed machinery in the sense of the EC Machinery Directive 2006/42/EC. A component is exclusively intended to form a partly complete machine or a complete machine together with other components. The component may only be commissioned after it has been installed in the machine/system for which it is intended and the safety of the entire system has been established in accordance with the machinery directive.

This product is intended for the following use:

The external gear unit is only allowed to be used as a hydraulic pump or hydraulic motor as part of the layout of hydraulically driven systems in machinery and system engineering.

- ▶ Adhere to the technical data, the application and operating conditions and the performance limits as specified in the data sheet (see Table 1, Page 7) and in the order confirmation. More information on the permissible hydraulic fluids can be found in data sheets 90220, 90221, 90222 and 90223.

The external gear unit is only intended for professional use and not private use.

Intended use includes having read and understood the complete documentation, especially the safety instructions in Chapter 2 on page 11.

### 2.3 Improper use

Any use other than that described as intended use shall be considered as improper and is therefore impermissible.

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

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

- Use outside the operating parameters approved in the data sheet or in the order confirmation (unless specifically approved by the customer)
- Use of non-approved fluids, e.g., water or polyurethane components
- Changes to factory settings by unauthorized persons
- Use of add-ons (e.g., attachment filter, control unit, valves) not in combination with the specified Rexroth components

- Using the external gear unit under water at a depth of more than 10 meters without necessary additional measures, e.g., pressure equalization
- Using the external gear unit when the ambient pressure is greater than the interior pressure
- Use of the external gear unit in explosive environments unless the component or machine/system has been certified as compliant with the ATEX directive 94/9/EC
- Using the external gear unit in a corrosive atmosphere
- Using the external gear unit in aircraft or spacecraft

## 2.4 Personnel qualifications

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

Skilled persons are those who can recognize possible dangers and institute the appropriate safety measures due to their professional training, knowledge, and experience, as well as their understanding of the relevant regulations pertaining to the work to be done. Qualified personnel must follow the rules relevant to their field and have the necessary hydraulics expertise.

Hydraulics expertise includes:

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



Bosch Rexroth offers training support for specialized fields. An overview of the training contents can be found online at: [www.boschrexroth.com/training](http://www.boschrexroth.com/training).

## 2.5 General safety instructions

- Observe the applicable accident prevention and environmental protection regulations.
- Observe the safety regulations and provisions of the country in which the product is used/operated.
- Use Rexroth products only when they are in good working order.
- Observe all notices on the product.
- Persons who install, operate, remove or maintain Rexroth products may not be under the influence of alcohol, drugs or medication that may affect their reaction time.
- Only use genuine Rexroth accessories and spare parts to ensure there is no risk to personnel from unsuitable spare parts.
- Observe the technical data and ambient conditions specified in the product documentation.
- If unsuitable products are installed or used in applications that are relevant for safety, unexpected operating conditions may occur in the application, which could result in injury to personnel or damage to equipment. For this reason, only use the product in a safety-related application if this use is expressly specified and permitted in the product documentation, for example in explosion protection applications or in safety-related parts of a control system (functional safety).
- You may only commission the product if it has been determined that the end product (e.g., machinery or system) in which the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards for the application.
- Use tools appropriate for the work being performed and wear appropriate protective clothing to prevent punctures and cuts (e.g., when removing protective covers, disassembly).
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference. Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. Potential electromagnetic interference for persons (e.g. persons with a pacemaker) and other components must be tested by the machine manufacturer.

## 2.6 Product-specific safety instructions

The following safety instructions apply to chapters 6 to 14.

### WARNING

#### **Danger from excessively high pressure.**

Risk of death or injury, or property damage.

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

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

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

#### **Danger from suspended loads.**

Risk of death or injury, or property damage.

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

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

#### **System/machine under pressure.**

Danger to life or risk of injury, serious injuries when working on machines/systems not secured ! Risk of property damage.

- ▶ Switch off the entire system and secure it against reconnection according to information provided by the machine/system manufacturer.
- ▶ Make sure that all relevant components of the hydraulic system are depressurized. Follow the machine/system manufacturer's specifications.
- ▶ Note that the hydraulic system may still be under pressure even after the pressure supply itself has been disconnected.
- ▶ Do not disconnect any line connections, ports and components as long as the hydraulic system is under pressure.
- ▶ Turn off all power-transmitting components and ports (electric, pneumatic, hydraulic, mechanical) in line with the manufacturer's specifications and secure them against being turned back on.

 **WARNING****Escaping oil mist.**

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

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

**Electrical voltage.**

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

- ▶ Always set up the relevant part of the machine/system so that it is free of electrical voltage before you install the product or when connecting and disconnecting connectors. Protect the machine/system against being re-energized.

**Danger from splashes from hydraulic fluid**

Risk of explosion, risk of injury!

The splashing of hydraulic fluid on hot components with damage to components (e.g. caused by overloading, incorrect sizing, operating when the connections are not closed) can cause fires.

- ▶ Pay attention to and eliminate potential sources of danger before commissioning the external gear unit.
- ▶ Make sure no one is in the danger zone of the machine/system.

## CAUTION

### **High noise levels during operation.**

Danger of hearing damage, deafness!

The noise emission of external gear units depends on, among other factors, rotational speed, working pressure, and installation conditions. The sound pressure level may rise above 70 dB (A) during normal application conditions.

- ▶ Always wear hearing protection when in the vicinity of the operating external gear unit.

### **Dangers due to noise effects**

In unauthorized operating states (e.g. overspeed, lack of supply) and faulty components (e.g. outboard bearings) unexpected noises and noise effects may arise

- ▶ If there is an increase in unusual noise, have Service identify and resolve the faults.

### **Hot surfaces on the external gear unit.**

Risk of burns.

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

### **Improper routing of cables and lines.**

Risk of stumbling and property damage! Improper routing of cables and lines can cause a risk of tripping as well as damage to parts and components, e.g. by tearing off lines and connectors.

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

### **Contact with hydraulic fluid.**

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

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

### **Escaping hydraulic fluid due to machine/system leakage!**

Risk of burns and risk of injury due to escaping oil jet!

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

 **CAUTION****Danger from improper handling.**

Risk of slipping. When using the external gear unit as a climbing aid there is a risk of slipping on wet surfaces when climbing on the external gear unit.

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

**2.7 Personal protective equipment**

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

All pieces of personal protective equipment must be intact.

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

The following information applies to chapters 6 to 14.

#### **NOTICE**

##### **Danger from improper handling.**

Product can be damaged.

- ▶ Do not expose the product to excessive mechanical loads.
- ▶ Never grab or climb onto the product.
- ▶ Do not place/lay any objects on the product.
- ▶ Do not strike the drive shaft of the external gear unit.
- ▶ Do not set/place the external gear unit on the drive shaft or assembled parts.
- ▶ Do not strike fittings (e.g., sensors or valves).
- ▶ Do not strike sealing surfaces (e.g., working line ports).
- ▶ Leave the protective covers on the external gear unit until you connect the lines.
- ▶ Disconnect all electrical connectors before electro-welding or painting.
- ▶ Make certain that the electronic components (e.g., sensors) do not become electrostatically charged (e.g., while painting).

##### **Risk of property damage due to improper lubrication.**

Product can be damaged or destroyed.

- ▶ Never operate the external gear unit with insufficient hydraulic fluid. Specifically, make sure that the rotary group has sufficient lubrication.
- ▶ When commissioning a machine/system, make sure that the case interior and the working lines of the external gear unit are filled with hydraulic fluid and remain filled during operation. Air inclusions in the forward drive shaft bearing are to be prevented, especially with the installation position “drive shaft upwards”.
- ▶ When commissioning a machine/system, make sure that the valves, cylinders and actuators and their working lines are filled with hydraulic fluid and remain filled during operation. Otherwise, the machinery/system may respond unexpectedly.
- ▶ Check the hydraulic fluid level in the case interior regularly; if necessary, recommission. With above-reservoir installation, the housing area may drain via the drain line after longer periods of disuse (air enters via the shaft seal) or via the working line (gap leakage). This means the bearings are insufficiently lubricated when the system is turned on.
- ▶ Make sure that the suction line is always filled with hydraulic fluid during commissioning and operation.  
Especially, when doing an above-reservoir installation the external gear unit must be able to draw in hydraulic fluid.

## **NOTICE**

### **Mixing of hydraulic fluids.**

Product can be damaged.

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

### **Contamination of the hydraulic fluid.**

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

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

### **Improper cleaning.**

Product can be damaged.

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

### **Environmental pollution due to improper disposal.**

Careless disposal of the external gear unit and its assembled parts, the hydraulic fluid and the packaging material can result in environmental pollution.

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

## **NOTICE**

### **Danger from chemical or corrosive environmental conditions.**

Product can be damaged. If the external gear unit is exposed to chemical or corrosive environmental conditions, such as sea water, fertilizer or road salt, it can result in corrosion or, in extreme cases, malfunction. Hydraulic fluid can escape if leaks occur.

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

### **Escaping or spilling hydraulic fluid.**

Environmental pollution and contamination of ground water!

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

### **Danger from hot components.**

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

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

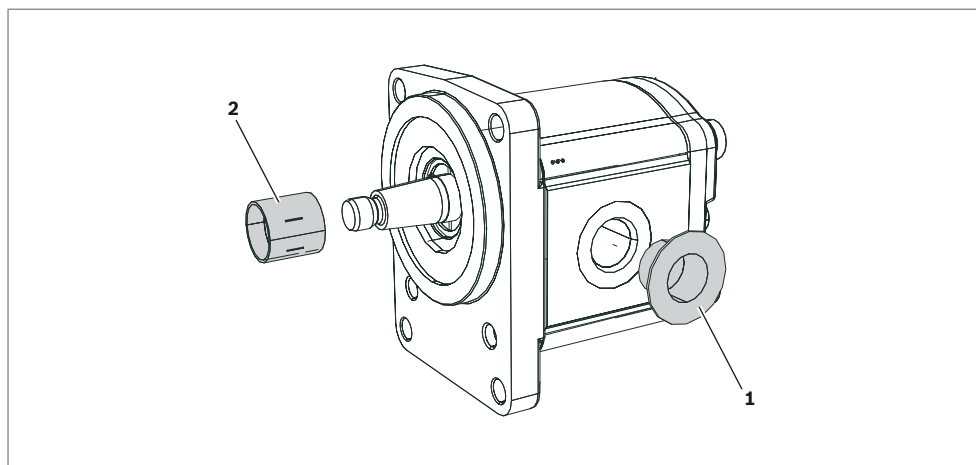
The warranty only applies to the delivered configuration.

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

## 4 Scope of delivery

The following is included in the scope of delivery:

- External gear unit with transport protection as per order confirmation
- Protective caps **(1)** for hydraulic connections
- Flange and shaft covers **(2)** (optional)



**Fig. 1: External gear unit scope of delivery**

## 5 About this product

### 5.1 Performance description

An external gear pump converts mechanical energy (torque and rotational speed) into hydraulic energy (volumetric flow and pressure).

The external gear motor converts hydrostatic flow into mechanical rotation and controls or regulates this. It is designed for mobile and stationary applications.

Refer to the data sheet and the order confirmation for the technical data, operating conditions and operating limits of the external gear unit.

### 5.2 Product description

The external gear unit consists essentially of a pair of gear wheels supported in bearing bushes/plain bearings and the housing with a front and a rear cover. The drive shaft usually protrudes from the front cover where it is sealed by the shaft seal. The bearing forces are absorbed by slide bearings. These were designed for high pressures and have excellent emergency running properties, especially at low rotational speeds. The gear wheels usually have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing of the pressure chambers is achieved by delivery pressure-dependent forces. This ensures optimum efficiency. On the rear side, the movable bearing bushes are pressurized with working pressure and pressed as seals against the gear wheels. The pressurized compression springs are limited by special seals. The seal on the area between the gear teeth and the housing is ensured by the smallest of gaps that adjust depending on the pressure between the gear teeth and housing.

#### 5.2.1 Layout of the external gear unit

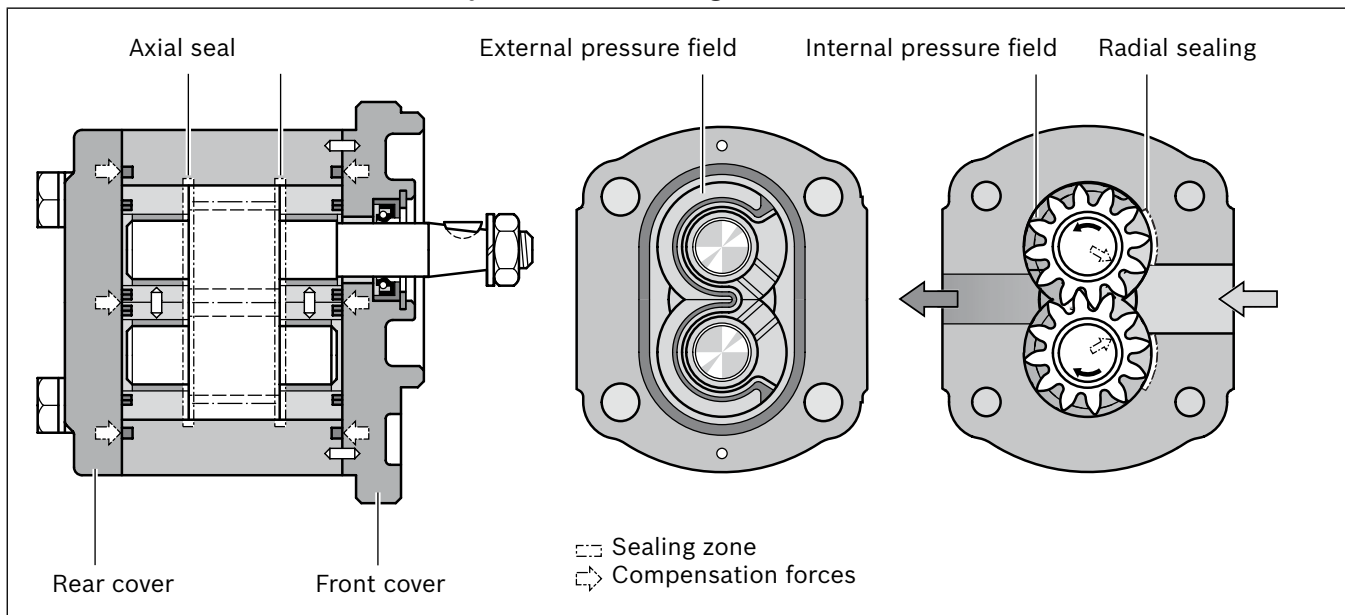
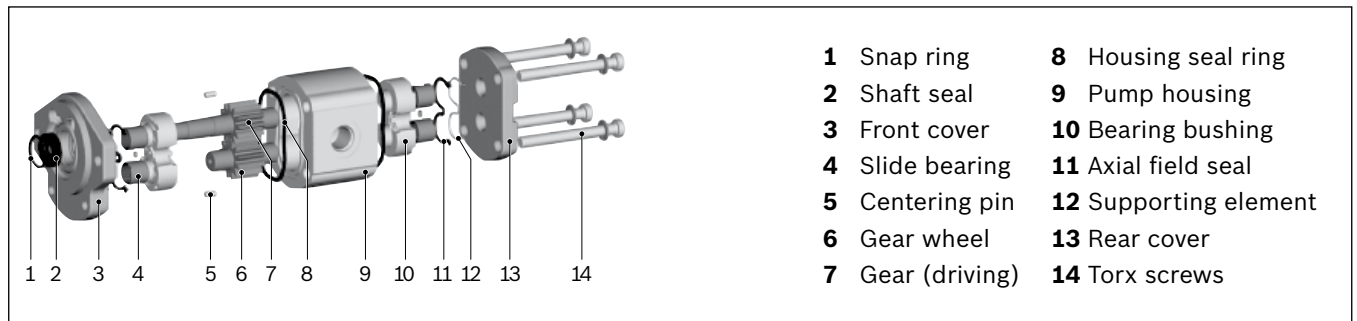


Fig. 2: Axial compensation external gear pump



**Fig. 3: Layout of external gear pump**

### 5.2.2 Functional description

The range of Rexroth external gear units includes hydraulic pumps and -motors. Refer to the technical data sheet and the order confirmation for the rotational speed and temperature range of the Rexroth external gear units.

#### External gear pumps

Rexroth external gear pumps are available in various series in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations; refer to the product-specific instruction manual for details.

External power is supplied on the driven gear wheel, which is turned by means of the gearing of the driven wheel. As the teeth chambers open, the hydraulic fluid is drawn in from the suction chamber via the pump inlet and transported through the gaps between the teeth in the two gearwheels to the pressure chamber. There, the meshing of the teeth forces the hydraulic fluid out of the gaps between the teeth, transporting it to the pump outlet.

#### External gear motors

Rexroth external gear motors are available in various series. Their displacements are graded by different gear widths. The displacement principle of external gear motors is the opposite of that of pumps. For motors, configuration variants are given by different flanges, shafts, valve arrangements and integrated speed sensor. When hydraulic fluid is fed into the gear motor, torque will be available at the external shaft. A distinction is made between motors with one direction of rotation and reversible motors.

#### Gear motor for one direction of rotation

External gear motors for one direction of rotation have an asymmetrical structure, i.e. the high-pressure side and low-pressure side are fixed. Reversing operation is not possible. The case drain fluid which arises is drained internally. Pressure loading of the drain is limited due to the shaft seal.

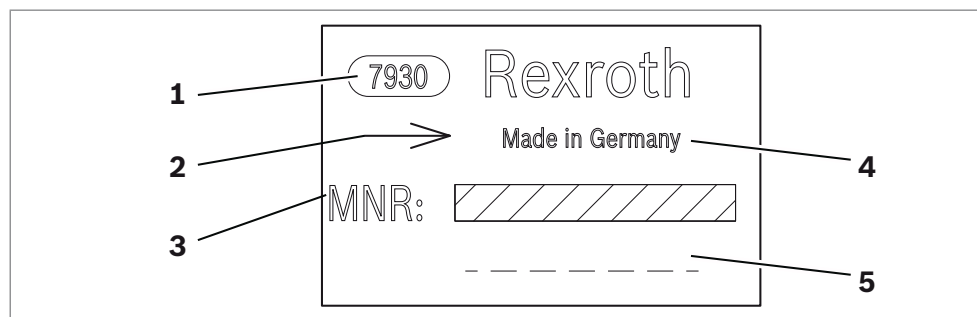
#### Reversible gear motor

The reversible motors are characterized by a special feature. Due to their structure, the high-pressure and low-pressure chambers are separated from the bearing ring and shaft seal ring chamber. The case drain fluid which arises is drained via a separate case drain port. By means of this case drain fluid drainage, it is possible to load the motor on the return side. As a result, series connections are possible.

### 5.3 Product identification

The external gear unit can be identified from the name plate. Multiple pumps can be identified from the name plate of the first pump section (pump section with drive shaft).

The following example shows an AZ name plate:



**Fig. 4: Name plate**

The name plate contains the following information:

- 1** Factory identifier
- 2** Specification of the direction of rotation
- 3** Material number of the external gear unit
- 4** Standard marking, country of manufacture
- 5** Optional (below the material number): Customer-specific numbers and other markings

### 5.4 Information on use at low temperatures

Observe the following limits:

- Warm-up phase with low load from  $-40\text{ °C}$  and above
- Operating with loads from  $-30\text{ °C}$  (NBR) or  $-20\text{ °C}$  (FKM) and above

Also observe the following information:

- We recommend you use the NBR shaft seal ring variant for applications under  $-20\text{ °C}$ . However, with the NBR variant, there is a maximum operating temperature of  $80\text{ °C}$ .
- Avoid moisture in the area surrounding the external gear units as potential moisture on the shaft seal may freeze the sealing lip to the shaft when stationary. During start-up, we cannot rule out damage to the seal ring.
- The limit viscosities specified in the data sheets for the external gear unit must be adhered to by selecting a suitable hydraulic fluid over the entire operating time, both in winter and in summer with warmer temperatures.
- Particular attention must be paid to start-up viscosity. On pumps, there is a acute risk of cavitation when starting up with highly-viscous (“gel-like”) hydraulic fluid in the suction line.
- When installing new components, these must be filled beforehand at higher temperatures so that a sufficient lubrication is assured in all areas.

## 5.5 Project planning notes

The following includes only a few, standard pieces of information. Bosch Rexroth is not responsible for correctness and completeness in individual cases.

We have included project planning notes for the following topics:

- Selecting hydraulic fluid
- Reservoir design
- Filter design
- Cooler
- Hose lines and piping
- Use under water
- Use under ambient pressure



During design, observe the maximum possible application data from the relevant data sheets.

### Selecting hydraulic fluid

The hydraulic fluid in the hydraulic circuit must be selected very carefully during drive project planning in order to ensure fault-free, efficient operation of the system. Often it is not possible to meet all the requirements on hydraulic fluid to the same extent. Therefore, we recommend you weigh up the relative merits together with the hydraulic fluid vendor.

Also note the information in the “Hydraulic fluids based on mineral oils and related hydrocarbons (90220)”, see Table 1, page 7.

The viscosity/viscosity temperature behavior have primary importance whereby the density and pour point must be observed.

Mineral oil basis fluids are suitable for use with external gear units. Its suitability depends, among other things, on the following factors:

- Wear properties
- Viscosity-temperature behavior
- Oxidation and corrosion protection
- Material compatibility
- Air separation ability (ASA)
- Water separation capability (WSC)

### Reservoir design

The reservoir must be generously proportioned due to the thermal balance.

An initial estimate of the reservoir volume  $V$  (in  $l$ ):

- For mobile systems:  $V = 0.25 \dots 0.4 \cdot Q + 1.25 \cdot EZ$ , whereby
  - $Q$  is the numerical value for the pump suction flow (in  $l/min$ ) and
  - $EZ$  is the sum of the filling volumes of all cylinders (in  $l$ ).
- For stationary systems:  $V = 3 \dots 5 \cdot Q$

Also take into account an air space of 10 to 15 % of the hydraulic fluid volume.



Attach a sign on a prominent position of the reservoir which marks the reservoir as a hydraulic fluid container. Also indicate the specification, volume, and replacement intervals for the hydraulic fluid. Add information about the filter replacement intervals and the names of the replacement cartridge filters.

Make sure that the reservoir filling process can only be performed using a permanently installed filter. New hydraulic fluid from new containers is normally contaminated.

#### Ground clearance Draining capability

Make sure the ground clearance is at least 15 cm to ensure good heat dissipation. Temperature variations cause condensed water to build up in the reservoir. This water and contaminants must be able to collect on the bottom-most part of the reservoir. Therefore, run the floor at a slope and provide a drainage point at the lowest point.

#### Baffles

Provide baffles to prevent turbulent disruptions in the reservoir and to promote dirt build-ups and air separation.

#### Breather filter

Make sure the provided air filter has the same filter grade as the system filter.

#### Hydraulic fluid level check

Please note: a hydraulic fluid status check must be placed at a prominent position. Hydraulic fluid that escapes from leaky parts is always contaminated and must not be fed back into the reservoir. Make an appropriate enhancement ahead of time so that the lowest hydraulic fluid level is never reached if at all possible.

#### Suction line

The suction lines should be installed so that are approx. 5 cm over the reservoir bottom or, in case of a lateral exit, are this distance from the reservoir bottom. The inlet diameter should be enlarged by means of an inclined gate and make an alignment to the oil-calmed side.

Air can be drawn in through a suction line ending too close to the surface. For this reason, when determining the lowest level of hydraulic fluid, pay attention to the temporary removal of hydraulic fluid through cylinders as well as a potential inclined position of the system or machine.

The negative pressure must not fall below 0.7 bar (abs.) (see the associated data sheet).

#### Drain line

Direct the mouth of the drain lines in the reservoir below the minimum hydraulic fluid level. Make sure there is a sufficient cross-section when combining several drain lines in a combination line.

**Filter design**

Premature failures in external gear pumps are largely caused by contaminated hydraulic fluid. Since there is no warranty for wear caused by contamination, we recommend a filtration which reduces the degree of contamination to a permissible measure in terms of the size and concentration of the dirt particles:

**Table 6: Filtration**

Required cleanliness level	
ISO 4406	20/18/15

We recommend that a full-flow filtration always be used.

The filter manufacturer must provide evidence that the filter is functional and compliance with the required cleanliness level.

**Accessibility**

In particular, make sure the filters are easily accessible to make maintenance work easier.

Add a contamination indicator to the filter where possible as well as a pressure-resistant filter element.

**Cooler**

Air-oil- or water-oil-cooling in the drain lines is usually sufficient. The quantity of heat to be drained is based on the load and rotational speed of hydraulic components. Load cycles and radiating surface are very important.

Check the temperature balance by taking temperature measurements during commissioning.

Arrange the air-oil heat exchangers to prevent them from lying in the vicinity of the warm exhaust of the engine or working machine.

Provide a cooler bypass to protect the oil cooler during a cold start. This can be realized by installing a check valve or a thermo bypass valve.

Make sure the lamella in oil-air heat exchangers are regularly de-dusted.

**Hose lines and piping**

In hydraulics systems, hose lines are used to connect ports which move relatively to each other. Hose lines also help reduce the transmission of mechanical vibrations. Please note that the machine and system manufacturer is responsible for the design and installation of hose lines and piping in accordance with the standards.

In particular, the machine/system manufacturer must ensure that hose lines and fittings are designed to the maximum dynamic pressure of the pumps and motors as specified in the offer drawing, or as seen in dynamic measurements, or which could occur at the operator.

In this respect, we would like to draw your attention to EN standards for hoses and hose lines according to DIN EN 853-857 and their installation based on the safety instructions of the BIA in ZH 1/74.

Here is some additional information about the ports:

- To achieve favorable noise values, all connecting lines (suction, hydraulic- and drain ports) are to be decoupled from the reservoir using flexible elements.
- Route the leak back to the reservoir to keep the build-up of case pressure to a minimum.

**Use under water**

If the plan is to use the machine/system under water, get in touch with Bosch Rexroth before implementation during project planning (specific case assessment).

**Use at high ambient pressure**

If the plan is for use in an ambient pressure greater than 2 bar absolute, get in touch with Bosch Rexroth before implementation during project planning.

## 6 Transport and storage

- ▶ Always observe the required ambient conditions for transport and storage, see Chapter 6.2 “Storing the external gear units” on page 25.



Notes on unpacking can be found in Chapter 7.1 “Unpacking” on page 33.

### 6.1 Transporting the external gear unit

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

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

Use suitable transport containers (plastic containers, partly with grid separators) which meet the requirements and are free of damage.

#### Dimensions and weights

You can find dimensions and weights in the technical data sheets for the series concerned, and also in the offer drawings.

#### 6.1.1 Transporting by hand

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

**CAUTION!** Danger from heavy loads.

Health hazard from carrying external gear units.

- ▶ Use suitable lifting, lowering and moving methods.
- ▶ Wear your personal protective equipment (e.g., safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Do not use sensitive attachments to transport the external gear unit (e.g., sensors or valves).
- ▶ Carefully place the external gear unit on the seating to prevent it from being damaged.

#### 6.1.2 Transporting with a lifting device

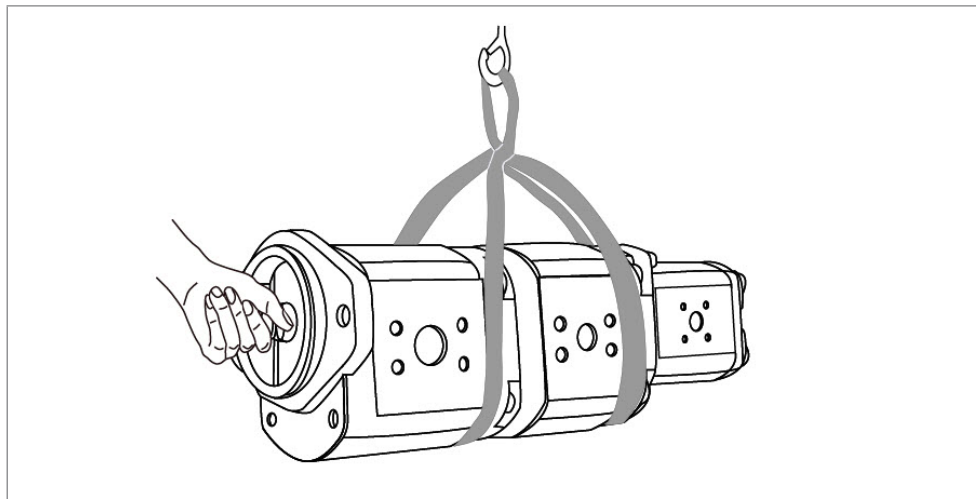
#### Transport with lifting strap

**WARNING!** Danger from suspended loads.

During transportation with a lifting strap, the external gear unit can tip out of the strap and cause injuries.

- ▶ Use the widest possible lifting strap.
- ▶ Make sure that the external gear unit is securely fixed with the lifting strap.
- ▶ Only guide the external gear unit by hand for fine positioning and to avoid oscillations.
- ▶ Never stand or put your hands under a suspended load.

- ▶ Place the lifting strap around the external gear unit in such a way that it passes over neither the attachment parts (e.g. valves) nor such that the external gear unit is hung from attachment parts (see Fig. 5).
- ▶ It is up to the machine manufacturer to determine whether corrective action is needed or not.



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

## 6.2 Storing the external gear units

**Requirements** When storing the external gear units for a longer period of time or when removing it from the machine/system and not installing it again, you must preserve it from corrosion during its time in storage.

- The storage areas must be free of corrosive materials and gases.
- To prevent damage to the seals, ozone-forming equipment (e.g., mercury-vapor lamps, high voltage equipment, electric motors, sources of electrical sparks or electrical discharge) must not be operated in storage areas.
- The storage areas must be dry.
- Ideal storage temperature: +5 °C to +20 °C.
- Minimum storage temperature: -50 °C.
- Maximum storage temperature: +60 °C.
- Avoid significant exposure to light (e.g. bright windows or direct fluorescent lighting).
- Do not stack external gear units and store them in a shock-proof manner.
- Do not store the external gear unit on the drive shaft or attachments, e.g., sensors or valves.
- Check the external gear unit monthly to ensure proper storage.

**After delivery** The external gear unit is provided ex-works with a corrosion protection packaging (corrosion protection film).

The active agent, which comes out of the corrosion protection film towards the inside, is deposited on the metal surface and forms a layer separating the material and electrolyte (water vapor).

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

Storage conditions	Standard corrosion protection	Long-term corrosion protection
Closed, dry room, at a consistent temperature between +5 °C and +20 °C throughout. Undamaged and sealed corrosion protection film.	Maximum 12 months	Maximum 24 months



Warranty is void if the requirements and storage conditions are not observed or after expiration of the maximum storage time of two years and a visual inspection after 12 months.

Procedure after expiration of the maximum storage time:

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



After expiration of the maximum storage time, we recommend that you have the external gear unit inspected by your Bosch Rexroth service partner.

In the event of questions regarding repair and spare parts, contact your responsible Bosch Rexroth service partner or the service department of the manufacturer's plant for the external gear unit, see Chapter 10.5 "Spare parts" on page 52.

#### **After removal**

A dismantled external gear unit must be stored with corrosion protection for the duration of storage.



The following instructions only refer to external gear units which are operated with a mineral oil-based hydraulic fluid. Other hydraulic fluids require preservation methods that are specifically designed for them. In such a case, consult with Bosch Rexroth Service, see chapter 10.5 "Spare parts" for address 52.

Bosch Rexroth recommends the following procedure:

1. Clean the external gear unit, see chapter 10.1 "Cleaning and care", on page 51.
2. Empty the external gear unit.
3. For storage periods up to 12 months: Coat the inside of the external gear unit with mineral oil and fill with approx. 100 ml mineral oil. For storage periods up to 24 months: Fill the external gear unit with corrosion protection VCI 329 (20 ml).
4. Plug all ports airproof.
5. Moisten the unpainted areas of the external gear unit with mineral oil or suitable, easily removable corrosion protection, e.g., acid-free grease.
6. Package the external gear unit with desiccant in corrosion protection film so it is airproof.
7. Store the external gear unit in a non-explosive area in a manner that is shock-proof, see "Requirement" on page 29 in this chapter.

When storing external gear units, pay attention to the following instructions taking internal and external corrosion protection measures into account. The external gear unit must not be stored under less favorable conditions than indicated in the table.

**Table 8: Storage conditions external gear units**

Storage conditions	Storage period	
	Up to 12 months	12 to 24 months
	<b>Protection process</b>	
Firm, dry room with even temperature	Empty the external gear unit and plug the ports so that they are airtight. Package the external gear machine in corrosion protection film so that it is airtight. (Standard protection procedure)	Empty the external gear unit and fill with approx. 10 to 20 ml of corrosion protection agent VCI 329. Plug all ports airtight. Package the external gear unit in corrosion protection film so that it is airtight.
Dry room, maximum temperature difference < 10 °C	Empty the external gear unit and fill with approx. 10 to 20 ml of corrosion protection agent VCI 329. Plug all ports airtight. Package the external gear unit in corrosion protection film so that it is airtight and in a wooden crate.	

## 7 Installation

The following documents must be available at hand prior to installation:

- Offer drawing for external gear unit (can be obtained from your contact at Bosch Rexroth)
- Hydraulic circuit diagram for the external gear unit (can be found in the offer drawing)
- Hydraulic circuit diagram for the machine/system (available from the machine/system manufacturer)
- Order confirmation (contains the order-related technical data for your external gear unit)
- Technical data sheet for the external gear unit (contains the permissible technical data)

### 7.1 Unpacking

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

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

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

- ▶ Place the packaging on a level, solid surface.
- ▶ Only open the packaging from the top.
- ▶ Remove the packaging from the external gear unit.
- ▶ Check the external gear unit for transport damage and completeness, see Chapter 4 “Scope of delivery” on page 21.
- ▶ Dispose of the packaging material according to the national regulations in your country.



The external gear unit is usually packed with grease paper (paraffin paper).

To help the environment, Bosch Rexroth uses reusable packaging for the external gear unit which is usually the property of Bosch Rexroth.

Always observe the following points when disposing of the external gear unit:

### 7.2 Installation conditions

- ▶ Fix the external gear unit so that the expected forces and torques can be transferred without any danger. The machine/system manufacturer is responsible for dimensioning the fasteners.
- ▶ Observe the permissible radial forces on the drive shaft when transferring output drive with radial force loading (belt drives). If necessary, the belt pulley must be stored separately.
- ▶ Make sure that the external gear unit is air bled and filled with hydraulic fluid during commissioning and operation. Do this also after relatively long periods of disuse, since the external gear unit may drain through the hydraulic lines.
- ▶ A check valve in the drain line is only permissible on a case-by-case basis upon request. Please consult your responsible contact person at Bosch Rexroth.
- ▶ To keep noise down, decouple all lines from all vibration-capable components (e.g., reservoir) using elastic elements.

- ▶ Make certain that the suction, drain, and return lines flow into the reservoir below the minimum fluid level in all operating conditions. This will prevent air from being drawn in and foam from being formed.
- ▶ Use lint-free cloths for cleaning.
- ▶ Use suitable mild detergents to remove lubricants and other difficult-to-remove contamination. Cleaning agents must not enter the hydraulic system.
- ▶ Do not use hemp or cement as sealant under any circumstances.
- ▶ Cover the shaft seal ring when applying paint with a spray or brush.



Make sure that the working environment at the installation site is fully free of dust and foreign substances.

The external gear unit must be installed in clean condition. Contamination of the hydraulic fluid can considerably affect the function and service life of the external gear unit and its suitability for use in explosive areas.

### 7.3 Installation position

The installation location and position of the external gear unit essentially determine the procedures during installation and commissioning (such as when filling the external gear unit).

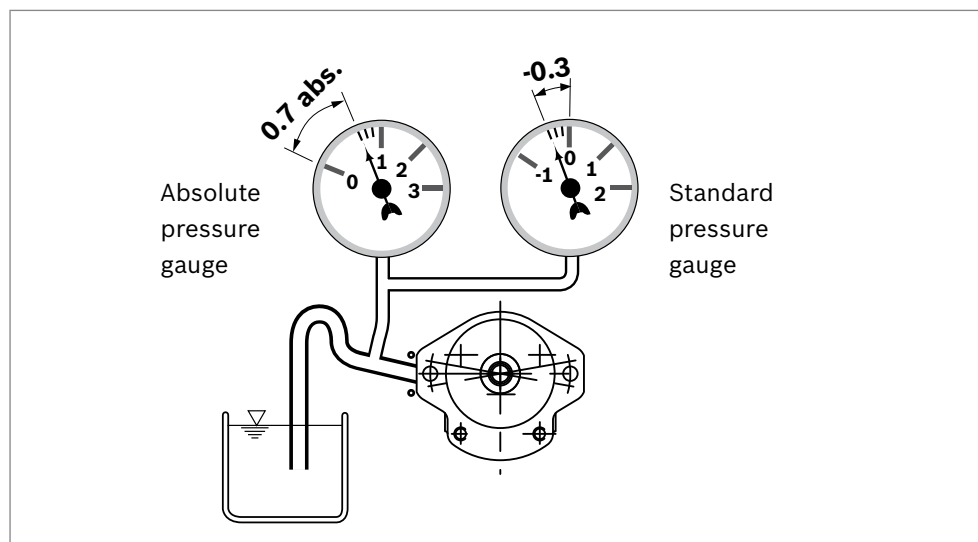
Note the information in the relevant data sheet, see Table 1 on page 7.

The following applies for all installation positions:

- During commissioning and operation, the housing of the external gear unit must be filled and remain filled with hydraulic fluid.
- To achieve favorable noise values, all connecting lines (suction, hydraulic- and leak ports) are to be decoupled from the reservoir using flexible elements.



With pumps, generally for all installation positions, a minimum suction pressure is required at port "S": minimum suction pressure  $\geq 0.7$  bar abs (for other values, refer to the technical data sheet).



**Fig. 6: Suction pressure**

**CAUTION!** Risk of damage if the hydraulic fluid supply is too low

The external gear unit must always be completely filled with hydraulic fluid.

- ▶ During commissioning, make sure the external gear unit is supplied completely with hydraulic fluid.
- ▶ Always ensure that the entire hydraulic system is leak-proof.
- ▶ If there is an unusual build-up of noise or vibrations, immediately switch off the machine or system and check to see whether the external gear unit is filled with hydraulic fluid.
- ▶ Provide an additional pressure relief valve to prevent a possible bursting if there is excess pressure in the system.

## 7.4 Installing the external gear units

### 7.4.1 Preparation

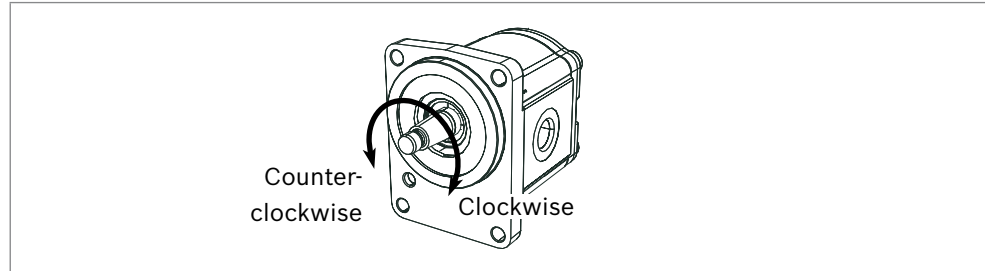
1. Check the delivery contents for transport damages.
2. Compare the material number and designation (type code) with the details in the order confirmation.



If the material number for the external gear unit does not correspond to the one in the order confirmation, contact Bosch Rexroth Service for clarification, see Chapter 10.5 “Spare parts” on page 52.

3. Before installing, completely empty the external gear unit to prevent mixing with the hydraulic fluid used in the machine/system.

4. Check the direction of rotation of the external gear unit (on the name plate) and make sure that this corresponds to the direction of rotation of the motor and the negative buoyancy of the power consumer (clockwise pump to anti-clockwise motor, and vice versa).



**Fig. 7: Direction of rotation**



The direction of rotation as specified on the name plate, see chapter 5.3 “Identification of the product” on page 24 is the direction of rotation of the external gear unit as viewed to the drive shaft.

#### 7.4.2 Dimensions

The offer drawing contains the dimensions for all ports on the external gear unit. Also observe the manuals provided by the manufacturers of the other hydraulic components when selecting the required tools.

#### 7.4.3 General instructions

Follow these general instructions when installing the external gear unit:

- Fix the external gear unit so that the expected forces and torques can be transferred without any danger.
- The permissible loads with respect to pressure and minimum and maximum speeds can be found in the relevant technical data sheet and offer drawing. For axial and radial force load, see chapter 5.5. “Project planning notes” on page 25. The customer must check for the appearance of radial and axial forces during the project planning program.
- **Toothed belts** After a short operating time, toothed belts lose a major portion of their pre-tension and thus cause speed variations and torsional vibrations. Torsional vibrations may cause leakages on the shaft seal ring of the driven external gear unit. Particularly at risk are diesel drives with a small number of cylinders and low flywheel weight. Rexroth recommends you avoid this type of toothed belt drive or equip it with an automatic clamping device.
- **V-belt drives** without automatic clamping device are also critical with regard to speed variations and torsional vibrations. These can also lead to leakages on the shaft seal ring. An automatic clamping device can lessen the speed variations and vibrations and thus avoid consequential damage. Rexroth recommends with automatic V-belt pulleys with clamping devices only.
- In both kinds of belt drives, the permissible radial forces on the shaft shall be followed and verified during project planning. If necessary, the belt pulley must be stored separately.

- Assembly of the drive and output drive elements is carried out by pulling onto the drive shaft with the aid of the threaded pin in the drive shaft end.
- For toothed gear drives, see the chapter on “Project planning notes”,

**CAUTION!** Risk of injury!

During assembly of the external gear unit, injuries may arise especially crushing, cuts, etc in the pump adjustment area.

- ▶ Use appropriate aids to remove the external gear unit from the packaging and follow ergonomic guidelines.
- ▶ Wear your personal protective equipment.
- ▶ Perform assembly properly with care.

**CAUTION!** Risk of damage

Malfunctions, leaks and increased wear is possible due to incorrect tightening torques.

- ▶ During attachment, make sure on the external gear unit that the tightening torque on the through-bolt joints is correct.

The installation method for the external gear unit depends on the connecting elements to the input or output side. The following descriptions explain the installation of the external gear unit:

- Via a coupling.
- via a gearbox

#### 7.4.4 Installation with coupling

How to install the external gear unit with a coupling is described in below:

**NOTICE** Danger from improper handling. Product can be damaged.

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

1. Install the specified coupling half onto the drive/output shaft of the external gear unit according to the instructions of the coupling manufacturer. No radial or axial forces are permitted to act on the shaft or coupling sleeve.



Generally pay attention to complying with the maximum torques which you can get from the relevant Y sheets and catalog sheets.

On elastic couplings, note:

- The maximum radial runout from the shaft to the spigot may not exceed 0.2 mm.
- See the coupling manufacturer’s assembly instructions for acceptable shaft misalignments.



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

On coupling sleeves, note:

- The coupling sleeve must be free to move axially.
  - Keep the distance between the drive shaft and output shaft (see technical data sheet).
  - Oil-bath or oil-mist lubrication is required.
2. Make sure that the installation location is clean and free from dirt and contaminants.
  3. Clamp the coupling hub onto the drive shaft or ensure permanent lubrication of the drive shaft. This prevents the formation of frictional corrosion and the associated wear.
  4. Transport the external gear unit to the installation position and install the coupling onto the drive or output drive according to the instructions of the coupling manufacturer.  
Note: only firmly screw the external gear unit after the coupling was correctly mounted.
  5. Fix the external gear unit at the installation location. Information on the required tool and tightening torques of fastening screws, where necessary, ask the machine and system manufacturer.
    - a) With **coupling bell construction** check the coupling axial play as per the coupling axial play as per manufacturer's specification via the bell window. The external gear unit must not be tightened down until the coupling has been correctly installed.
    - b) With **flange installation**, align the support for the external gear unit for a drive or output drive.

**CAUTION!** Danger of injury by tearing the shaft

Over-tightening screw nuts when assembling the coupling halves can cause the shaft to tear. Persons can be injured.

- ▶ Only tighten the screws with torque wrench and suitable to the set torque.



Prevent frictional corrosion on the coupling components by permanent lubrication.

**When installing using coupling claws**

Coupling claws and drivers are used for direct installation of the external gear unit to a drive motor, a gearbox, etc.

Plug-in connections (coupling claws) of the drive shaft are to be protected from frictional corrosion (permanent lubrication).

Through concealed installation, after installation of the external gear unit, it can no longer be checked whether the spigot diameter centers the external gear unit (note tolerances) or whether axial or radial forces apply to the drive shaft of the external gear unit (installation length). The check must therefore be done before installation and during assembly.

For installation and sealing, pay attention to the recommendations from the technical data sheet.

### When installing using gears and V-belts

When driving through V-belts/gear wheel, please get in touch with Rexroth. Indicate the operating conditions and mounting situations.

Outboard bearing are offered to eliminate possible problems when the pumps are driven by V-belts or gear wheels.

#### 7.4.5 Completing installation

Remove the transport protection.

The external gear unit is delivered with protective covers and protective plugs.

They are not pressure-resistant and have to be removed prior to connection. Use a suitable tool for this to prevent damage to the sealing and functional surfaces.

If sealing or functional surfaces are damaged, contact your Bosch Rexroth service partner or the service department of the manufacturer's plant for the external gear unit.

#### **CAUTION!** Operation with protection plugs!

Operating the external gear unit with protective plugs may result in injuries or damage to the external gear unit.

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



Ports intended for connecting lines are provided with protective plugs or threaded plugs, which serve as transport protection. All connections required for the function must be connected. Failure to do so could lead to malfunctions or damage. If a port is not connected, it must be plugged with a threaded plug because protection plugs are not pressure-resistant.

#### **WARNING!** Danger through contamination and injury

The contact with residual amounts of hydraulic fluid or preservative agent in the housing can damage your health (e.g. allergies, eye injuries, skin and tissue damage, poisoning through inhalation).

- ▶ When removing stoppers, wear safety gloves and safety glasses.
- ▶ If hydraulic fluid or lubrication oil should, nevertheless, come into contact with your eyes or penetrate your skin, consult a doctor immediately.
- ▶ When working with operating- and preservative agents, strictly observe the manufacturer's safety instructions (safety data sheet).



Sealing rings and sealing surfaces can be damaged if the transport protection is not removed properly.

Also observe the following information:

- Do not damage the sealing surfaces.
- Connect hoses and pipes to all ports and seal them with threaded plugs in accordance with the hydraulic circuit diagram.
- The working ports and function ports are only intended to install hydraulic lines (see "Connect lines" below).

### 7.4.6 Hydraulically connecting the external gear unit

## **NOTICE**

### **Insufficient suction pressure!**

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

- ▶ Make sure that the necessary suction pressure is not undercut.

This is influenced by:

- ▶ the piping (e.g. suction cross-section, pipe diameter, length of suction line)
- ▶ the position of the reservoir
- ▶ the viscosity of the hydraulic fluid
- ▶ a filter cartridge or check valve in the suction line, if these are fitted (regularly check the level of soiling of the filter cartridge)

The machine/system manufacturer is responsible for dimensioning the lines. The external gear unit must be connected to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine/system manufacturer. The ports and fastening threads are designed for the maximum pressure specified in the data sheet. The machine/system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.



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

### **Notes on routing lines**

- Observe the following notes when routing the suction, pressure, and drain lines.
- Lines and hoses must be installed without pre-charge pressure, so that no further mechanical forces are applied during operation that will reduce the service life of the external gear unit and, if applicable, the entire machine/system.
  - Use suitable seals as sealing material.
  - Suction line (pipe or hose) -  
The suction line should be as short and straight as possible.  
Measure the line cross section of the suction line so that the pressure at the suction port does not drop below the minimum permissible pressure. Make sure that the maximum suction pressure is not exceeded (e.g. when pre-filling).  
Make sure the connections and connecting elements are airtight.  
The hose must be pressure-resistant, also for external air pressure.
  - Pressure line
    - Ensure sufficient burst resistance of the pipes, hoses and connecting elements must be ensured for pressure lines.

- Install drain lines so that the housing is constantly filled with hydraulic fluid and to ensure that no air gets through the shaft seal even during extended standstill periods. Under no operating circumstances may the case pressure exceed the maximum limit values specified for the external gear unit in the data sheet.
- If the external gear unit is equipped with installed fittings, these must not be unscrewed. Screw the stud end of the fitting directly into the installed fitting.

### Risk of confusion with threaded connections

External gear units are employed in application areas that use the metric measuring system as well as the Anglo-American (imperial) and the Japanese measuring system (JIS – **J**apan **I**ndustrial **S**tandard). Moreover, various kinds of seal are used. The system of units, the kind of seal and the size of female thread and stud ends (e.g., threaded plug) must all match. The limited ways of telling them apart visually poses a risk of confusing them.

#### **WARNING!** Leaky or bursting stud ends.

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

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

#### Fittings

Note the following information to prevent damage to the screws and threads.

### Risk of mix-ups!

Due to missing, visual differentiation, there is a danger of mixing up the following tapped holes and threaded plugs of different dimension systems:

**Table 9: Risk of mixing up female thread UN – UNF thread with threaded plug metric or with pipe thread**

Female thread type	1/2-20 UNF	9/16-18 UNF	3/4-16 UNF	7/8-14 UNF	1 3/16 – -12 UN	1 5/16 – -12 UN
Risk of mixing up with threaded plug	M12 x 1.5	M14 x 1,5	M18 x 1,5	G 1/2	M30 x 2	M33 x 2

**Table 10: Risk of mixing up female thread with metric fine thread with screw plugs UN, UNF and pipe thread**

Female thread Thread type	M8 x 1	M10 x 1	M12 x 1.5	M14 x 1,5	M20 x 1,5	M22 x 1.5	M42 x 2	M48 x 2
Risk of mixing up with threaded plug	5/16-24 UNF	G 1/8 3/8-24 UNF	7/16-20 UNF	G 1/4	3/4-16 UNF	G 1/2	1 5/8 – -12 UN	1 7/8 – -12 UN

**Table 11: Risk of mixing up female pipe thread with screw plugs UN, UNF and metric pipe thread**

Female thread type	G 1/8	G 1/4	G 3/8	G 1/2	G 1 1/4
Risk of mixing up with threaded plug	3/8-24 UNF	1/2-20 UNF	M16 x 1.5	M20 x 1,5	1 5/8 – -12 UN

- Procedure** To connect the external gear unit to the hydraulic system:
1. Remove the transport locks (if not done already).
  2. Clean the cables.  
Contamination in the hydraulic fluid can have a considerable impact on the service life of the external gear unit. The cables must be cleaned before installation.
  3. Secure the cables according to the instructions of the machine manufacturer.  
Either pipes or hoses must be connected to all ports according to the installation drawing and machine or system circuit diagram or the ports plugged using suitable locking screws.  
Comply with the information of the offer drawing and the manufacturer on the permissible tightening torques of the fittings used. For fixing screws according to DIN 13/ISO 68, we recommend checking the tightening torque in individual cases as per VDI 2230.
  4. Make sure
    - that the cap nuts on the fittings and flanges are tightened correctly (observe the manufacturer's tightening torque!). Mark all checked fittings using e.g. a permanent marker pen.
    - Make sure that the pipes and hose lines and every combination of connecting piece, coupling or connecting point with hoses or pipes have been inspected by a technically qualified person for safe working condition.

**Tightening torques for customer fittings** The following tightening torques for the customer fittings to external gear motors and -pumps are to be considered maximum admissible values. If the screw fitting manufacturer requires lower values, these shall apply.  
For thread sizes not shown, please talk to Bosch Rexroth.  
The information applies for technically standard surfaces of fastening screws (come delivered slightly oiled; total friction coefficient  $\mu_{\text{total}} = 0.1$ ; recommended property class 10.9).  
If divergent values apply in the offer drawing, these shall have priority.  
Torque information apply for nut threads on the pump housing and on the end cover (usually aluminum or cast iron).

**Table 12: tightening torques for customer fittings**

<b>Thread</b>	<b>Tightening torque [Nm] ±10%</b>	<b>min. load-bearing screw-in depth [mm]</b>	<b>Remarks (value/type AZP and AZM)</b>	<b>Code (hydraulic connections)</b>
G1	381	17		01
G3/4	217	15		01
G1/2	117	13		01
G3/8	60	10		01
G1/4	37	9		01
1-11 1/2 NPTF	81	–	–	XX
3/4-14 UNF	68	17	FS	XX
1/2-14 UNF	54	19.6	B	XX
1 7/8 – -12 UN	427	16	G-1x	12
1 5/8 – -12 UN	332	16	N, T, G-1x	12
1 5/16 – -12 UN	285	16	N, T, G-22, U	12
1 1/16 – -12 UN	176	16 /13.6	F, S, G-22, U // N, T	12
7/8-14 UNF	103	13.6	N, T	12
3/4-16 UNF	77	11	FS	12
9/16-18 UNF	34	16 /9.7	B / F, S	12
1/2-20 UNF	26	–	–	12
7/16-14 UNF	58	15	G-22, U	12
3/8-16 UNF	28//34//39	11//13//15	N, T // G-1x // G-22, U	12
5/16-18 UNF	20	10	FS	12
1/4-20 UNF	14	10	FS	12
M42x2	599	17		03
M33x2	333	15		03
M27x2	237	16		03
M26x1.5	80	7		03
M22x1.5	101	11		03
M18x1.5	65	10		02, 03
M16x1.5	55	10		02, 03
M14x1.5	41	9		02, 03
M12x1.5	44	11.5		02, 03
M12	98	20		07, 20, 30
M10	38//46//54	11//13//15	F, S, N, T//G-1x//G-22, U	07, 20, 30
M8	21	10		07, 20
M6	12	10		20, 30
M14	100	21	G-22, U	Pump screwed diagonally onto the customer connection.
M10	55	15	F, S, N, T, G-1x	Pump screwed diagonally onto the customer connection.
M8	28	12	B	Pump screwed diagonally onto the customer connection.

#### 7.4.7 Performing flushing cycle

In order to remove foreign particles from the system, Bosch Rexroth recommends a flushing cycle for the entire system before the first commissioning.



During the flushing cycle, the external gear unit must be operated without load.

The flushing cycle can be performed, e.g. by using an additional flushing unit. Follow the instructions of the flushing unit's manufacturer for the exact procedure during the flushing cycle.

To assure the hydraulic fluid has the required purity, pay attention to the following:



The finer the filtration, the higher the cleanliness level of the hydraulic fluid and the longer the service life of the external gear unit.

To ensure the functional reliability of the external gear unit, cleanliness level 25/18/15 according to at least ISO 4406 is necessary for the hydraulic fluid.

Please contact Rexroth if the above classes cannot be observed.

## 8 Commissioning

This chapter describes how to commission the external gear unit. Follow the guide in this Chapter if you:

- you are commissioning the external gear unit for the first time;
- are going to recommission the external gear unit after a period of downtime with an empty suction line.
- you are going to recommission the external gear unit after a longer period of downtime (> 6 months).

Please note:

Within the sense of the Machinery Directive 98/37/EC, the external gear unit is a component which is designed for installation in a machine or system. Commissioning is not permitted until it has been established that the machine or system in which this product is built meets the provisions of the EU guidelines and all the other applicable guidelines.

Note the following safety instructions when commissioning:

### **WARNING**

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

Danger to life or risk of injury or serious injury!

- ▶ Pay attention to and eliminate potential sources of danger before commissioning the external gear unit.
- ▶ Make sure no one is in the danger zone of the machine/system.
- ▶ The emergency stop button for the machine/system must be within the operator's reach.
- ▶ Always follow the instructions of the machine/system manufacturer during commissioning.

### **WARNING**

#### **Danger due to startup of the fan wheel or from the running fan wheel!**

Danger to life or risk of injury.

During startup, the fan wheel may already be running. While in the area of the rotating fan wheel there is risk of being caught-up due to the suction effect.

- ▶ Do not stand in the danger zone of the running fan wheel.
- ▶ Before entering the danger zone, ensure the fan wheel has stopped, e.g., by disconnecting the drive source.  
**ATTENTION:** Pulling out the plug does not lead to a safe condition, but actually leads to the fan wheel turning at maximum speed
- ▶ The machine manufacturer must test the application to see whether additional protective measures are required.

## CAUTION

### **Commissioning an improperly installed product.**

Risk of injury and property damage.

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

## **NOTICE**

### **Increased wear and malfunction due to dirty hydraulic fluid**

Risk of property damage.

- ▶ Make sure no hard foreign matter such as welding beads or metal chips can get into the suction line of the external gear unit.
- ▶ Ensure the utmost cleanliness during commissioning.
- ▶ Be sure to inspect the hydraulic system before commissioning.

## **NOTICE**

### **Risk of damage!**

Commissioning or re-commissioning without or with too little hydraulic fluid levels in the housing area can lead to damage or immediate destruction of the external gear unit.

- ▶ When commissioning or recommissioning a machine or system, make sure that the entire housing area of the external gear unit and the suction and service lines of the are filled with hydraulic fluid and remain filled during operation.

## **8.1 Initial commissioning**



During all work for commissioning the external gear unit, observe the general safety instructions and intended use detailed in chapter 2 “Safety instructions” on page 11.

**Preparation** Before beginning with commissioning of the external gear unit, make sure all the necessary precautions have been taken and all equipment has been prepared.

**Required tools** You need a suitable tool:  
The offer drawing contains the dimensions for all ports on the external gear unit. Also observe the manuals provided by the manufacturers of the other hydraulic components when selecting the required tools.

**Hydraulic fluid required** The machine or system manufacturer can provide you with precise details on the hydraulic fluid.

### 8.1.1 Filling the external gear unit

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



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

To ensure the functional reliability of the external gear unit, cleanliness level 25/18/15 according to at least ISO 4406 is necessary for the hydraulic fluid. Please contact Rexroth if the this class cannot be met. For permissible temperatures, see the data sheet.

**WARNING!** Contact with hydraulic fluid is harmful to health!

Eye injuries, skin or tissue damage, poison when breathing in vapors

- ▶ Before each commissioning, check the lines for wear and any damage.
- ▶ While performing these checks, wear safety gloves, safety goggles and suitable working clothes.
- ▶ If hydraulic fluid should come into contact with your eyes or penetrate your skin despite these measures, consult a doctor immediately.
- ▶ When working with hydraulic fluids, always observe the safety instructions provided by the hydraulic fluid manufacturer.
- ▶ Never check the external gear unit with a high-pressure device to prevent hydraulic fluid from splashing or escaping.

**WARNING!** Hydraulic fluid will explode when making contact with water.

Risk of fire and explosion

- ▶ Do not bring hot hydraulic fluids in contact with water.
- ▶ Keep hydraulic lines and fluids away from source of heat.

Observe the following when filling the hydraulic system:



If there is an unusual build-up of noise or vibrations, immediately switch off the machine or system and check to see whether the external gear unit is filled with hydraulic fluid.

The external gear unit must not be operated while it is being filled.

The lines must be filled.

**Procedure** To fill the external gear unit with hydraulic fluid, proceed as follows:

1. Use the highest port for bleeding.
2. Make certain that all other ports are either connected to pipes or plugged according to the overall circuit diagram.  
Remove existing protection caps as necessary.
3. Completely fill the external gear unit with hydraulic fluid.
4. Close the connection again.

### 8.1.2 Testing the hydraulic fluid supply

The external gear unit must always have a sufficient supply of hydraulic fluid. For this reason, the supply of hydraulic fluid must be ensured at the start of the commissioning process.

When you test the hydraulic fluid supply, constantly monitor the noise development and check the hydraulic fluid level in the reservoir. If the external gear unit becomes louder (cavitation) or the hydraulic fluid is discharged with bubbles, this is an indication that the external gear unit is not being sufficiently supplied with hydraulic fluid.

Notes on troubleshooting can be found in chapter 14 “Troubleshooting”, on page 56.

To test the hydraulic fluid supply:

1. Start the external gear unit without load and let it run for a few minutes in order to ensure sufficient lubrication.  
Pay attention to leaks and noises.
2. Should the pump not displace bubble-free oil after approx. 2 minutes, re-check the system.
3. After the operating values have been reached, check the pipe connections for leakage.
4. Check the operating temperature.

### 8.1.3 Performing functional test

#### **WARNING**

##### **Improperly connected external gear unit.**

Mixing up the ports will cause malfunctions (e.g., lift instead of lower) and could endanger persons and equipment!

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

#### **WARNING**

##### **Overheating of the external gear unit**

The external gear unit heats up during operation. Touching the external gear unit can lead to serious injury.

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

Once you have tested the hydraulic fluid supply, you must perform a functional test on the machine/system. The functional test should be performed according to the instructions of the machine/system manufacturer.

The external gear unit is tested for functional capability and performance before delivery according to the technical data. During commissioning, it must be ensured that the external gear unit was installed properly in the machine/system.

- ▶ After starting the drive motor, check in particular the specified pressures, e.g. system pressure, working pressure and case pressure.

- ▶ Perform a leak test without and with load prior to normal operation.
- ▶ If necessary, disconnect the pressure gauge and plug the ports with the designated threaded plugs.

## 8.2 Running-in phase

### **NOTICE**

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

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

- ▶ Monitor the operating temperature during the running-in phase, e.g. by measuring the hydraulic fluid temperature in the reservoir.
- ▶ Reduce the loading (pressure, rotational speed) of the external gear unit if impermissible operating temperatures and/or viscosities occur.
- ▶ Operating temperatures that are too high indicate faults that have to be analyzed and cleared.

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

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

- ▶ After the running-in phase, have a hydraulic fluid sample analyzed for the required cleanliness level.
- ▶ Change the hydraulic fluid if the required cleanliness level is not reached. If a laboratory test is not carried out after the running-in phase, it is recommended to change the hydraulic fluid.

## 8.3 Recommissioning after standstill

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

Among others, the following criteria may make recommissioning necessary:

- Air and/or water in the hydraulic system
  - Old hydraulic fluid
  - Other contamination
- ▶ Before recommissioning, proceed as described in Chapter 8.1 “Initial commissioning” on page 46.

## 9 Operation

The product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Use the product only within the performance range specified in the technical data.

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

## 10 Maintenance and repair

### **NOTICE**

#### **Inspection and maintenance overdue!**

Risk of property damage.

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

### 10.1 Cleaning and care

### **NOTICE**

#### **Damage to seals when cleaning**

The jet of a high-pressure cleaner may damage the seals and electrical system of the external gear unit.

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

For cleaning and care of the external gear unit, observe the following:

- ▶ Check whether all seals and fittings on the connections are securely seated to ensure that no moisture can penetrate into the external gear unit during cleaning.
- ▶ Use only water and, if necessary, a mild cleaning agent to clean the external gear unit. Never use solvents or corrosive cleaning agents.
- ▶ Remove major external contamination and keep sensitive and important components, such as solenoids, valves and sensors, clean.

### 10.2 Inspection

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

- Operating temperature given a comparable load state
- Level of hydraulic fluid
- Quality of hydraulic fluid.

The external gear unit itself must be regularly checked for:

- Leakage

Early detection of hydraulic fluid loss can help to find errors on the machine or system and to rectify them. For this reason, Rexroth recommends that the external gear unit and system always be kept in a clean condition.

- Unusual noise development:

Unusual noise development can have different causes. The “Troubleshooting” chapter on page 56 will help you find possible causes.

- Loosened fastening elements (based on information provided by the machine manufacturer):  
All fixing elements have to be checked when the system is switched off, depressurized and cooled down.

By documenting the operating conditions consistently (such as e.g. increasing operating temperatures) you can quickly recognize wear and take the necessary countermeasures.



The external gear unit must only be operated according to the specifications in the offer drawing.

If the external gear unit leaves the permissible operating parameters, stop the system and take corrective action.

### 10.3 Maintenance

External gear units are maintenance-free. The service life of the external gear unit is heavily dependent on the quality of the hydraulic fluid.

The service life of the hydraulic fluid is heavily dependent on the machine or system. The machine or system manufacturer is thus responsible for determining the maintenance intervals.

### 10.4 Repair

Bosch Rexroth offers a comprehensive range of services for the repair of Rexroth external gear units.

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

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

In the event of questions regarding repair, contact your responsible Bosch Rexroth Service or the service department of the manufacturer's plant for the external gear unit, see chapter 10.5 "Spare parts" on page 52.

### 10.5 Spare parts

#### CAUTION

##### **Use of unsuitable spare parts.**

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

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

The spare parts lists for external gear units are order-specific. When ordering spare parts, quote the material and serial number of the external gear unit as well as the material numbers of the spare parts.

Address all questions regarding spare parts to your responsible Bosch Rexroth Service partner or the service department of the manufacturer's plant for the external gear unit.

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

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Bosch Rexroth AG  
Dieselstraße 10  
90441 Nuremberg, Germany  
Tel. +49 911 665-0

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

If you have general questions, please contact [svm.support@boschrexroth.de](mailto:svm.support@boschrexroth.de)

For addresses in our sales and service network, please refer to [www.boschrexroth.com/addresses](http://www.boschrexroth.com/addresses)

# 11 Removal and replacement

## 11.1 Required tools

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

## 11.2 Preparing for removal

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

## 11.3 Performing removal

Proceed as follows to remove the external gear unit:

1. Make sure you have the appropriate tools and wear personal protective equipment.
2. Switch off the machine or system.
3. Relieve the hydraulic system according to the instructions of the machine or system manufacturer. Make sure that the hydraulic system is non-pressurized.
4. Let the external gear unit cool down. Check whether the external gear unit has cooled down far enough so that it can be disassembled without danger.
5. Place a collecting pan under the external gear unit to collect any hydraulic fluid that may leak.
6. Using a suitable tool, disconnect the external gear unit from the pipelines in such a way that any escaping hydraulic fluid can be captured by the provided container.
7. Completely drain the external gear unit.
8. Plug all openings.

## 11.4 Preparing the components for storage or later use

- ▶ Proceed as described in Chapter 6.2 “Storing the external gear unit” on page 30.

## 12 Disposal

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

Observe the following points when disposing of the external gear unit:

1. Completely drain the external gear unit.
2. Dispose of the external gear unit and packaging material in accordance with the national regulations in your country.
3. Dispose of the hydraulic fluid according to the national regulations in your country. Also observe the applicable safety data sheet for the hydraulic fluid.
4. Disassemble the external gear unit into its individual parts and properly recycle these parts.
5. For example, separate the parts into:
  - Cast parts
  - Steel
  - Aluminum
  - Non-ferrous metal
  - Electronic waste
  - Plastic
  - Seals

## 13 Extension and conversion

Do not modify the external gear unit or its attachments.



The warranty by Bosch Rexroth only applies to the product as delivered.  
The warranty is void if the unit is modified or extended.

# 14 Troubleshooting

The following table may assist you in troubleshooting. The table does not claim to be exhaustive.

Issues may occur in practice that are not listed here.

Only authorized personnel may perform troubleshooting inside a safety area designated by the machine manufacturer.

The typical characteristics and faults are the columns of the table, the potentially affected parts as they may arise on the external gear unit and machine or system form the rows. The individual table cells describe the causes for the faults (column) for the part (row).

## 14.1 How to proceed with troubleshooting

- ▶ Proceed in a systematic and purposeful manner, even when pressed for time. Random and imprudent removal and changing of settings could result in the inability to ascertain the original failure cause.
- ▶ First obtain a general overview of how your product works in conjunction with the entire system.
- ▶ Try to find out whether or not the product was working properly in conjunction with the entire system before the fault occurred.
- ▶ Try to determine any changes to the entire system in which the product is installed:
  - Were there any changes to the product's operating conditions or operating range?
  - Has maintenance work recently been carried out? Is there an inspection or maintenance log?
  - Have any changes (e.g., upgrades) or repairs been made to the overall system (machine/system, electrics, control) or to the product? If yes, which?
  - Has the hydraulic fluid been changed?
  - Has the product or machine been used as intended?
  - How did the malfunction appear?
- ▶ Try to get a clear idea of the cause of the fault. Directly ask the (machine) operator.
- ▶ Document the work carried out.
- ▶ If you cannot rectify the fault, contact one of the contact addresses which can be found at:  
[www.boschrexroth.com/addresses](http://www.boschrexroth.com/addresses).

**Table 13: External gear unit malfunction table**

Components	Unusual noises	No or insufficient flow	No or insufficient pressure	Pressure / volumetric flow rate fluctuations	Hydraulic fluid temperature too high
Drive elements	Mechanical parts on the drive side are faulty (coupling play, misalignment, etc)	speed monitoring or path transmission faulty	Torque transition faulty	Drive elements faulty	–
Hydraulic cylinder hydraulic motor	Rotational speed too low, overtaking (hydraulic motor is driven by the working machine to the pump), braking noises, missing inner seal, rotary group damage.	Internal losses, leaky seals, wear through dirt	Internal or external leaks, wear through dirt, rotary group damage	Not ventilated or poorly so, faulty seals, stick-slip effects, alternating load direction, intake volume of hydraulic motor too small or too large.	Internal leak, gap losses, wear damage, hydraulic motors and cylinders too small
Flow control valves	Air pockets, differential pressure too small, vibrations	Control orifice blocked, throttle check valve misaligned	–	Air pockets, differential pressure too small, flow control valve contamination, check valve faulty	Wear, gap losses
Pressure valves/anti-cavitation valves (secondary)	Vibrations or buzzing points to air pockets or a lack of damping, incorrect pressure setting, deficient anti cavitation feeding, cracking pressure of anti-cavitation valves too high, cavitation in oil motor	Setting too low, valve seat damaged, blocked by dirt	Setting too low, valve seat damaged, spring break, foreign matter in valve seat	Alternating counter pressure, pressure valve set too low, valve seat damaged	Setting too high: Increase the gap losses in all parts, increase incidence of leaks. Load cycle too high through the machine. Setting too low: Loss of power, heat increase, valve poppet jammed in open position
Directional valves	Control unit faulty, design error (nominal width), throttling points	Incorrect or inexact spool setting, negative covering, pilot pressure too low - does not switch through	Incorrect position, mechanically jammed, return spring break, leaky, welch plug undone	Flow forces influence the action of the valve and opening paths, positioning faults, unstable position, pilot pressure fluctuations.	Incorrect position, throttle losses, measured too short, cross-section too small, wear

**Table 13: External gear unit malfunction table**

<b>Components</b>	<b>Unusual noises</b>	<b>No or insufficient flow</b>	<b>No or insufficient pressure</b>	<b>Pressure / volumetric flow rate fluctuations</b>	<b>Hydraulic fluid temperature too high</b>
Pressure valves (primary)	Vibrations or buzzing points point to air pockets or incorrect damping, incorrect pressure setting	Setting too low, valve seat damaged, blocked by dirt	Setting too low, valve seat damaged, spring break, foreign matter in valve seat	Alternating counter pressure, pressure valves set too low, valve seat damaged	Setting too high: Increase the gap losses in all parts, increase incidence of leaks. Load cycle too high through the machine. Setting too low: Loss of power, heat increase, valve poppet jammed in open position
Hydraulic accumulator	Accumulator bladder faulty, nitrogen filling goes into hydraulic circuit, faulty seals, inlet or outlet speed too large. Accumulators in connection with throttle adjustments can cause systems to vibrate.	Nitrogen filling pressure too low	Nitrogen filling pressure too low or too high: Power storage not sufficient	System which can vibrate between hydraulic accumulator, pressure and flow control valves and pumps	–
Return flow lines	Line does not discharge under hydraulic fluid, turbulence towards the suction end, a lack of partitioning, mechanical vibrations, mounting insufficient	–	–	–	Cross-section too narrow
Filter	A lack of mounting, mechanical vibrations	For high-pressure filters: Insert dirty, bypass valve jammed	For high-pressure filters: Insert dirty, bypass valve jammed	–	Cracking pressure of bypass valve too high
Cooler	Oil/air cooler fan noise, mechanical vibrations	–	–	–	Dimensions too small, cooling action too small, room and ambient temperature too high, external ventilation/ water supply interruption, surface contamination, bypass valve open

**Table 13: External gear unit malfunction table**

Components	Unusual noises	No or insufficient flow	No or insufficient pressure	Pressure / volumetric flow rate fluctuations	Hydraulic fluid temperature too high
Pressure lines	Improper mounting, mechanical vibrations, pipe cross section too small	Fittings leaky, cross-section too small, pressure increase on throttle side	Line break, fittings have leaks, display or measuring devices faulty	Bleeding not fault-free, display or measuring devices faulty, incorrect display	Cross-section too narrow, constrictions through too small bending radii
Drive motor	Incorrect direction of rotation, excessive rotational speed, bearing play, damage to bearing	Rotational speed too low	Direction of rotation wrong, drive power too low, electric motor connected incorrectly	Irregularity of drive motor too large, too low idling speed in diesel motors, frequency fluctuations in electric motors	Rotational speed too high
Coupling	Coupling seat faulty, alignment error, elastic elements faulty	Rotational speed transition faulty	Torque transition faulty	–	–
Pump	Rotational speed too high, air suction, cavitation, mechanical damage	Power comparison drive motor vs. pump (do outputs match?), internal leakage, wear caused by dirt	Power comparison drive motor vs. pump (do outputs match?), internal leakage, wear caused by dirt, rotary group damage	Air intake, inner leak, wear caused by dirt, rotary group damage. Disrupted control behavior due to high motor load or temporary overload due to dirt attachment. High motor load due to excessive power consumption at secondary drive, controller fluctuates	Internal leak, wear caused by dirt
Drain line	Mounting insufficient	–	–		High temperature due to high leaks points to an expected failure of part
Suction conditions	Insufficient suction cross-section, suction height too high, cross-section constrictions, leaky suction line, air bubbles, reservoir stop valve not open, resistance at filter	Suction behavior disrupted, suction cross-section is insufficient, suction height too high, cross-section constrictions, suction line has leaks	Suction behavior disrupted, suction cross-section is insufficient, suction height too high, cross-section constrictions, suction line has leaks, air pockets	Suction behavior disrupted, suction cross-section is insufficient, suction height too high, cross-section constrictions, suction line has leaks, air pockets	–

**Table 13: External gear unit malfunction table**

<b>Components</b>	<b>Unusual noises</b>	<b>No or insufficient flow</b>	<b>No or insufficient pressure</b>	<b>Pressure / volumetric flow rate fluctuations</b>	<b>Hydraulic fluid temperature too high</b>
Hydraulic fluid container	Oil level too low, oil foaming, water in oil, cold hydraulic fluid, viscosity too high, reservoir breathing ineffective	Oil level too low, reservoir breathing ineffective	Oil level too low, viscosity of hydraulic fluid too low, resulting in high leakage losses, gap losses	Air bubbles, turbulence on return flow and suction side, incorrect reservoir construction, no partitioning between return line and suction space	Incorrect viscosity, oil filling too low, container too small. When localized warming is too strong, lubricity, pressurization and aging speed of hydraulic fluid impaired. Component wear, gap losses, warming

## 15 Technical Data

The permissible technical data of the external gear unit can be found in the product-specific data sheet, Table 1, page 7).

The data sheet The data sheets can be found on the internet at  
[www.boschrexroth.com/mediadirectory](http://www.boschrexroth.com/mediadirectory)

Additional information can be found in the online product catalog  
[www.boschrexroth.com/external-gear-pumps](http://www.boschrexroth.com/external-gear-pumps)  
[www.boschrexroth.com/external-gear-motors](http://www.boschrexroth.com/external-gear-motors)

Order-related technical data for your external gear unit can be found in the order confirmation.

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