

Radial piston motor MCR

Series 30, 31, 32, 33 and 41

Instruction manual
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English



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The data specified within only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

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

The original instruction manual was created in the English language.

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1 About this manual

1.1 Validity of the documentation

This documentation applies to the following products:

- Radial piston motor MCR Series 30, 31, 32, 33 and 41

This documentation is intended for machine/system manufacturers, fitters and service technicians.

This documentation contains important information on the safe and appropriate transport, installation, commissioning, operation, maintenance, removal and simple troubleshooting of the radial piston motor.

- ▶ Read this documentation completely and in particular the chapter 2 "Safety instructions" on page 8 and chapter 3 "General instructions on damage to equipment and the product" on page 15 before you start work with the radial piston motor.

1.2 Required and supplementary documentation







- ▶ Only commission the radial piston motor 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
	Installation drawing Contains the outer dimensions, all connections and the hydraulic schematic for the MCR radial piston motor.	Please request the installation drawing via your contact person at Bosch Rexroth.	Installation drawing
	Radial piston motor for wheel drives MCR-F	15198	Data sheets
	Radial piston motor for heavy duty wheel drives MCR-W	15200	
	Radial piston motor for compact drives MCR-C	15197	
	Radial piston motor for frame integrated drives MCR-A	15195	
	Radial piston motor for chain drives MCR-S	15226	
	Radial piston motor for track drives MCR-T	15221	
	Radial piston motor for integrated drives MCR-H	15199	
	Radial piston motor for hydraulic drive assist MCR-R, series 41	15223	
	Radial piston motor for industrial applications MCR-D / MCR-E Contain the permissible technical data, ports, main dimensions and circuit diagrams.	15196	
	Mineral-oil based hydraulic fluid and related hydrocarbons Describes the requirements on a mineral-oil based hydraulic fluid and related hydrocarbons for the operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your hydraulic system.	90220	Data sheet
	Environmentally acceptable hydraulic fluids Describes the requirements on an environmentally acceptable hydraulic fluid for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	90221	Data sheet
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors) Contains the hydraulic fluids positively evaluated by Bosch Rexroth.	90245	Data sheet
	Instructions on the Use of Radial Piston Motors at Low Temperatures Contains additional information on the use of Rexroth radial piston motors at low temperatures.	90321	Data sheet


1.3 Display of information

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

1.3.1 Safety instructions




This documentation includes safety instructions in chapter 2.6 "Product-specific safety instructions" on page 11 and in chapter 3 "General instructions on damage to equipment and the product" on page 15. Prior to any action or operation being carried out on the MCR motor these instructions must be read and the described danger prevention measures implemented.

Safety instructions are set out as follows:

 SIGNAL WORD	
Type and source of danger!	
	Consequences in case of noncompliance
	▶ Measure for danger prevention

- **Safety sign:** draws attention to the danger
- **Signal word:** identifies the degree of the danger
- **Type and source of danger:** identifies 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: Danger classes in accordance with ANSI Z535.6

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

1.3.2 Symbols

The following symbols mark notes that are not safety-relevant but which increase the understanding of the documentation.

Table 3: Meaning of the symbols

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

1.3.3 Designations

This documentation uses the following designations:

Table 4: Designations

Designation	Meaning
MCR	Radial piston motor (multi-stroke)
MCR-F	Radial piston motor for wheel drives
MCR-W	Radial piston motor for heavy duty wheel drives
MCR-C	Radial piston motor for compact drives
MCR-A	Radial piston motor for frame integrated drives
MCR-S	Radial piston motor for chain drives
MCR-T	Radial piston motor for track drives
MCR-H	Radial piston motor for integrated drives
MCR-R	Radial piston motor for hydraulic drive assist
MCR-D / MCR-E	Radial piston motor for industrial applications
Threaded plug	Metal screw, pressure-resistant
Protective plug	Made out of plastic, not pressure-resistant, only for transportation

1.3.4 Abbreviations

This documentation uses the following abbreviations:

Table 5: Abbreviations

Abbreviation	Meaning
ATEX	EU directive for explosion protection (A tmosphère e xplosible)
DIN	D eutsche I ndustrie N orm (German Institute for Standardization)
ISO	I nternational O rganization for S tandardization
JIS	J apan I ndustrial S tandard
RE	R exroth document in the E nglish language
VDI 2230	Directive for the systematic calculation of high duty bolted joints and joints with one cylindrical bolt from the VDI (V erein D eutscher I ngenieur – A ssociation of German Engineers)

2 Safety instructions

2.1 About this chapter

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

- ▶ Read this documentation completely and thoroughly before working with the radial piston motor.
- ▶ 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 radial piston motor on to third parties.

2.2 Intended use

Radial piston motors are hydraulic components, meaning that in their application they are classified neither as complete nor as incomplete machines in the sense of the EU machine directive 2006/42/EC. A component is exclusively intended to form an incomplete or a complete machine together with other components. The component may only be commissioned after it has been installed in the machine/system for which it is intended and the safety of the entire system has been established in accordance with the machine directive.

The product is intended for the following use:

The radial piston motor converts hydrostatic flow into mechanical rotation. It is certified for use as a hydraulic motor in hydrostatic drives.

- ▶ Observe the technical data, application and operating conditions and performance limits as specified in data sheets 15195, 15196, 15197, 15198, 15199, 15200, 15221, 15223 or 15226 and in the order confirmation. Information about approved hydraulic fluids can be found in data sheets 15195, 15196, 15197, 15198, 15199, 15200, 15221, 15223 or 15226.

The radial piston motor is only intended for professional use and not for private use. Intended use includes having read and understood the complete documentation, especially the chapter 2 "Safety instructions" on page 8.

2.3 Improper use

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

Bosch Rexroth AG shall accept no liability whatsoever for damage resulting from improper use. The user shall bear all risks arising from improper use.

Similarly, the following foreseeable faulty usages are also considered to be improper:

- Use outside the operating parameters approved in the data sheet or in the order confirmation (unless customer-specific approval has been granted)
- Use for non-approved fluids, e.g. water or polyurethane components
- Modification of factory settings by non-authorized persons
- Use of the radial piston motor in a machine or with load position that has not been approved by Bosch Rexroth RM Engineering Department.

- Using the radial piston motor under water unless customer-specific approval has been granted by Bosch Rexroth RM Engineering Department
- Using the radial piston motor in explosive environments unless the component or machine/system has been certified as compliant with the ATEX directive 2014/34/EU
- Using the radial piston motor in an aggressive atmosphere
- Using the radial piston motor in aircraft or space craft

2.4 Personnel qualifications

The activities described in this documentation require basic mechanical, electrical and hydraulic knowledge, as well as knowledge of the associated technical terms. For transporting and handling the product, additional knowledge is necessary with regard to working with a lifting device and the corresponding attachment equipment. In order to ensure safe use, these activities may therefore only be carried out by appropriate qualified personnel or an instructed person under the direction and supervision of qualified personnel.

Qualified personnel are those who can recognize possible hazards 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 observe the rules relevant to the subject area and have the necessary hydraulic knowledge.

Hydraulic knowledge means, for instance:

- reading and fully understanding hydraulic plans,
- fully understanding in particular the interrelationships regarding safety devices, and
- having knowledge on the function and interaction of hydraulic components.



Bosch Rexroth offers training support for special fields. You can find an overview of the training contents on the internet at:

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 technical order and condition.
- Observe all notes on the product.
- Persons who install, operate, remove or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may adversely affect their abilities.
- Only use Rexroth original accessories and spare parts to ensure there is no risk to persons from unsuitable spare parts.
- Conform to the technical data and ambient conditions specified in the product documentation.

- If unsuitable products are installed or used in applications that are of relevance to safety, unexpected operating conditions may occur in the application which could result in injury to persons or property damage. For this reason, only use the product in a safety-relevant application if this use is expressly specified and permitted in the product documentation, for example in ex-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 a system) into which the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.
- Use tools appropriate for the work being performed and wear appropriate protective clothing to prevent punctures and cuts (e.g. when removing protective covers, disassembly).
- There is a risk of entanglement when operating the radial piston motor with a bare shaft end. Check whether or not your machine requires additional safety measures for your application. If necessary, make sure that these are properly implemented.

2.6 Product-specific safety instructions

The following safety instructions apply for chapters 6 to 14.

WARNING

Motor external overload!

Danger to life or risk of injuries, motor failure resulting in major motor break up and failure to support loads .

- ▶ To ensure the durability of the motor for the specific combination of external loads a technical approval by Bosch Rexroth RM Engineering Department is required for each application. Please contact your Bosch Rexroth sales partner.

Danger from excessively high pressure!

Danger to life or risk of injury, damage to equipment!

Changing the factory pressure settings can cause pressure to increase beyond the permissible maximum.

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

- ▶ Changes to the factory settings must only be made by Bosch Rexroth specialist personnel.
- ▶ In addition, a pressure-relief valve is needed as back-up in the hydraulic System or in the main pump. If the radial piston motor is equipped with a pressure cut-off and/or a pressure control, this is not an adequate back-up against pressure overload.

Danger from suspended loads!

Danger to life or risk of injury, damage to equipment!

Improper transportation may cause the radial piston motor to fall potentially causing crushing injuries or damage to the product.

- ▶ Make certain that the forklift truck or lifting device has adequate lifting capacity.
- ▶ Never stand under or put your hands under suspended loads.
- ▶ Ensure your position is stable during transportation.
- ▶ Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- ▶ Use suitable lifting devices for transportation.
- ▶ Observe the prescribed position of the lifting strap.
- ▶ Observe the national laws and regulations on work and health protection and transportation.



WARNING

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 relevant machine/system component and secure it against reconnection according to instructions provided by the machine/system manufacturer.
- ▶ Make sure that all relevant components of the hydraulic system are depressurized. Follow the instructions given by the machine/system manufacturer.
- ▶ 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.

Escaping hydraulic fluid mist!

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

- ▶ Depressurize the relevant machine/system component and repair the leak.
- ▶ Only perform welding work when the machine/system is depressurized.
- ▶ Keep open flames and ignition sources away from the radial piston motor.
- ▶ If radial piston motors are to be situated in the vicinity of ignition sources or powerful thermal radiators, a shield must be erected to ensure that any escaped hydraulic fluid can not ignite, and to protect hose lines from premature aging.

Electrical voltage!

Danger to life or risk of injury due to electric shock or damage to equipment!

- ▶ 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 plugs. Protect the machine/system against being energized.

Presence of strong magnets (only in specific motor types e.g. MCR-R)!

Danger to life or risk of injury, malfunction of pacemakers or similar devices possible.

- ▶ People who use pacemakers or similar devices are not allowed to service or disassemble the motor
- ▶ Be careful while handling these parts, only handle these parts in a clean environment free of small ferromagnetic parts or particles.

 **WARNING****Motor with dynamic and/or parking brake may not provide sufficient brake torque!**

Danger to life or risk of injuries, due to improper use of brakes/worn brakes!

- ▶ Avoid any contamination of braking surfaces particularly with lubricants.
- ▶ Ensure any fluids/lubricants used in any part of the motor comply with the specification in the data sheet.
- ▶ Make sure the brake components are not worn, check brake torque on a regular basis (see chapter 10).
- ▶ Do not use the parking brake as a dynamic brake, ensure the brake is fully released during operation using the specified brake release pressure.
- ▶ Make sure the orientation of the motor is according to the installation drawing.

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

Risk of burns and injury from escaping hydraulic fluid jet!

If there are leaks in the radial piston motor, fluid jets under high pressure can escape.

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

CAUTION

High noise development in operation!

Danger of hearing damage, deafness!

The noise emission of radial piston motors depends on speed, operating pressure and installation conditions. The sound pressure level may rise to significant levels during normal application conditions.

- ▶ Always wear hearing protection when in the vicinity of the operating radial piston motor.

Hot surfaces on the radial piston motor!

Risk of burns!

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

Improper cable and line routing!

Trip hazard with risk of personal injury and damage to property! Improper routing of cables and lines can create a trip hazard with a potential for personal injury and/or damage to equipment and components, e.g., due to lines and connectors being torn off.

- ▶ 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 through sharp-edged ducts.

Contact with hydraulic fluid!

Hazard to health/health impairment e.g. eye injuries, skin damage, toxication during inhalation!

- ▶ Avoid contact with hydraulic fluids.
- ▶ When working with hydraulic fluids, strictly observe the safety instructions provided by the lubricant manufacturer.
- ▶ Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- ▶ If hydraulic fluid should, nevertheless, come into contact with your eyes or bloodstream or is swallowed, consult a doctor immediately.

Danger from improper handling!

Slip hazard! Risk of slipping on wet surfaces when climbing on the radial piston motor.

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

2.7 Personal protective equipment

The provision of personal protective equipment is the responsibility of the user of the radial piston motor. Observe the safety regulations and provisions of your country.

All components of the personal protective equipment must be intact.

3 General instructions on damage to equipment and the product

The following instructions apply for chapters 6 to 14.

NOTICE

Danger from improper handling!

Product can be damaged!

- ▶ Do not expose the product to an impermissible mechanical load.
- ▶ Never use the product as a handle or step.
- ▶ Do not place/lay any objects on the product.
- ▶ Do not strike the drive shaft of the radial piston motor.
- ▶ Do not set/place the radial piston motor on the fittings.
- ▶ Do not strike fittings (e.g. sensors or valves).
- ▶ Do not strike sealing surfaces (e.g. service line ports).
- ▶ Leave the protective covers on the radial piston motor until shortly before the lines are connected.
- ▶ Disconnect all electrical connectors before performing electro-welding or painting operations.
- ▶ Make sure that the electronics are not electro-statically charged (e.g. for painting operations).

Damage to equipment due to improper lubrication!

Product can be damaged or destroyed!

- ▶ Never operate the radial piston motor with insufficient hydraulic fluid. Make sure in particular that the rotary group has sufficient lubrication.
- ▶ When commissioning a machine/system, make sure that the case interior and the service lines of the radial piston motor are filled with hydraulic fluid and remain filled during operation. Air intrusions in the forward drive shaft bearing are to be prevented, especially with the installation position "drive shaft upwards".
- ▶ Check the hydraulic fluid level in the case regularly and replenish if necessary. This is particularly important with an above-reservoir installation, where after long stationary periods the case fluid may drain via the drain line which will leave the bearings insufficiently lubricated during start up.

Mixing of hydraulic fluids!

Product can be damaged!

- ▶ Before installation, remove all fluids from the radial piston motor to prevent contamination of the hydraulic fluid used in the machine/system.
- ▶ Mixing of hydraulic fluids from different manufacturers or different types from the same manufacturer is not advisable.

NOTICE

Contamination of the hydraulic fluid!

The cleanliness of the hydraulic fluid has a considerable impact on the service life of the radial piston motor. Contamination of the hydraulic fluid could cause premature wear and malfunctions!

- ▶ Make sure that the working environment at the installation site is free of dust and foreign substances in order to prevent contaminants, such as welding beads or metal cuttings, from getting into the hydraulic lines and causing product wear or malfunctions. The radial piston motor must be installed in a clean environment.
- ▶ Use only clean connections, hydraulic lines and attachments.
- ▶ Only remove blanking plugs immediately prior to making connections .
- ▶ Before commissioning, make sure that all hydraulic connections are tight and that all of the connection seals and plugs are installed correctly to ensure that they are leakproof and fluids and contaminants are prevented from penetrating the product.
- ▶ Use a suitable filter system to filter hydraulic fluid during filling to minimize contamination entering in the hydraulic system.

Improper cleaning!

Product can be damaged!

- ▶ Plug all openings with the appropriate protective equipment in order to prevent detergents from entering the radial piston motor.
- ▶ Never use solvents or aggressive detergents. Use only water and, if necessary, a mild detergent to clean the radial piston motor.
- ▶ Do not point the power washer at sensitive components, e.g. shaft seal, electrical connections and components.
- ▶ Use lint-free cloths for cleaning.

Environmental pollution due to incorrect disposal!

Careless disposal of the radial piston motor and its fittings, the hydraulic fluid and the packaging material could lead to pollution of the environment!

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

Danger from chemical or corrosive environmental conditions!

Product can get damaged. If the radial piston motor 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 radial piston motor from chemical or corrosive environmental conditions.

NOTICE

Escaping or spilling hydraulic fluid!

Environmental pollution and contamination of the ground water!

- ▶ Always place a drip tray under the radial piston motor 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 maschin/system manufacturer.

Danger due to heat development in components!

Adjacent products may be damaged! Due to a heat development in components, adjacent products may be damaged during assembly if no sufficient safety distance is complied with.

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

The warranty applies only 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 Delivery contents

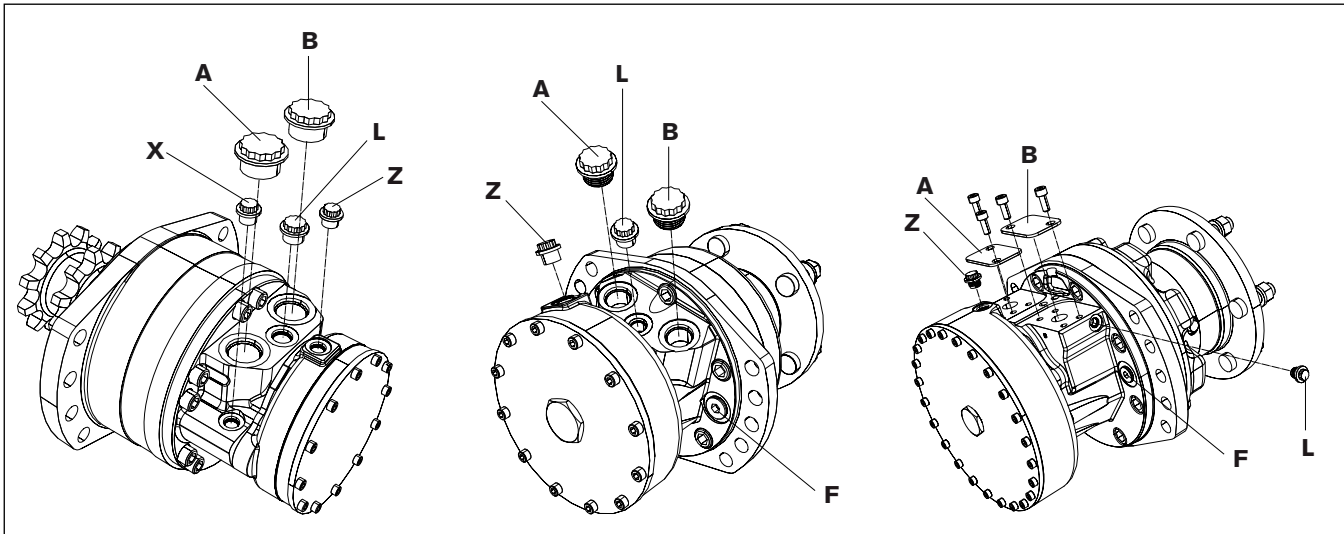


Fig. 1: Radial piston motors with various port protection

Included in the delivery contents are:

- Radial piston motor as per order confirmation

The following ports are protected with protective plug/threaded plug and protective covers.

- Standard
 - main ports **A** and **B**
 - drain port **L**
- Where applicable
 - brake port **Z**
 - 2-speed port **X**
 - filler port **F** (metal plug)

5 About this product

5.1 Performance description

A radial piston motor converts fluid flow into mechanical rotation. It has been designed for mobile and stationary applications.

Refer to the relevant data sheet listed at chapter 1.2 for the technical data, operating conditions and operating limits of the radial piston motor.

5.2 Product description

The MCR is a hydraulic motor with pistons arranged radially within a rotary group. It is a low-speed, high torque motor which operates according to the multiple stroke principle and delivers torque directly to the output shaft. MCR motors can be used both in open and closed circuits.

Open circuit In the open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is transported to the hydraulic motor. From the hydraulic motor, the hydraulic fluid flows directly back to the reservoir. The output direction of rotation of the hydraulic motor can be changed, e.g. by a directional valve.

Closed circuit In the closed circuit, the hydraulic fluid flows from the hydraulic pump to the hydraulic motor and from there directly back to the hydraulic pump. The output direction of rotation of the hydraulic motor is changed, e.g. by reversing the flow direction in the hydraulic pump. Closed circuits are generally used for hydrostatic transmission in mobile applications.

5.2.1 Section of the radial piston motor

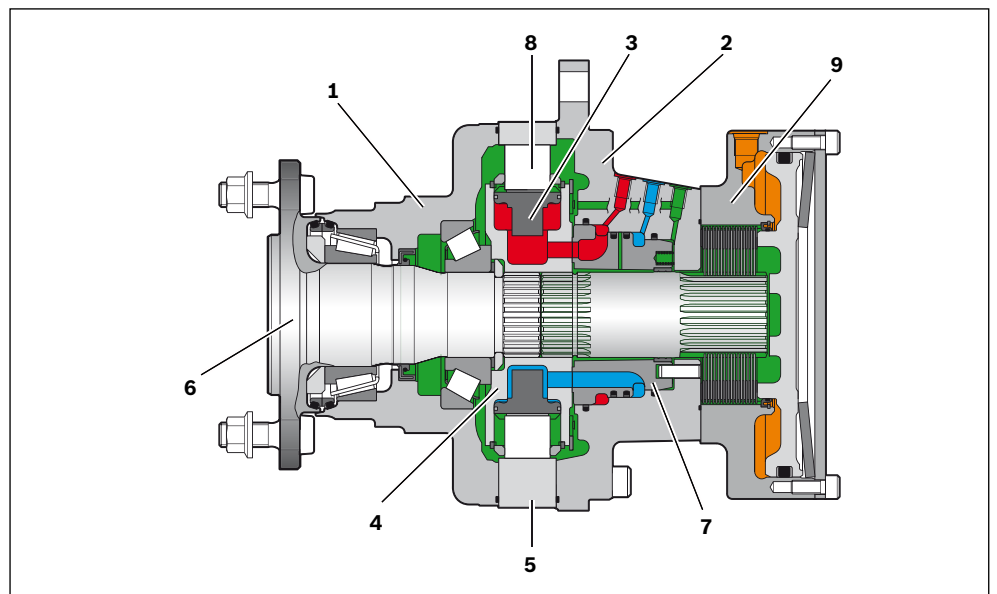


Fig. 2: Typical section of a MCR motor with parking brake

- | | | |
|------------------|--------------------|------------------------------|
| 1 Front case | 5 Cam | 9 Parking brake or end cover |
| 2 Rear case | 6 Output shaft | |
| 3 Piston | 7 Flow distributor | |
| 4 Cylinder block | 8 Roller | |

5.2.2 Functional description

Motor function

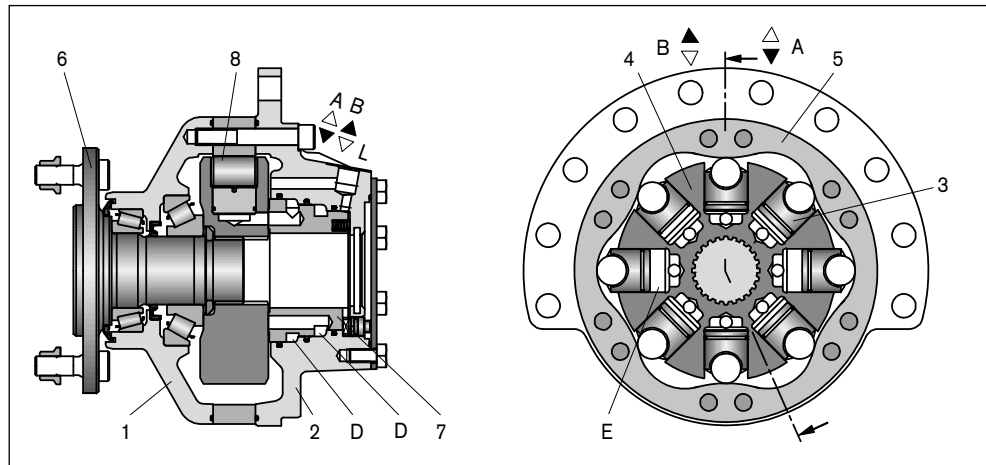


Fig. 3: MCR motor section

A radial piston motor consists of a two part housing (**1**, **2**), rotary group (**3**, **4**), cam (**5**), output shaft (**6**) and flow distributor (**7**).

It converts hydrostatic energy into mechanical energy.

Hydraulic fluid is directed from the motor inlet port in the rear case (**2**) via the flow distributor (**7**) through galleries to the cylinder block (**4**). Pressure increases in the cylinder bore which forces the radially arranged pistons (**3**) outwards. This radial force acts via the rollers (**8**) against the profile on the cam ring (**5**) to create a rotary torque. This torque is transferred to the output shaft (**6**) via the splines in the cylinder block (**4**).

If the torque exceeds the shaft load, the cylinder block turns, causing the pistons to stroke (working stroke). Once the end of a stroke is reached the piston is returned to its bore by the reaction force at the cam (return stroke) and the fluid is fed to the motor outlet port in the rear case.

The output torque is produced by the force resulting from the pressure and piston surface. It increases with the pressure difference between the high- and low-pressure side.

The output speed depends on the displacement and is proportional to the inward flow.

The number of working and return strokes corresponds to the number of lobes on the cam multiplied by the number of pistons.

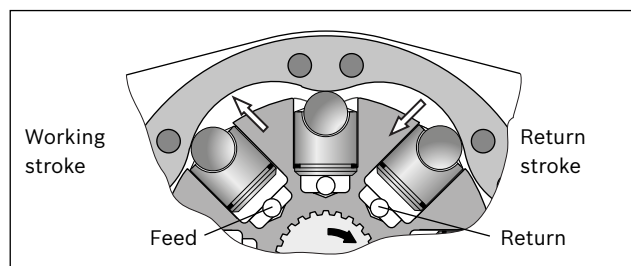


Fig. 4: Torque generation

Flow paths The cylinder chambers (**E**) are connected to ports **A** and **B** via the axial bores and the annular passages (**D**).

Bearings Tapered roller bearings capable of transmitting high axial and radial forces are fitted as standard, except on Hydrobase motors (half motor without front case).

Freewheeling In certain applications there may be a requirement to freewheel the motor. This may be achieved by connecting ports **A** and **B** to zero pressure and simultaneously applying a pressure of 2 bar to the housing through port **L**. In this condition, the pistons are forced into the cylinder block which forces the rollers to lose contact with the cam thus allowing free rotation of the shaft.

Two speed operation (2W) In mobile applications where vehicles are required to operate at high speed with low motor loads, the motor can be switched to a low-torque and high-speed mode. This is achieved by operating an integrated valve which directs hydraulic fluid to only one half of the motor while continuously re-circulating the fluid in the other half. This "reduced displacement" mode reduces the flow required for a given speed and gives the potential for cost and efficiency improvements. The motor maximum speed remains unchanged.

Rexroth has developed a special spool valve to allow smooth switching to reduced displacement whilst on the move. This is known as "soft-shift" and is a standard feature of 2W motors. The spool valve requires either an additional sequence valve or electro-proportional control to operate in "soft-shift" mode.

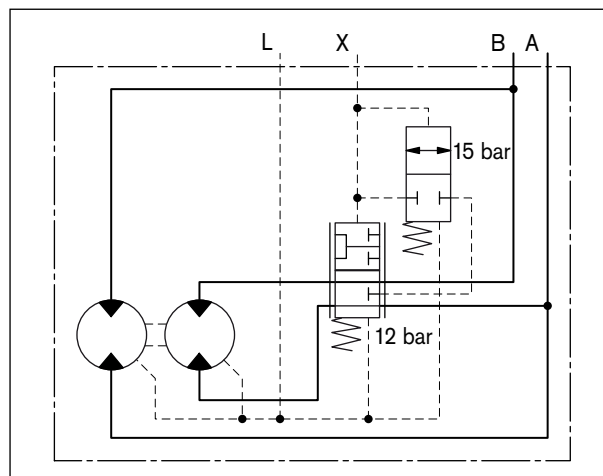


Fig. 5: 2-speed motor schematic

Flushing valve In a closed circuit, the same hydraulic fluid continuously flows between the pump and the motor which could lead to overheating of the hydraulic fluid. The function of the flushing valve is to replace a proportion of the hydraulic fluid in the closed circuit with that from the reservoir. When the hydraulic motor is operated under load, either in the clockwise or anti-clockwise direction, the flushing valve opens and takes a fixed flow of fluid through an orifice from the low pressure side of the circuit. This flow is then fed to the motor housing and back to the reservoir normally via a cooler. In order to charge the low pressure side of the circuit, cool fluid is drawn from the reservoir by the boost pump and is fed to the pump inlet through the check valve. Thus the flushing valve ensures a continuous renewal and

cooling of the hydraulic fluid. The flushing feature incorporates a relief valve which is used to maintain a minimum boost pressure and operates at a standard setting of 14 bar.

Different orifice sizes may be used to select varying flows of flushing fluid between 1.6 to 14 l/min (based on a boost/charge pressure of 25 bar). For all available options refer to flushing information sheet 15225-01.

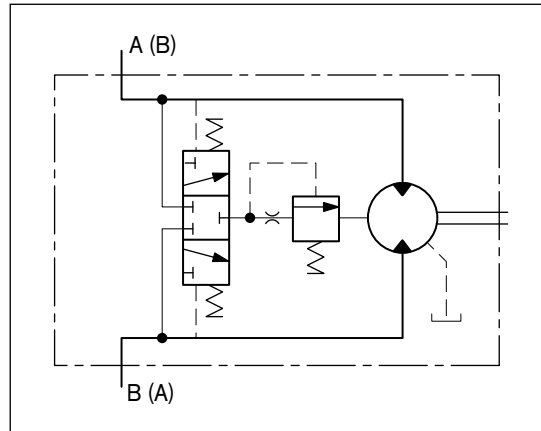


Fig. 6: Flushing schematic

**Parking brake
(multi-disc brake)**

NOTICE! Danger from improper use of the parking brake!

Product can be damaged!

- The parking brake is designed solely for static use and should not be applied whilst the motor is rotating.

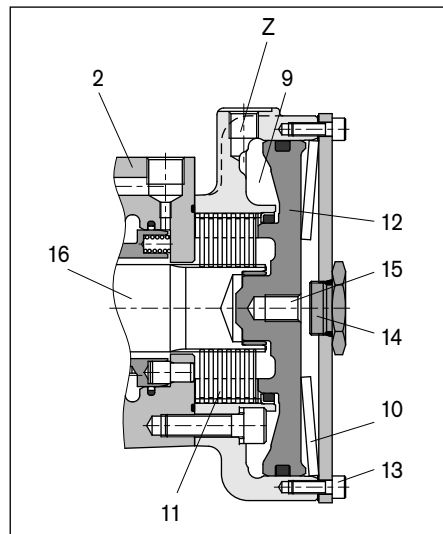


Fig. 7: Parking brake section

As a safety requirement in mobile applications a parking brake may be provided to ensure that the motor cannot turn when the machine is not in use.

The brake is mounted by the way of the rear case (**2**) and brake shaft (**16**).

A disc pack (**11**), with alternate discs splined to the brake shaft and brake housing, is compressed by the force of a disc spring (**10**) acting through a piston (**12**). The friction between the discs generates a holding torque.

When fluid is fed via the brake port **Z** into the annular area (**9**), the pressure on the underside of the piston rises, opposing the spring force. If sufficient pressure is applied, the piston moves to the right, removing the compression on the disc pack and allowing the motor to turn freely. When the pressure is removed the spring forces the piston back to the left and once again compresses the disc pack. Thus, the brake is fail-safe.

Manual release of parking brake:

In case of hydraulic system failure, the brake may be manually released by loosening the end cover screws (**13**), or by removing plug (**14**), where present, and inserting a puller into the tapped hole on the brake piston (**15**).

Parking brake (multi-disc brake) MCR-T

NOTICE! Danger from improper use of the parking brake!
Product can be damaged!

- ▶ The parking brake is designed solely for static use and should not be applied whilst the motor is rotating.

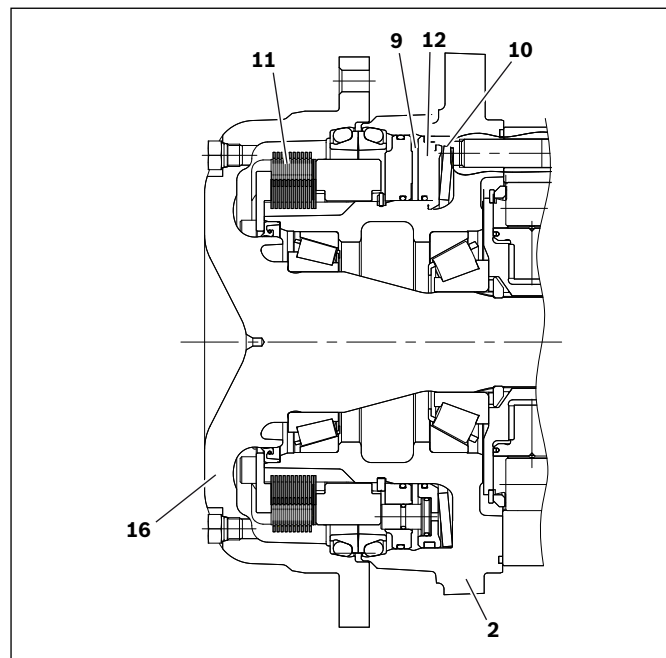


Fig. 8: Parking brake section MCR-T

The brake is mounted by the way of the front case (**2**) and drive shaft (**16**). A disc pack (**11**), with alternate discs splined to the drive shaft and front case, is compressed by the force of a disc spring (**10**) acting through a piston (**12**). The friction between the discs generates a holding torque. When fluid is fed via the brake port **Z** into the annular area (**9**), the pressure on the underside of the piston rises, opposing the spring force. If sufficient pressure is applied, the piston moves to the right, removing the compression on the disc pack and allowing the motor to turn freely. When the pressure is removed the spring forces the piston back to the left and once again compresses the disc pack. Thus, the brake is fail-safe.

**Parking brake
(form brake) MCR-S**

NOTICE! Danger from improper use of the parking brake!
Product can be damaged!

- ▶ The parking brake is designed solely for static use and should not be applied whilst the motor is rotating.
- ▶ Over time, wear may occur to the brake teeth. Brake holding capacity should be confirmed on a regular basis.

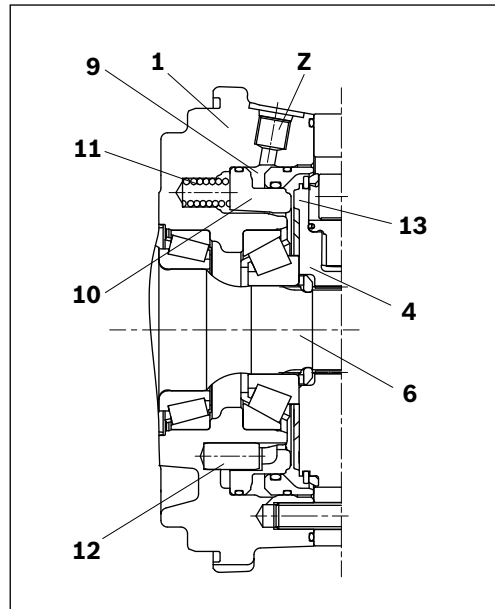


Fig. 9: Parking brake section MCR-S

The form brake consists of a toothed brake piston (10) which is housed within the motor's front case (1). The brake piston is prevented from rotating by dowel pins (12). The cylinder block (4) which is splined onto the motor's shaft (6) has teeth formed on its forward face (13) which engage with the teeth on the brake piston and prevent rotation of the shaft. This engagement is maintained by an annular arrangement of springs (11). To release the brake, hydraulic pressure is applied to the brake piston chamber (9) via the port (Z) to compress the springs and disengage the teeth.

Dynamic brake

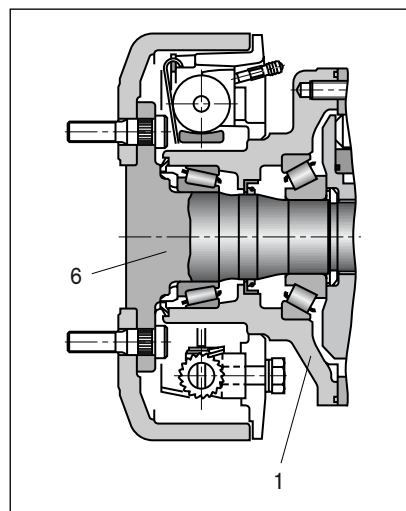


Fig. 10: Dynamic brake section

Where mechanical dynamic braking is required, a drum brake may be specified. The drum brake is mounted directly onto the drive shaft (**6**) and front housing (**1**). Braking torque is provided by brake shoes acting on the inside of the drum.

Operation of brake:

- for dynamic braking: hydraulic brake fluid (special order required for mineral oil operation)
- for parking brake: mechanical brake cable (not supplied)

Speed sensor

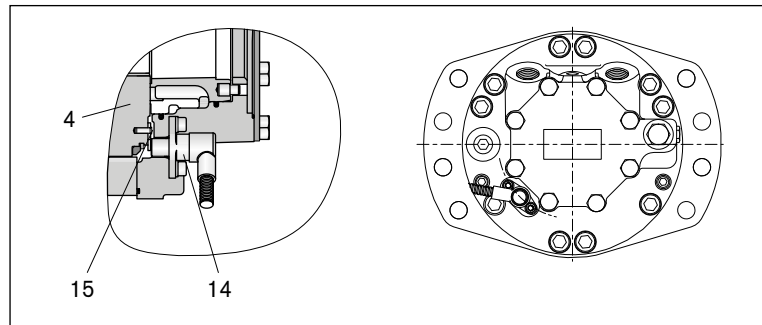


Fig. 11: Speed sensor

A Hall-Effect speed sensor (**14**) may be fitted as an option, giving a two-channel output of phase-displaced square waves, and enabling detection of speed and direction. A toothed target disc (**15**) is fitted to the motor cylinder block (**4**), and the sensor, fitted to a port in the rear case, produces a pulse on each channel as each tooth passes in front of it. The frequency of the pulses is proportional to the rotational speed.

The motor can also be supplied fitted with a target disc and with a speed sensor port machined, but covered and sealed with a blanking plate. These "sensor-ready" motors may be fitted with a sensor at a later date.

For more details on the available speed sensor options refer to the information sheet 15225-06.

5.3 Product identification

Each MCR motor has a unique identification label similar to the following example:

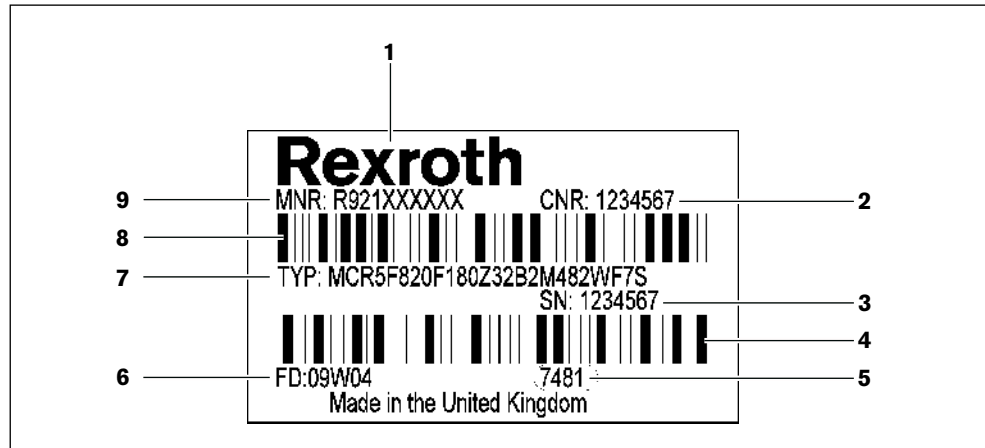


Fig. 12: Label of a MCR motor

- | | |
|--|---------------------------------------|
| 1 Manufacturer | 6 Manufacture date (yrWwk) |
| 2 Customer part number (where applicable) | 7 Motor description |
| 3 Motor serial number | 8 Barcode of motor part number |
| 4 Barcode of motor serial number | 9 Motor part number |
| 5 Internal plant designation | |

Additionally the motor serial number (**3**) along with the manufacture date (**6**) is stamped on either the front case, rear case or the end cover of the radial piston motor.

The cam part number along with the displacement is stamped on the cam. These numbers are normally located in line with the main work ports.

5.4 Product variants

There are many different product variants depending on the motor code.

The main visual differences relate to:

- Frame size
- Front case
- Front shaft
- Brake
- Auxiliary functions such as 2-speed, flushing, speed sensor, valve block

Examples are:

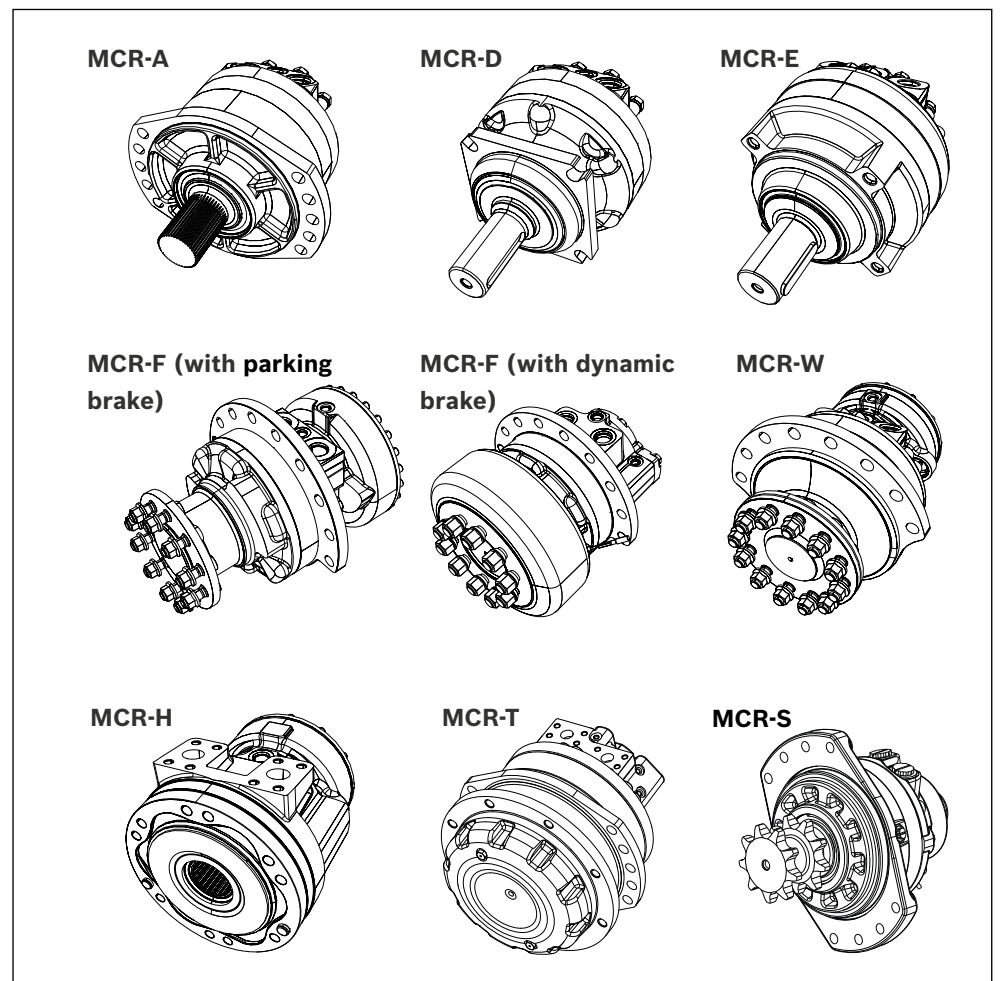


Fig. 13: Examples of different MCR motor types

For full details please refer to the motor code in the relevant data sheet.

6 Transport and storage

- ▶ Always observe the required ambient conditions for transport and storage, see chapter 6.2 "Storing the radial piston motor" on page 31.



Notes on unpacking can be found in chapter 7.1 "Unpacking" on page 32.

6.1 Transporting the radial piston motor

The transportation options below exist depending on the weight and duration of the transport:

- Transport by hand
- Transporting with lifting device (ring screw or lifting strap)

Dimensions and weights The weight specification may vary depending on the motor type and configuration.

Table 6: Dimensions and weights (motors without brakes)

Frame size	MCR		3	4	5	6	10	15	20	
Weight	kg	MCR-F	1L	21	–	38	–	65	95	–
			2WL	26	–	46	–	70	95	–
		MCR-W	1L	28	–	53	–	65	–	–
			2WL	30	–	46	–	–	–	–
		MCR-C	1L	–	–	–	–	–	–	121
			2WL	–	–	–	–	–	–	121
		MCR-A	1L	23	–	43	–	70	–	–
			2WL	28	–	50	–	–	–	–
		MCR-S	1L	–	33	–	–	–	–	–
			2WL	–	35	–	–	–	–	–
		MCR-T	1L	–	–	58	–	84	–	–
			2WL	–	–	63	66	93	–	–
		MCR-H	1L	12	–	23	–	36	54	76
			2WL	18	–	30	–	40	54	76
		MCR-R, series 32	1L	–	–	–	–	33	–	–
		MCR-R, series 41	1L	–	–	–	–	31	–	–
		MCR-D	1L	21	–	39	–	62	–	–
			2WL	27	–	47	–	67	–	–
		MCR-E	1L	–	–	–	36	–	–	–
			2WL	–	–	–	44	–	–	–
Width	mm	The dimensions vary with the motor type. The values applicable to the radial piston motor can be found in the installation drawing (available on request).								
Height	mm									
Length	mm									

6.1.1 Transporting by hand

Radial piston motors should only be hoisted and transported by means of suitable lifting equipment.

CAUTION! Danger from heavy loads!

There is a danger of health damage when carrying radial piston motors.

- ▶ Use suitable lifting, placement and relocation equipment.
- ▶ Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- ▶ Do not lift the radial piston motor by using sensitive attachment parts (e.g. sensors cables or valves).
- ▶ Carefully lower the radial piston motor onto the seating to prevent it from being damaged.

6.1.2 Transporting with lifting device

For transporting, the radial piston motor can be connected to a lifting device via an eye bolt, a hook or a lifting sling.

WARNING! Danger from suspended loads!

Danger to life or risk of serious injury when working with suspended loads.

Damage to equipment.

- ▶ Never stand or position any part of the body below a suspended load.
- ▶ Always wear correct PPE (personal protective equipment).
- ▶ Ensure all equipment used in the lifting operation is of sufficient capacity for the load.
- ▶ Never leave a suspended load unattended.

WARNING! Care should be taken when transporting H and R (hydro base) type motors as internal components may not be secure and could fall from the motor!

Transport with eye bolt

For some motor types the drive shafts can be used to transport the radial piston motor.

- ▶ This requires the use of an eye bolt of the correct thread size and load rating (the thread size is stated on the installation drawing for the particular motor).
- ▶ The eye bolt should be screwed fully into the female thread in the end of the drive shaft, the motor may then be hoisted as indicated in Fig. 14 below.

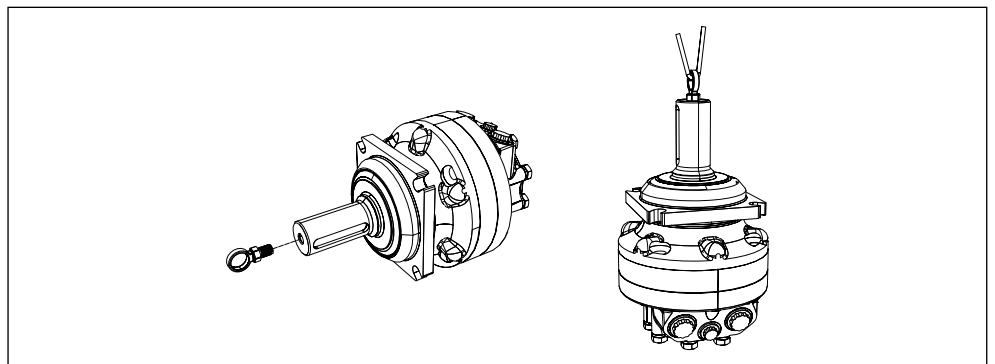


Fig. 14: Fixing the eye bolt

Transport with hook Some motors have a mounting flange which can be used to transport the radial piston motor.

WARNING! Danger from suspended loads!

- ▶ Ensure the hook is of sufficient load rating for the motor to be lifted
- ▶ Never stand below the motor during lifting.

- ▶ Insert the hook into one of the mounting holes of the flange, the motor may then be lifted as indicated in Fig. 15.
- ▶ During lifting operations the motor must be manually supported to ensure it cannot slip from the hook.

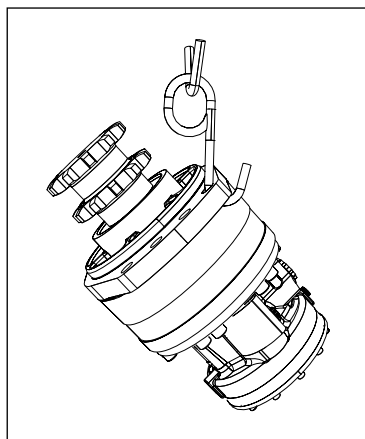


Fig. 15: Hoisting a motor with a hook

Transport with lifting sling **WARNING!** Danger from suspended loads!
Ensure the sling is of sufficient load capacity for the motor being lifted.

- ▶ Use the widest possible lifting sling.
- ▶ Ensure the radial piston motor is securely held within the sling by positioning it in such a way that it cannot slip off the end of the motor (Fig. 16).
- ▶ During lifting operations the motor must be manually supported to ensure it cannot slip from the sling.

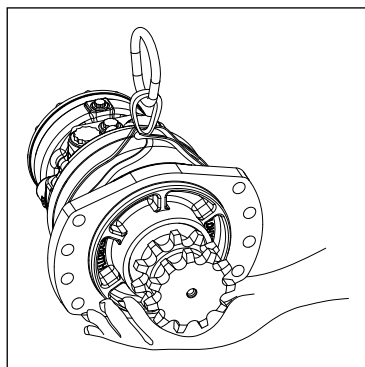


Fig. 16: Transport with lifting sling

6.2 Storing the radial piston motor

Requirements

- The storage areas must be free from 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 discharges) must not be operated in storage areas.
 - Relative humidity of storage area: 0...95 %.
 - Ideal storage temperature: +5 °C to +40 °C.
 - Minimum storage temperature: -30 °C (short duration only).
 - Maximum storage temperature: +60 °C (short duration only).
 - Protect from rain, snow and direct sunlight.
 - Do not stack radial piston motors.
 - Do not store radial piston motor on the drive shaft or fitting, e.g. sensor or valve.
- Check the radial piston motor monthly to ensure proper storage.

After delivery

The radial piston motors are provided ex-works with corrosion protection packaging. The radial piston motor can be stored for a maximum of 2 years after which it should be returned to Bosch Rexroth RM Service Department at Glenrothes for inspection, seal replacement and functional test

The maximum cumulative storage time (from original manufacture date) for a radial piston motor is 6 years after which it should be scrapped.



Entitlement to warranty will be rendered void if storage conditions and inspection measures are not complied with.

After removal

If a removed radial piston motor is to be stored, it must be preserved against corrosion for the duration of storage.



The following instructions only refer to radial piston motors which are operated with a mineral-oil based hydraulic fluid. Other hydraulic fluids require preservation methods that are specifically designed for them. In such cases, consult your local contact person; you can find their contact information at www.boschrexroth.com/addresses

Bosch Rexroth recommends the following procedure:

1. Clean the radial piston motor, see chapter 10.1 "Cleaning and care" on page 49.
2. Drain the radial piston motor.
3. Ensure the inside of the radial piston motor remains coated with a thin film of mineral oil.
4. Seal all ports in an airtight manner.
5. Coat the unpainted surfaces of the radial piston motor with mineral oil or a suitable, easily removed corrosion protection agent, e.g. acid-free grease.
6. Package the radial piston motor in an airtight, corrosion protective film with an enclosed desiccant.
7. Store the radial piston motor so that it is protected against jolts.

7 Installation

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

- Data sheet of the radial piston motor (contains the permissible values of technical data)
- Installation drawing for radial piston motor (can be obtained from your responsible contact person at Bosch Rexroth)
- Hydraulic schematic for the radial piston motor (included in the installation drawing)
- Hydraulic schematic for the machine/system (available from the machine/system manufacturer)
- Order confirmation (contains the order-related technical data for your radial piston motor)

7.1 Unpacking

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

CAUTION! Danger from parts falling out!

If the packaging is not opened correctly, parts may fall out and cause damage to the parts or injury to personnel!

- ▶ Place the packaging on a solid and level surface.
- ▶ Only open the packaging from the top.

- ▶ Remove the packaging from the radial piston motor.
- ▶ Check the radial piston motor for transport damage and completeness.
- ▶ Dispose of the packaging according to the applicable regulations of your country.

7.2 Installation conditions

The location and position of the radial piston motor essentially determine the procedures during installation and commissioning.

- ▶ Make sure that the case of the radial piston motor is filled with hydraulic fluid prior to operation. This will happen automatically where the motor is fitted with a flushing valve. It should also be noted that following long periods without operation the radial piston motor may empty via the hydraulic lines.
- ▶ Use a check valve in the case drain line where the motor is installed above reservoir level and the drive shaft is facing upwards (see paragraph 7.3.2 "Above-reservoir installation" on page 34).
- ▶ To minimise noise levels ensure connecting lines are isolated by use of anti-vibration mountings.
- ▶ Ensure that the case drain line, and return line flow into the reservoir below the minimum reservoir fluid level during all operational conditions.
- ▶ Ensure that the maximum permitted case drain pressure, as specified in the data sheet, is not exceeded.
- ▶ Absolute cleanliness is essential. The radial piston motor must be installed in a clean condition. Contamination of the hydraulic fluid can have a considerable impact on the service life of the radial piston motor.

- ▶ Do not use any cotton waste or lint cloths for cleaning.
- ▶ Ensure that motors sharing the same axle have common brake and drain pressure values

7.3 Installation position

The following installation positions are permissible.

7.3.1 Below-reservoir installation (standard)

Below-reservoir installation means that the radial piston motor installation is below the minimum fluid level of the reservoir.

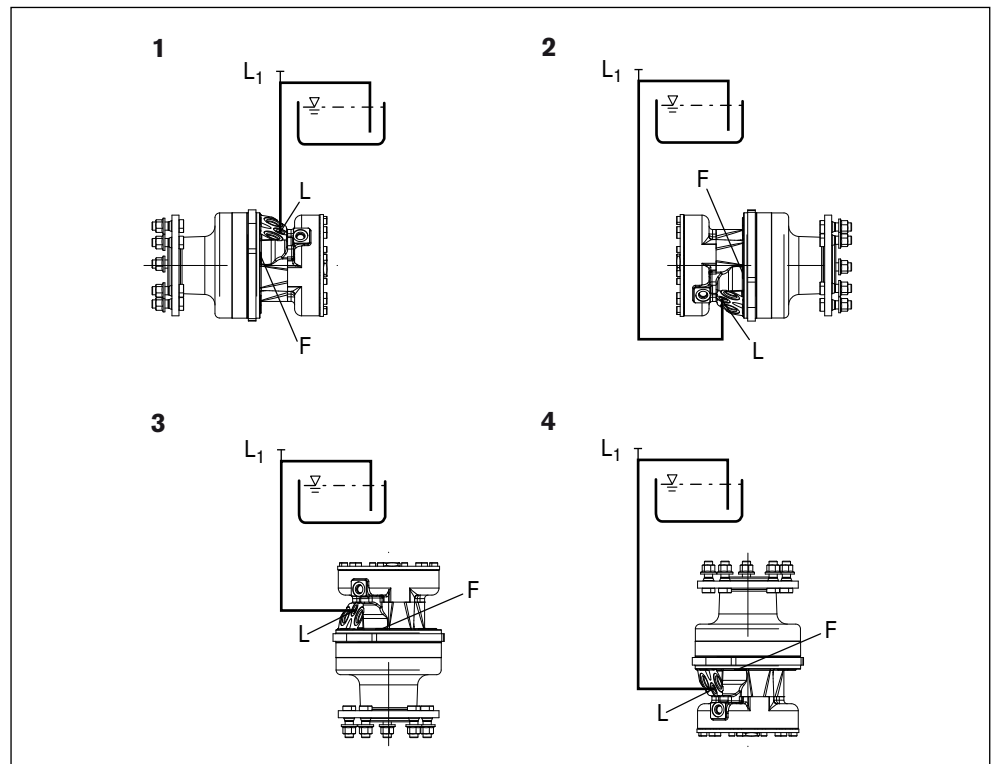


Fig. 17: Below-reservoir installation MCR with installation position 1-4

- L** Drain port
 - F** Filler port
 - L₁** Air bleeding
- Note: L₁ is part of the external piping

The oil filling of the case should always take place via the filler port **F** and the air bleeding via port **L₁** in the drain line.

7.3.2 Above-reservoir installation

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



Recommendation for installation position 6 and 8:

A check valve in the case drain line (opening pressure 0.5 bar) can prevent draining of the motor's case.

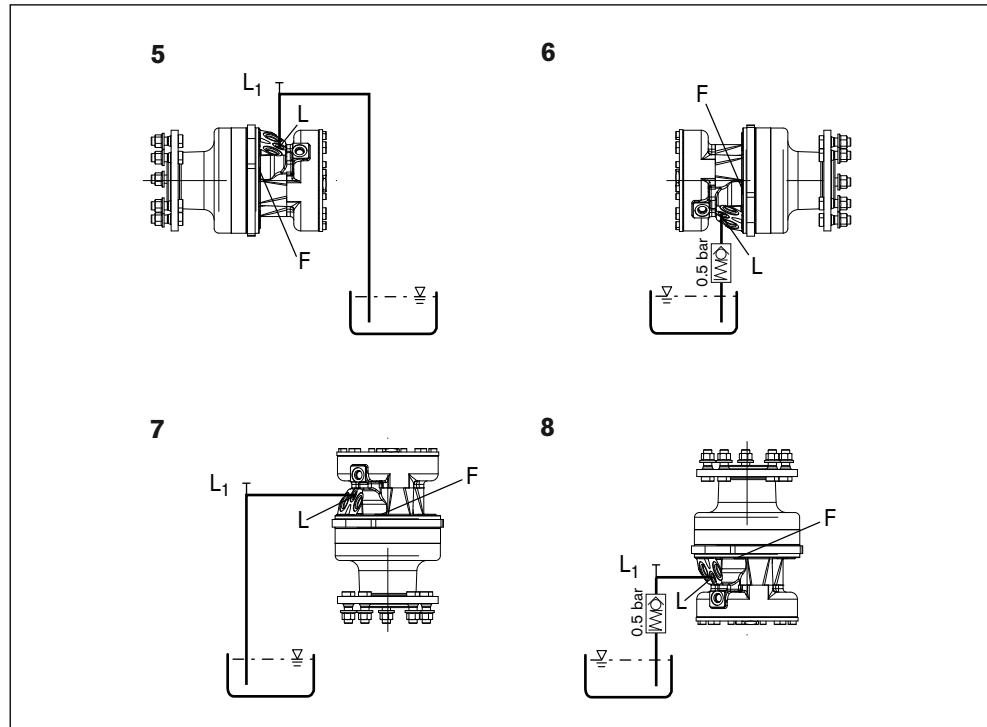


Fig. 18: Above-reservoir installation MCR with installation position 7-12

- L** Drain port
 - F** Filler port
 - L₁** Air bleeding
- Note: L₁ is part of the external piping

The oil filling of the case should always take place via the filler port **F** and the air bleeding via port **L₁** in the drain line.

Where a check valve is fitted to the drain line, it should be sized to ensure the motor's case pressure limit is not exceeded at start-up.

Note: when the pistons are pushed out of the cylinder block at start-up, this displaces oil from the motor case, momentarily delivering full pump flow to the drain line.

7.4 Installing the radial piston motor

7.4.1 Preparation

1. Check the delivery contents for completeness and transport damage.



If the part number on the motor identification label (chapter 5.4) does not correspond to the order confirmation, contact your local contact person for clarification. You can find their contact information at www.boschrexroth.com/addresses

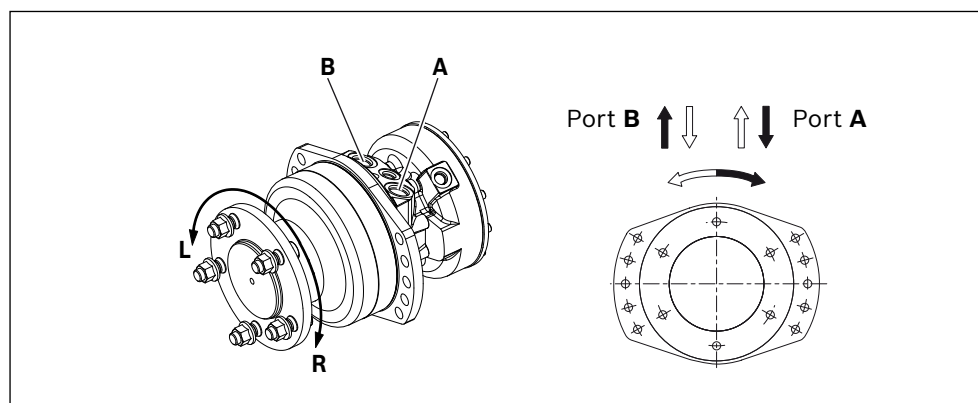


Fig. 19: Direction of rotation

View motor from shaft with ports uppermost and pressurising port **B**:

- L** Counter-clockwise
R Clockwise



The direction of rotation is specified in the motor description on the identification label (chapter 5.3).

Letter "L" in code, or no designation, means counter-clockwise rotation.
 Letter "R" in code means clockwise rotation.

7.4.2 Dimensions

The installation drawing specifies the dimensions of the mountings and ports of the radial piston motor.

7.4.3 General instructions

During installation (and removal) of the radial piston motor, observe the following general instructions and handling instructions:

- The radial piston motor should be installed using suitable fasteners which have the capacity to safely withstand the expected loads and torque.
- The permissible axial and radial loading on the drive shaft is specified in the relevant motor data sheet.
- To minimise noise levels ensure connecting lines are isolated by use of anti-vibration mountings.
- Make sure that the installation location is clean and free from contamination.

- All connections should be made with reference to the installation drawing and data sheet and must all be completed prior to motor operation.
- Oil cleanliness is vital to obtaining long service life, therefore well maintained filtration is essential.
- Care must be taken to ensure excessive forces are not generated by eccentric mounting of the radial piston motor to a load. A suitable flexible coupling should be used if this loading cannot be avoided.

7.4.4 Connection to the output shaft

The installation of the radial piston motor depends on the type of connection to the drive shaft. The following connections are possible, depending on the motor type:

Wheel **WARNING!** Risk of damage and injury!

Ensure mounting face is flat and perpendicular to the motor axis, allowing no distortion of the motor mounting flange.

- ▶ Failure to adhere to this could result in shaft breakage.

Where wheel studs and nuts are supplied, the nuts must be tightened to the following torque values:

Table 7: Wheel nut tightening torques

Stud	Flat [Nm]	Spherical [Nm]
M14	140	180
M18	300	380
M20	420	610
M22	560	780

The shaft connection to the wheel must use all mounting holes or wheel studs specified on the drive shaft.

Spline Protect the spline from frictional corrosion by application of a suitable lubricant.

Keyway **WARNING!** Risk of damage and injury!

When assembling shafts with keyways, an appropriate fit (H7 or G6 tolerance with the mating bore) must be used to ensure that the torque transmission is evenly distributed around the diameter of the shaft.

- ▶ Failure to achieve this will result in the key transmitting all torque which could result in shaft failure.

Gear **WARNING!** Risk of damage and injury!

An incorrect gear mesh can result in injuries or damage to the radial piston motor.

- ▶ Ensure that the gear mesh is not excessively tight leading to high loading on the teeth and shaft causing excessive wear or possible shaft failure.
- ▶ Ensure the gear mesh is not excessively loose as this could cause excessive backlash and premature gear wear.

Protect the gear from frictional corrosion by application of a suitable lubricant.

Sprocket **WARNING!** Risk of damage and injury!

Ensure mounting face is flat and perpendicular to the motor axis, with no distortion of the motor mounting flange.

- ▶ Failure to adhere to this could result in shaft breakage.

Where wheel studs and nuts are supplied, the nuts must be tightened to the torque values as per Table 7 "Wheel nut tightening torques" on page 36.

The shaft connection to the sprocket must use all mounting holes or wheel studs specified on the drive shaft.

Chain **WARNING!** Risk of damage and injury!

Ensure chain tension is not excessive as this could result in premature wear of the sprocket.

Where a dirt seal is not fitted to the radial piston motor the oil level in the chain case must come at least to the level of the sprocket.

- ▶ Failure to adhere to this could result in insufficient bearing lubrication and premature failure of the bearing.

Protect the sprocket on the drive shaft from frictional corrosion by providing adequate lubrication.

Bearing and shaft assembly
(with hydrobase motors
MCR-H and MCR-R)

The installation drawings for the MCR-H and MCR-R specifies all relevant data such as spline connection, bearing loads and sealing arrangements.

7.4.5 Assembly of the speed sensor

Where a radial piston motor is supplied "speed sensor prepared" (P0 in the motor code) a sensor may be fitted as follows:

1. Remove blanking plate from speed sensor port.
2. Remove plastic shipping cover from sensor nose.
3. Apply a suitable thread locking adhesive to the two M6 screws. Use just enough to cover the threads and remove any excess.
4. Insert the sensor into the port and seat o-ring by pressing down firmly on the centre of the sensor.
5. Tighten the two M6 screws, drawing down each side evenly.
6. Tighten to a final torque of 10 Nm.

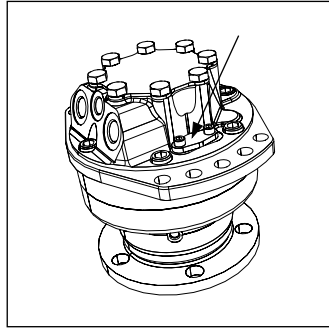


Fig. 20: Speed sensor port (blanking plate fitted)

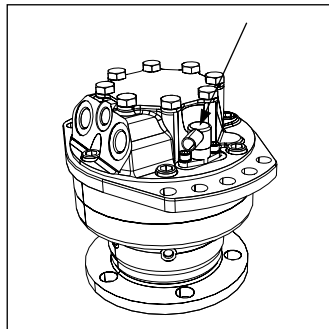


Fig. 21: Tighten speed sensor to final torque

7.4.6 Completing installation

1. Remove any transportation screws or plugs.

CAUTION! Operation with protective plug!

Operating the radial piston motor with transportation plugs may result in injuries or damage to the radial piston motor.

- ▶ Before commissioning remove all transportation plugs and replace with metal plugs of a suitable pressure rating or connect the appropriate lines.

2. Remove the transport protection.

The radial piston motor is delivered with protective covers and plugs. These are not pressure-resistant and must 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 responsible Bosch Rexroth Service partner or the service department of the manufacturing plant for the radial piston motor.

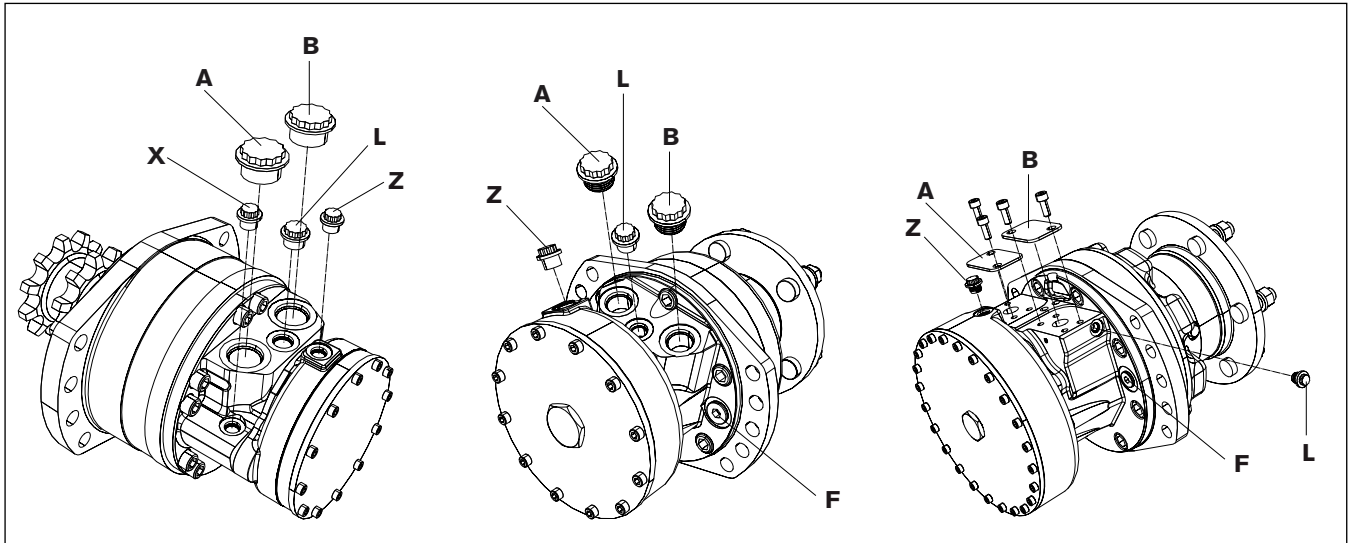


Fig. 22: Removing transport protection



Ports intended for connecting lines are sealed from contamination by protective covers or threaded plugs. All ports required for the motor's function must be connected. If a port is not connected, it must be plugged with a threaded metal fitting of sufficient capacity to withstand system pressure.

7.4.7 Hydraulically connecting the radial piston motor

WARNING! Risk of damage or injury!

Ensure all hydraulic connections are of the correct standard, size, thread type and pressure rating. Failure to do so may lead to failure of the connection and high pressure fluid leak.

The machine/system manufacturer is responsible for dimensioning the hydraulic connections. The radial piston motor must be connected to the rest of the hydraulic system in accordance with the hydraulic schematic 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.

Observe the following notes when routing the boost, pressure, drain and control lines:

- Lines and hoses must be installed without any mechanical pre-tension to ensure additional motor loads are not created during operation.
- Ensure correct sealing materials are used appropriate for the fluid type and operating conditions.

- Pressure/boost line
 - For the pressure/boost lines, use only pipes, hoses and connecting elements rated for the operating pressure range specified in data sheet
- Drain line
 - The drain line should be routed to ensure that the motor's case remains filled with hydraulic fluid (reference chapter 7.3).
 - The case pressure must not exceed the limit specified in the motor's data sheet under any operating conditions.
 - The drain line connection to the reservoir must be below the minimum fluid level under all conditions (see chapter 7.3 "Installation position" on page 33).

WARNING! Leaking or popped-out threaded plugs!

If a threaded plug of the incorrect standard or size is used there is a risk that under pressure this may become ejected from the port resulting in serious injury and damage to equipment.

- ▶ Use the installation drawing to determine the required threaded plug for each fitting.
- ▶ Make certain that there are no mix-ups when installing fittings, mounting bolts and threaded plugs.
- ▶ For all female threads, use a threaded plug from the same standard and of the correct size.

Port specifications Please refer to the data sheet and installation drawing with regards to port sizes, peak pressure etc.

Tightening torques The following tightening torques apply:

- Ports on the radial piston motor:

The maximum permissible tightening torques are maximum values to prevent damage to the threaded holes. These must not be exceeded. For values, please refer to the following table.
- Fittings:

Observe the machine manufacturer's instruction regarding tightening torques for the fittings used.
- Mounting screws:

As every application is different, the required grade and torque for the mounting screws must be determined on an individual basis. For correct values, observe the installation instructions of the machine manufacturer.
- Filler Plugs:

For the metal filler plug supplied with the radial piston motor, the tightening torque stated in the below table applies.
- Wheel nuts:

Where wheel studs and nuts are supplied, the nuts must be tightened to the torque values as per Table 7 "Wheel nut tightening torques" on page 36.

Table 8: Tightening torques for threaded holes and filler plug

Thread size at ports		Minimum thread engagement [mm]	Maximum permissible tightening torque of the threaded holes [Nm]	Tightening torque for filler plug [Nm]
G 1/4	ISO 228-1	9.5	70	–
G 3/8	ISO 228-1	9.5	110	–
G 1/2	ISO 228-1	13.0	200	60
G 3/4	ISO 228-1	13.0	330	–
7/16-20 UNF	ISO 11926	9.0	40	–
9/16-18 UNF	ISO 11926	10.0	80	–
3/4-16 UNF	ISO 11926	11.0	160	60
1 1/16-12 UN	ISO 11926	15.0	360	–
1 5/16-12 UN	ISO 11926	15.0	540	–

Above torque values are calculated based on the minimum thread engagements quoted.

They represent the maximum values that can be applied without damaging the motor housing. However, the actual tightening torque for the fittings must come from the specification of the machine manufacturer.

Shorter thread engagement lengths result in a lower permissible tightening torque, but higher thread engagement lengths do not result in a higher permissible tightening torque.

If higher thread engagement lengths are used, check the available thread depths in the housing to ensure that the fitting can be screwed fully home.

For the filler plug, the nominal setting on the torque wrench must be within ± 2 Nm.

Procedure

To connect the radial piston motor to the hydraulic system:

1. Remove the protective plugs and threaded plugs at the ports at which the connections are to be made.
2. Make sure that the sealing surfaces of the hydraulic ports and functional surfaces are undamaged and free from contamination.
3. Hydraulic lines should be flushed with clean fluid before installation. (Note chapter 7.5 "Performing flushing cycle" on page 41 when you flush out the hydraulic system.)
4. Connect the lines in accordance with the installation drawing and the machine or system schematic. Check whether all ports are connected or plugged with threaded plugs of a sufficient pressure rating.
5. Tighten the fittings correctly (note tightening torques).
6. Check all pipes, hose lines, connecting pieces and couplings to ensure they are in condition for safe working.

7.5 Performing flushing cycle

In order to remove foreign particles from the system, Bosch Rexroth recommends a flushing cycle for the hydraulic system before the first commissioning. To avoid internal contamination, the radial piston motor must not be included in the flushing cycle.



The flushing cycle must be performed with an additional flushing unit. Follow the instructions of the flushing unit's manufacturer for the exact procedure during the flushing cycle.

8 Commissioning

WARNING

Danger while working in the danger zone of a machine/system!

Danger to life, risk of injury or serious injuries!

- ▶ Pay attention to and rectify potential danger sources before operating the radial piston motor.
- ▶ Nobody may stand in the danger zone of the machine/system.
- ▶ The emergency stop button for the machine/system must be within the operator's reach.
- ▶ Always follow the instructions of the machine/system manufacturer during commissioning.

CAUTION

Commissioning of an incorrectly installed product!

Risk of injury and damage to equipment!

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

8.1 First commissioning



Lubricants such as petroleum jelly may be used to retain seals during production assembly of radial-piston motors. Traces of lubricant may appear during running-in of the motor, adjacent to sealing interfaces. This is normal and does not indicate leakage where no recurring drip is observed.



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

- ▶ Connect pressure gauges to the functional and drain lines of the radial piston motor to record operating and case pressures during commissioning.
- ▶ During the commissioning process, monitor the temperature of the hydraulic fluid in the reservoir to ensure that it remains within the permissible viscosity limits.

8.1.1 Filling the radial piston motor

CAUTION

Risk of impaired brake performance!

For braked motors ensure that the fluid does not contain any friction modifying additives (e.g. anti-stick slip additives), as they may cause a significant reduction in brake torque.

- ▶ When using fluids other than mineral oil, brake torque needs to be checked on a case-by-case basis.
- ▶ Ensure that the correct additive is present where specified on installation drawing (dynamic disc brake). This is necessary to prevent brake noise.
- ▶ The drum and caliper disc brake can be configured to operate with either mineral oil or brake fluid. Ensure the correct seals have been specified for the intended fluid otherwise damage and leakage will occur.
- ▶ If in doubt please contact Bosch Rexroth RM Engineering Department in Glenrothes (contact details see chapter 10.5 "Spare parts" on page 52).

Professional filling and air bleeding is necessary to prevent damage to the radial piston motor and to maintain correct function. The radial piston motor must not be operated while it is being filled.



Usually, the cleanliness level of commercial hydraulic fluids is insufficient for our components. These hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

Use an approved hydraulic fluid.

The machine or system manufacturer can provide precise details of the hydraulic fluid. Details of minimum requirements for mineral-oil based hydraulic fluids, environmentally acceptable hydraulic fluids or HF hydraulic fluids for the radial piston motor are contained in the related Rexroth documents listed in Table 1 "Required and supplementary documentation" on page 5.



Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to data sheet 90235. For hydraulic fluids which have been positively evaluated in the Fluid Rating, please refer to data sheet 90245 "Bosch Rexroth fluid rating list for Rexroth hydraulic components (pumps and motors)". The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range.

To ensure the functional reliability of the radial piston motor, cleanliness level 20/18/15

according to at least ISO 4406 is necessary for the hydraulic fluid. You can find details on the permissible and optimal viscosities and admissible temperatures in data sheet.

Procedure Proceed as follows to fill the radial piston motor:

1. Place a drip tray under the radial piston motor to collect any hydraulic fluid that may escape.

NOTICE! Contaminated hydraulic fluid!

The cleanliness levels of hydraulic fluids on delivery do not normally conform to the requirements for our components.

- ▶ Use a suitable filter system to filter hydraulic fluids during filling to minimize the risk of contamination and water in the hydraulic system.

2. Fill the radial piston motor via the filler port **F**. See section 7.3 "Installation position" on page 33. Motors fitted with internal flushing will automatically fill at initial operation. The hydraulic lines of the system must also be filled.

NOTICE! Damage to equipment due to improper lubrication!

Product can be damaged or destroyed!

- ▶ When using a shut-off valve in the reservoir line, make sure that the radial piston motor can only be started when the shut-off valves are open.

3. The air bleeding should be done via the port **L₁** in the drain line. See section 7.3 "Installation position" on page 33.
4. On completion of the filling operation, ensure that all ports are reconnected and plugs refitted.

8.1.2 Testing the hydraulic fluid supply

For the radial piston motor to function correctly, the pump 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 testing the hydraulic fluid supply, constantly monitor the noise level and check the hydraulic fluid level in the reservoir. If the pump becomes louder (cavitation) or the case drain fluid is discharged with bubbles, this is an indication that the pump is not being sufficiently supplied with hydraulic fluid.

If excessive noise is heard from the motor, ensure that sufficient charge pressure is present (see data sheet for values). Pay particular attention during rapid deceleration under maximum load.

For information on troubleshooting, see chapter 14 "Troubleshooting" on page 56.

To test the hydraulic fluid supply:

1. Allow the pump to run at low speed and without load. Pay attention to leakage and noise.
2. Check the case drain line during the test. The case drain fluid should not contain any bubbles.
3. Check the case drain pressure of both pump and motor. Refer to the data sheets for the permissible values. If the motor is used in freewheeling mode, ensure that excessive case pressure spikes are not present when re-engaging drive.

8.1.3 Performing functional test

WARNING

Incorrectly connected radial piston motor!

Incorrectly connected ports will lead to malfunctions (e.g. reverse instead of forward) and will present serious danger to persons and equipment!

- ▶ Before the functional test, check that all piping and hoses have been correctly installed and connected in accordance with the system or machine hydraulic schematic.

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 radial piston motor is tested for functional capability and performance before delivery to ensure it meets the specification of the technical data sheet. To achieve the required performance during commissioning it must be ensured that the radial piston motor is installed properly in the machine/system.

- ▶ For braked motors, check brake hold and function are sufficient to meet the requirements of the system or machines.

8.2 Running-in phase

NOTICE

Damage to equipment by incorrect viscosity!

Increased hydraulic fluid temperature may reduce the fluid viscosity to an unacceptable level resulting in damage to the motor (see data sheet)!

- ▶ Monitor the operating temperature during the running-in phase, e.g. by measuring the case drain temperature.
- ▶ Reduce the loading (pressure, rpm) of the radial piston motor if unacceptable operating temperatures occur.
- ▶ If operating temperatures remain too high then the cooling capacity of the system must be improved.

MCR dynamic brake run-in procedure!

Where a drum or caliper disc brake is fitted, running in is required to achieve full brake torque. For the drum brake, the following procedure should be carried out:

- ▶ Brake the machine hard, in forward and reverse directions, until the brake drum temperature reaches 200° C.
- ▶ Allow the brake to cool.
- ▶ To remove residue, brake gently 2 times each in the forward and reverse directions.

For the caliper disc brake, the following procedure should be carried out:

- ▶ Brake the machine hard until the disc temperature reaches 250° C.
- ▶ Allow to cool.
- ▶ To remove residue brake gently 2 times.

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 motor efficiency continues to increase until the end of the running-in phase.

During the running-in period (minimum 24 hours) the motor should not be run unloaded (shaft not connected to load) at greater than 100 rpm.

(e.g. The motors on a wheeled machine should not be run if the machine is jacked off the ground.)

8.3 Recommissioning after standstill

Depending on the installation, ambient conditions or operating cycle, it may become necessary to carry out a recommissioning.

Additionally, the following criteria may make recommissioning necessary:

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

- ▶ For recommissioning, proceed as described in chapter 8.1 "First commissioning" on page 42.

8.4 Final checks

After the running-in phase confirm the following conditions:

- ▶ Case drain pressure < 10 bar.
- ▶ Minimum pressure at ports **A** and **B** > 15 bar (general rule) or exact value as stated in the data sheet, to avoid cavitation.
- ▶ Parking brake release pressure > 15 bar and < 30 bar (standard specification) or exact values as stated on the installation drawing for all non-standard specifications (SO versions).
- ▶ 2 speed switching pressure:
For minimum and maximum 2 speed switching pressures refer to the appropriate motor installation drawing.
- ▶ Case drain oil temperature < 85 °C. For operation above this temperature please consult Rexroth engineering department in Glenrothes.
- ▶ Operating speeds, pressures and drive power are within current data sheet recommendations.

9 Operation

The MCR motor is not designed with any end user adjustable settings.

For this reason, this chapter of the manual does not contain any information on adjustment options. Only use the product within the performance range provided in the technical data. The machine or system manufacturer is responsible for the proper layout of the hydraulic system and its control.

Confirm at regular intervals:

- ▶ Operating speeds, pressures and temperature and fluid viscosity are within current data sheet recommendations (see also section 8.4 "Final checks" on page 46).
- ▶ Fluid cleanliness within data sheet limits.
- ▶ Motor is still securely mounted, running at normal sound level and free from external leakage.
- ▶ Fluid is changed per the machine manufacturer's recommendation.
- ▶ Where applicable, check bearing lubrication is still effective.

For higher loading or speed conditions, case flushing may be added to obtain a temperature reduction. Flush using both motor drain ports **L** and **F**. Before any changes in operating requirements or conditions are considered please contact Bosch Rexroth RM Engineering Department in Glenrothes (contact details see chapter 10.5 "Spare parts" on page 52).

9.1 Manual brake release in case of emergency



This option is not available for the MCR-T or the MCR-S.



Mechanical brake release should only be used in the event of hydraulic failure. Ensure mechanical release is disengaged after use to maintain fail-safe operation of the brake.

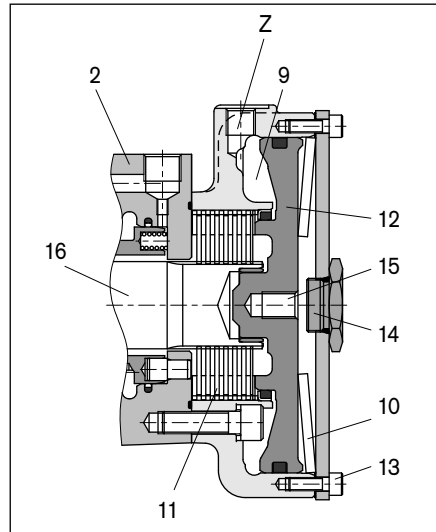


Fig. 23: Parking brake section

In case of hydraulic system failure, the brake may be manually released by removing the plug (**14**) and inserting a puller into the tapped hole in the brake piston (**15**).

Table 9: Required puller size for emergency brake release

Motor type	Screw size	Minimum screw length	Approx. release torque
MCR3	M12	30 mm	60 Nm
MCR5	M16	30 mm	120 Nm
MCR10	M16	40 mm	160 Nm
MCR15	M20	45 mm	230 Nm
MCR20	M20	50 mm	340 Nm

Alternatively, if the plug is not present or a suitable puller is not available, the brake may be released by loosening the end cover screws (**13**). Ensure the screws are retightened in a diametrically opposed manner and to the torque values specified in Table 10.

Table 10: Brake end cover screw torque values

Motor type	Screw size	Torque
MCR3	M12	14...16 Nm
MCR5	M16	35...39 Nm
MCR10	M16	70...77 Nm
MCR15	M20	70...77 Nm
MCR20	M20	117...122 Nm

10 Maintenance and repair

NOTICE

Inspection and maintenance work carried out too late!

Damage to equipment!

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

10.1 Cleaning and care

NOTICE

Damage to seals and electrical system by high pressure cleaning apparatus!

The water jet of a power washer may damage the seals and electrical system of the radial piston motor!

- ▶ Do not point the power washer at sensitive components, e.g. shaft seal, electrical connections and the brake end cover.

For cleaning and care of the radial piston motor, observe the following:

- ▶ Check whether all seals and fittings on the connections are securely seated to ensure that no moisture can penetrate into the radial piston motor during cleaning.
- ▶ Use only water and, if necessary, a mild detergent to clean the radial piston motor. Never use solvents or aggressive detergents.
- ▶ Remove coarse external dirt and keep sensitive and important components, such as solenoids, valves, indicators and sensors, clean.

10.2 Inspection

In order to ensure long and reliable operation of the radial piston motor, Bosch Rexroth recommends regular monitoring of the hydraulic system and radial piston motor. The inspection schedule in Table 11 should be followed and the results documented and archived:

Table 11: Inspection schedule

Task to be carried out	Interval	
Hydraulic system	Check level of hydraulic fluid in the reservoir.	Daily
	Check the operating temperature at a comparable load condition at the reservoir port and in the reservoir.	Weekly
	Conduct analysis of hydraulic fluid: viscosity, aging and dirt contamination	Yearly or every 2000 operating hours (whichever occurs first)
	Check filter. The change interval may vary depending on the degree of cleanliness of the hydraulic fluid. We recommend using a contamination indicator.	Yearly or every 1000 operating hours (whichever occurs first)
Radial piston motor	Check radial piston motor for leakage. Early detection of hydraulic fluid loss can help identify faults with the machine/system. To assist with leak detection, Bosch Rexroth recommends that the radial piston motor and system are always kept in a clean condition.	Daily
	Check radial piston motor for unusual noise.	Daily
	Check security of fasteners. All fasteners should be checked with the hydraulic system switched off, depressurized and cooled down.	Monthly
	Check tightness of wheel nuts, where fitted.	monthly
	Check the thickness of the brake linings, where a drum or caliper disc brake is fitted. Where applicable, replace bearing lubrication, when included in machine manufacturer's instructions.	twice a year

Monitoring and recording of the operating conditions (e.g. operating temperatures) will enable early detection of wear and allow preventive measures to be carried out.

10.3 Maintenance

The radial piston motor is low maintenance when used properly.

The service life of the radial piston motor is heavily dependent on the quality of the hydraulic fluid. For this reason, we recommend changing the hydraulic fluid at least once per year or every 2000 operating hours (whichever occurs first) or having it analyzed by the hydraulic fluid manufacturer or a laboratory to determine its suitability for further use.

The service life of the radial piston motor is limited by the service life of the bearings fitted. You can ask your local contact person about service life. You can find their contact information at

www.boschrexroth.com/addresses

A life calculation must, in all cases, be carried out prior to installation of a radial piston motor on a new machine.

Based on these details, a maintenance period is to be determined by the system manufacturer for the replacement of the bearings and included in the maintenance schedule of the hydraulic system.

Where a drum brake is fitted, the thickness of the brake shoe linings has to be checked by sight control through the wear checking hole at regular intervals, depending on the use of the vehicle, but at least twice a year.

When the remaining lining thickness is small, these intervals have to be shortened correspondingly in order to avoid greater damage to the brake and drum.

Remaining thickness must be minimum 2.0 mm at the thinnest point of the lining.

Where a caliper disc brake is fitted pads should be examined at least twice a year and replaced when the lining thickness is reduced to 2 mm. An optional pad thickness indicator is available which can be used to operate a warning when the pad thickness reaches this limit.

10.4 Repair

Bosch Rexroth offers a comprehensive range of services for the repair of Rexroth radial piston motors.

Repairs to Rexroth radial piston motors should only be carried out by authorized and qualified staff at service centers certified by Bosch Rexroth.

- ▶ Only original spare parts supplied by Bosch Rexroth should be used to repair Rexroth radial piston motors. Failure to do so will invalidate the warranty and may result in unsatisfactory performance and component failure.

In the event of questions regarding repairs, contact your responsible Bosch Rexroth Service partner or the service department of the manufacture's plant for the radial piston motor, see chapter 10.5 "Spare parts" on page 52.

10.5 Spare parts

CAUTION

Use of unsuitable spare parts!

Spare parts that do not meet the technical requirements specified by Bosch Rexroth may cause personal injury or property damage!

- ▶ Only original spare parts supplied by Bosch Rexroth should be used to repair Rexroth radial piston motors. Failure to do so may result in unsatisfactory performance and possible component failure.

The spare parts lists for radial piston motors are order specific. When ordering spare parts, quote the material and serial number of the radial piston motor 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 radial piston motor.

Bosch Rexroth Limited
Viewfield Industrial Estate
Glenrothes, Fife
Scotland, KY6 2RD
United Kingdom
Phone +44 1592 631777

For spare parts please contact customerservice@boschrexroth.co.uk

For general inquiries, please contact your local contact person. You can find their contact information at

www.boschrexroth.com/addresses

11 Removal and replacement



This chapter is not applicable to MCR-R type motors. For MCR-R refer to the appropriate installation drawing and procedure.

11.1 Required tools

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

11.2 Preparing for removal

1. Decommission the relevant system component 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 machine/system components are not under pressure or voltage.
2. Protect the relevant system component against being energized.
3. For applications where the motor is in a load bearing installation, ensure the machine or connecting mechanism is fully supported and restrained from uncontrolled movement.

11.3 Removing the radial piston motor

Proceed as follows to remove the radial piston motor:

1. Ensure the hydraulic system is depressurized.
2. Ensure the radial piston motor has been allowed to cool down.
3. For below-reservoir installation, before disconnecting the radial piston motor, isolate the connection to the reservoir or drain the reservoir.
4. Place a drip tray under the radial piston motor to collect any hydraulic fluid that may escape.
5. Uncouple/unbolt the shaft of the radial piston motor from the the system or machine ensuring any disconnected mechanism is restrained from uncontrolled movement.
6. Disconnect the hydraulic lines ensuring the escaping hydraulic fluid is collected in the drip tray.
7. Support the radial piston motor by use of a suitable lifting device. Remove mounting bolts and lift the motor free of its installation and lower onto a suitable level surface. Care should be taken with H type motors to ensure that internal components are not allowed to fall free.
8. Drain the radial piston motor.
9. Plug all openings.

11.4 Preparing the components for storage or further use

- ▶ Proceed as described in chapter 6.2 "Storing the radial piston motor" on page 31.

12 Disposal

Incorrect disposal of the radial piston motor, hydraulic fluid or packaging material could lead to pollution of the environment.

Observe the following points when disposing of the radial piston motor:

1. Completely drain the radial piston motor of hydraulic fluid.
2. Dispose of the radial piston motor packaging material in accordance with the national regulations in your country.
3. Dispose of the hydraulic fluid according to the national regulations of your country. Reference should also be made to the applicable safety data sheet for the hydraulic fluid.
4. Dismantle the radial piston motor into its individual parts and properly recycle these parts.
5. Separate the parts into:
 - Cast parts
 - Steel
 - Aluminum
 - Non-ferrous metal
 - Electronic waste
 - Plastic
 - Seals

13 Modification and adjustments

There are no facilities for end users to carry out modifications or adjustments to the radial piston motor. The only exception to this is the fitting of an optional speed sensor (see chapter 7.4.5 “Assembly of the speed sensor” on page 37).



The Bosch Rexroth warranty only applies for the delivered configuration. Any unauthorised modifications or adjustments carried out to the radial piston motor will invalidate the product warranty.



If any modifications or adjustments to the radial piston motor are considered necessary, please contact your local contact person; you can find their contact information at

www.boschrexroth.com/addresses

14 Troubleshooting

Table 12 contains a list of potential issues that may affect the radial piston motor. This list should not be considered comprehensive and is for guidance only. Where motor disassembly is suggested, advice should be requested from the Bosch Rexroth RM Service Department in Glenrothes prior to any action taking place. Only authorized personnel may perform troubleshooting inside a safety area designated by the machine manufacturer.

14.1 How to proceed for troubleshooting

- ▶ Where possible, troubleshooting should always be carried out at minimum operating conditions.
- ▶ Always act systematically and purposefully. Random adjustment and component replacement could result in the inability to ascertain the original failure cause.
- ▶ First establish a general overview of how the radial piston motor works in conjunction with the entire system.
- ▶ Confirm that the product was working properly in conjunction with the entire system before the fault occurred.
- ▶ Try to determine if there were any recent changes made to the system in which the product is integrated
 - Were there any changes to the product's application conditions or operating range?
 - Has maintenance work recently been carried out? Is there an inspection or maintenance log?
 - Were changes (e.g. conversions) or repairs made to the complete system (machine/system, electrics, control) or on the product? If yes, which?
 - Has the hydraulic fluid been changed?
 - Was the product or machine operated as intended?
 - How did the malfunction appear?
- ▶ Try to get a clear idea of the symptoms. Directly ask the (machine) operator.
- ▶ Document the work carried out.
- ▶ If you cannot rectify the error, contact one of the contact addresses which can be found at: www.boschrexroth.com/addresses.

14.2 Malfunction table

Table 12: Radial piston motor malfunction table

Fault	Possible cause	Remedy
Unusual noise	Output speed too high, causing cavitation and/or pistons to lift off cam.	Check motor speed versus machine specification. If too high, reset pump, and/or engine speed.
	Charge pressure too low, causing cavitation and/or pistons to lift off cam.	Check charge pressure versus machine specification. If necessary, adjust, repair or replace charge pump (closed circuit) or other source of charge pressure (open circuit).
	High case pressure causing pistons to lift off cam, or 2-speed spool (where fitted) to remain partially shifted.	Check case pressure versus machine specification. If too high, check drain line for blockages.
	Low 2-speed shift pressure causing partial shifting of 2-speed spool (where fitted).	Check 2-speed shift pressure versus machine specification. If too low, adjust, repair or replace pressure source.
	2-speed spool (where fitted) jammed in a partially shifted position.	Check 2-speed spool and replace spool and/or motor housing as necessary.
	Motor mounting screws are loose, causing motor to rattle against frame.	Check motor mounting screws are correctly tightened per machine manufacturer's specifications.
	Improper fixing of wheel or load to motor output shaft.	Check wheel or load is attached per machine manufacturer's specifications, and is correctly aligned.
	Improper fixing of hydraulic lines causing rattling against machine frame.	Check installation of lines per machine manufacturer's specifications.
	Internal damage to radial piston motor.	Strip down and inspect motor. Replace defective parts or complete motor as necessary.
	Air intake.	Completely bleed hydraulic system. Check tightness of all connections.
High pressure fluctuations	Internal damage to radial piston motor.	Strip down and inspect radial piston motor. Replace defective parts or complete motor as necessary.
	Out-of-balance or fluctuating load.	Check load and attachment of load per machine manufacturer's specifications, and adjust as necessary.
	Blocked or incorrectly sized supply or return line.	Check main lines to motor A and B ports for blockages, and that they are correctly sized per machine manufacturer's specifications.
High speed fluctuations	Internal damage to motor, causing leakage variation.	Blank off flushing (if fitted) and check motor case drain leakage for pulsations, while rotating motor at low speed, under load. If necessary, strip down and inspect motor, paying particular attention to piston rings. Replace defective parts or complete motor as necessary.
	Faulty pump or pump controller.	Check pump and pump controller versus machine manufacturer's specifications and adjust, repair or replace as necessary.
	Fluctuating signal from speed sensor (where fitted and used in closed-loop speed control system).	Check output from speed sensor on oscilloscope (should give correct number of pulses per motor revolution per specification). Replace sensor or target disc as necessary.

Table 12: Radial piston motor malfunction table

Fault	Possible cause	Remedy
Expected output torque or tractive effort not achieved	Insufficient pressure generated by pump.	Apply full load to motor(s) and check maximum pressure per machine manufacturer's specification. If too low, block A and B lines and check maximum pressure at blocked lines. If pressure is still too low, adjust, repair or replace pump, pump control or system pressure relief valves as necessary.
	High leakage in motor does not allow full pressure to be generated.	Apply full load to motor(s) and check maximum pressure per machine manufacturer's specification. If too low, block A and B lines and check maximum pressure at blocked lines. If pressure is now correct, strip down and inspect motor. Replace defective parts or complete motor as necessary.
	Motor not fully run in.	Continue to run motor (under load) for 24 – 48 hours to achieve maximum efficiency. A continuing increase in output torque may be noticed over this period.
	High 2-speed shift pressure causing partial or full shifting of 2-speed spool (where fitted) when not intended.	Check 2-speed pressure when not shifted versus machine specification. If too high, adjust, repair or replace control valve and check for blocked lines as necessary.
	2-speed spool (where fitted) jammed in a partially or fully shifted position.	Strip 2-speed valve and check all components, including bore in motor housing. Remove any contamination and replace components or motor housing as necessary.
	Brake release pressure too low, causing brake (where fitted) not to be fully released.	Check brake release pressure versus machine manufacturer's specification and adjust, repair or replace pressure source as necessary. If pressure source OK, strip down brake, check and replace brake seal as necessary.
	Internal damage to motor.	Apply full load to motor(s) and check maximum pressure per machine manufacturer's specification. If pressure is correct, and none of other above faults are apparent, strip down and inspect motor. Replace defective parts or complete motor as necessary.
Expected output speed not achieved	Insufficient flow generated by pump.	Check engine/prime mover speed and pump flow. Adjust, repair or replace engine/prime mover or pump as necessary.
	High leakage in motor.	Strip down and inspect motor. Replace defective parts or complete motor as necessary.
	Low 2-speed shift pressure causing partial or non-shifting of 2-speed spool (where fitted).	Check 2-speed pressure when shifted versus machine specification. If too low, adjust, repair or replace external control valve for 2-speed actuation and check for blocked lines as necessary.
	2-speed spool (where fitted) jammed in a partially or non-shifted position.	Strip 2-speed valve and check all components, including bore in motor housing. Remove any contamination and replace components or motor housing as necessary.

Table 12: Radial piston motor malfunction table

Fault	Possible cause	Remedy
Motor does not rotate	Expected motor torque achieved and load exceeds motor torque.	Check system pressure. If pressure has risen to relief valve setting, reduce load on motor.
	Expected motor torque not achieved and load exceeds motor torque.	See Problem/Symptom "Expected output torque or tractive effort not achieved".
	No oil being supplied to motor.	Check engine/prime mover speed, pump flow and operation of control valve (if fitted). Adjust, repair or replace engine/prime mover, pump or valve as necessary.
	Brake not released.	See Problem/Symptom "Brake does not release".
Motor rotates in wrong direction	Oil supply connections to motor incorrectly connected.	Connect oil supply correctly.
Hydraulic fluid temperature too high	Excessive inlet temperature at motor.	Check cooling system and external flushing valve, if fitted.
	Malfunction of pressure control valves (e.g. high-pressure relief valve, pressure controller).	Check appropriate components and repair or replace if necessary.
	Output speed too high.	Check motor speed versus machine specification. If too high, reset pump, and/or engine speed.
	Motor case drain pressure too high, causing integrated flushing valve (where fitted) to close.	Check case pressure versus machine specification. If too high, check drain line for blockages.
	Pump charge pressure below opening pressure of integrated flushing valve (where fitted).	Check charge pressure versus machine specification. Reset charge pressure, and check/repair charge pump as necessary.
	Malfunction of integrated flushing valve (where fitted).	Apply a differential pressure of > 10 bar across motor, and check case drain flow versus machine manufacturer's specification. If insufficient flow is present, check flushing poppet for blocked orifice. If poppet OK, remove flushing spool and springs, and inspect parts including bore in motor housing. Clean and/or replace parts as required.
External leakage	External seals (e.g. shaft/cam/brake seal) damaged.	Check oil cleanliness and motor pressure, confirm drain line is unblocked and case drain pressure is within machine manufacturer's specification. Strip down motor and inspect suspected leaking seals. If shaft seal is damaged, check bearings. Replace parts as necessary.
	Loose bolts.	Ensure all bolts are tightened to correct torque setting per Service Manual or motor assembly drawing.
	Loose fittings.	Ensure all fittings are tightened to correct torque setting per manufacturer's specification.

Table 12: Radial piston motor malfunction table

Fault	Possible cause	Remedy
Insufficient brake torque	Excessive pressure in brake release chamber (disc brake).	Check brake pressure in engaged state per machine manufacturer's specification. If too high, check control valve and drain lines to reservoir, and repair/replace, or remove blockage, as necessary.
	Motor case drain pressure too high, causing partial release of brake (disc brake).	Check case pressure versus machine specification. If too high, check drain line for blockages.
	Worn brake linings, discs or teeth (MCR-S).	Replace brake shoes or brake discs as necessary. In case of wear on parking brake (disc or form brake), investigate cause, as brake should not be used dynamically and should not wear.
	Anti-stick/slip additive in hydraulic fluid (disc brake).	Drain and flush system and refill with hydraulic fluid without additive. Strip and thoroughly clean all motor components, replacing all brake discs.
	Insufficient brake actuation pressure (dynamic brake).	Check pressure versus machine specification and check pressure source. Repair or replace components as required.
	Drum brake not run in.	Carry out drum brake run-in procedure per motor data sheet.
Brake does not release	Brake release pressure too low (disc or form brake).	Check brake release pressure versus machine manufacturer's specification and adjust, repair or replace pressure source as necessary. If pressure source OK, strip down brake and check and replace brake seal as necessary.
	Brake piston or seals damaged (disc or form brake).	Replace brake piston or seals as required.
	Brake plates seized (disc brake).	Strip and inspect brake, replacing parts as required. If seized, investigate cause of seizure, as parking brake should not be used dynamically.
Incorrect function of 2-speed control (where fitted)	2-speed control pressures incorrect.	Check shifted and non-shifted control pressures versus machine specification. Check, and repair or replace control components as necessary.
	Integrated 2-speed valve damaged.	Strip 2-speed valve and check all components, including bore in motor housing. Remove any contamination and replace components or motor housing as necessary.
	Motor case drain pressure too high, causing partial or non-shifting of 2-speed valve.	Check case pressure versus machine specification. If too high, check drain line for blockages.
Incorrect signal from speed sensor (where fitted)	Speed sensor or target disc damaged.	Check output from speed sensor on oscilloscope (should give correct number of pulses per motor revolution per specification). Replace sensor or target disc as necessary.

15 Technical data

The technical data of the radial piston motors can be found in the relevant data sheet as listed in Table 1 “Required and supplementary documentation” on page 5.

The data sheets can be found on the internet under
www.boschrexroth.com/mediadirectory

Further information can be found in the online product catalog Mobile Hydraulics:
www.boschrexroth.com/radial-piston-motors

The order-related technical data of your radial piston motor can be found in the order confirmation.

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