

# Hydraulic power brake valves

for mobile applications

Applies to the following types:

|       |       |
|-------|-------|
| LT 05 | LT 10 |
| LT 06 | LT 12 |
| LT 07 | LT 13 |
| LT 08 | LT 17 |
| LT 09 | LT 31 |

**Operating instructions**  
**RE 66200-B/04.2013**

Replaces: –.–  
English



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

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The cover shows an example configuration. The product supplied may therefore differ from the photo shown.

The original operating instructions were prepared in German.

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# 1 About this documentation

## 1.1 Validity of the documentation

This documentation applies to the following products:

- LT 05
- LT 06
- LT 07
- LT 08
- LT 09
- LT 10
- LT 12
- LT 13
- LT 17
- LT 31

This documentation is aimed at the machine manufacturer.

This documentation contains important information on the safe and appropriate transport, assembly, and disassembly, commissioning, operation, maintenance and simple troubleshooting of the product.

- Read this documentation carefully, and in particular chapter 2 "Safety instructions" on page 9 and chapter 3 "General information on damage to property and damage to the product" on page 14, before working with the power brake valve.

This documentation applies to all hydraulic power brake valves of the listed series irrespective of their manufacturing date until a new version of this document is issued.

## 1.2 Required and amending documentation

- Do not commission the product until you have been provided with the documentation marked with the book symbol  relating to your Rexroth product and you have understood and observed it.

**Table 1: Required and amending documentation**

| Title                                                                                                                                                                                                                                                                                                                                                                              | Document number | Document type      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|
|  1 circuit power brake valve LT 05 series 3X                                                                                                                                                                                                                                                       | 66143           | Data sheet         |
|  1 circuit power brake valve LT 05 series 3X                                                                                                                                                                                                                                                       | 66143-E         | Spare parts list   |
|  Accumulator charging valve LT 06 series 3X                                                                                                                                                                                                                                                        | 66191           | Data sheet         |
|  2 circuit power brake valve LT 07 series 2X                                                                                                                                                                                                                                                       | 66146           | Data sheet         |
|  2 circuit power brake valve LT 07 series 2X                                                                                                                                                                                                                                                       | 66146-E         | Spare parts list   |
|  Hand brake valve LT 08 series 2X                                                                                                                                                                                                                                                                  | 66148           | Data sheet         |
|  Hand brake valve LT 08 series 2X                                                                                                                                                                                                                                                                  | 66148-E         | Spare parts list   |
|  Relay valve LT 09 series 2X                                                                                                                                                                                                                                                                       | 66153           | Data sheet         |
|  Relay valve LT 09 series 2X                                                                                                                                                                                                                                                                       | 66153-E         | Spare parts list   |
|  Steering brake valve LT 10 series 2X                                                                                                                                                                                                                                                              | 66154           | Data sheet         |
|  1 circuit power brake valve with compact design LT 12 series 3X                                                                                                                                                                                                                                   | 66218           | Data sheet         |
|  1 circuit power brake valve with compact design LT 12 series 3X                                                                                                                                                                                                                                   | 66218-E         | Spare parts list   |
|  2 circuit power brake valve with compact design LT 13 series 3X                                                                                                                                                                                                                                   | 66221           | Data sheet         |
|  2 circuit power brake valve with compact design LT 13 series 3X                                                                                                                                                                                                                                   | 66221-E         | Spare parts list   |
|  2 circuit power brake valve with compact design LT 17 series 4X                                                                                                                                                                                                                                  | 66228           | Data sheet         |
|  2 circuit power brake valve with compact design LT 17 series 4X                                                                                                                                                                                                                                 | 66228-E         | Spare parts list   |
|  Inching power brake valve LT 31 series 1X                                                                                                                                                                                                                                                       | 66227           | Data sheet         |
|  Inching power brake valve LT 31 series 1X                                                                                                                                                                                                                                                       | 66227-E         | Spare parts list   |
|  <b>Order confirmation</b><br>Contains the order-specific technical data of your power brake valve.                                                                                                                                                                                              |                 | Order confirmation |
|  <b>Quotation drawing (installation drawing)</b><br>Contains the external dimensions, all connections and the hydraulic circuit diagram of your power brake valve.                                                                                                                               |                 | Quotation drawing  |
|  <b>Hydraulic fluids based on mineral oils and related hydrocarbons</b><br>Describes the requirements on mineral oil-based hydraulic fluids and related hydrocarbons for operation with Rexroth hydraulic components and helps you to select a hydraulic fluid for your Bosch Rexroth component. | 90220           | Data sheet         |
|  <b>Environmentally compatible hydraulic fluids</b><br>Describes the requirements on environmentally compatible hydraulic fluids for operation with Rexroth hydraulic components and helps you to select a hydraulic fluid for your Bosch Rexroth component.                                     | 90221           | Data sheet         |
|  <b>MTTFd reliability characteristics regarding the functional safety according to ISO 13849</b><br>MTTF <sub>d</sub> values for power brake valves                                                                                                                                              | 90291           | Data sheet         |



Further information is available from Rexroth and at  
[www.boschrexroth.de/mobilhydraulik-katalog](http://www.boschrexroth.de/mobilhydraulik-katalog).

### 1.3 Representation of information

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

#### 1.3.1 Safety instructions

In this documentation, safety instructions are contained in chapter 2.6 "Product-specific safety instructions" on page 11 and in chapter 3 "General information on damage to property and damage to the product" on page 14 and wherever sequences of actions or instructions are explained which bear the danger of personal injury or damage to property. The measures described for preventing these hazards must be observed.

Safety instructions are set out as follows:

|  <b>SIGNAL WORD</b>                          |
|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Type and source of danger!</b><br>Consequences in case of non-compliance<br>► Hazard avoidance measures<br>► <Enumeration> |

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

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

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

### 1.3.2 Symbols

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

**Table 3: Meaning of the symbols**

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

### 1.3.3 Designations

The following designations are used in this documentation:

**Table 4: Designations**

| Designation | Meaning                |
|-------------|------------------------|
| SBS         | Service brake system   |
| PBS         | Parking brake system   |
| ABS         | Auxiliary brake system |

## 2 Safety instructions

### 2.1 General information on this chapter

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

- ▶ Read this documentation completely and thoroughly before working with the product.
- ▶ 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 power brake valve on to third parties.

### 2.2 Intended use

Power brake valves are hydraulic components and are therefore neither covered by the scope of machinery nor partly completed machinery pursuant to the EC machinery directive 2006/42/EC. The component is exclusively intended to be assembled together with other components to form partly completed or complete machinery. The component may only be commissioned if it has been integrated in the machine for which it is designed.

The product is designed to be used in power brake systems in mobile machines.

Any deviating use is only permitted after consultation with Bosch Rexroth.

- ▶ Comply with the technical data, application and operating conditions and performance limits according to data sheet and order confirmation. For information on the permitted hydraulic fluids, see the respective data sheet.

The power brake valve is no safety equipment.

Intended use includes having read and understood this documentation, especially chapter 2 "Safety instructions" on page 9.

### 2.3 Improper use

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

Bosch Rexroth AG does not assume any liability for damage caused by improper use.

## 2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics and hydraulics as well as knowledge of the appropriate technical terms. In order to ensure safe use, these activities may only be carried out by a corresponding expert or an instructed person under the direction and supervision of an expert. Experts are those who can recognize potential hazards and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant conditions pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary hydraulic expert knowledge.

Hydraulic expert knowledge means, amongst others:

- Reading and understanding hydraulic schemes,
- Having knowledge of the function and interaction of hydraulic components.



Bosch Rexroth offers measures supporting the training in specific fields. Please find an overview of the training contents on the internet at:

<http://www.boschrexroth.de/didactic>

## 2.5 General safety instructions

- Observe the valid regulations on accident prevention and for environmental protection.
- Observe the safety regulations and provisions of the country where the product is implemented/used.
- Exclusively use Rexroth products in technically perfect condition.
- Observe all notices on the product.
- Persons who assemble, operate, disassemble or maintain Rexroth products must not be under the influence of alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- Only use genuine Rexroth accessories and spare parts.
- Comply with the technical data and environmental conditions indicated in the product documentation.

## 2.6 Product-specific safety instructions

Observe the applicable national and international directives, provisions and laws regarding the design and safe operation of power brake systems that are equipped with a power brake valve.



All legal regulations require that a vehicle is roadworthy in all operating states. Furthermore, the braking system has to be state-of-the-art.

Braking systems have to be accepted by the competent authority pursuant to the applicable national and international provisions.

The vehicle manufacturer is responsible for this.

The following safety instructions apply to chapters 6 to 14.

### **WARNING**

#### **Danger due to an unintended pressure build-up/pressure reduction!**

Danger to life, risk of injury, damage to property!

The power brake may block in an undefined position due to internal pollution, e.g. polluted hydraulic fluid, abrasion dust or residual dirt from system components. As a result, the driven actuator is no longer under the operator's control.

- ▶ Secure the machine against rolling (away) and unintended movements according to the machine manufacturer's specifications.
- ▶ Comply with the specified cleanliness class for the hydraulic fluid according to the data sheet.

#### **Pressurized machine!**

Danger to life, risk of injury, severe injury when working at systems that have not been stopped! Damage to property!

- ▶ Safeguard the overall system according to the manufacturer's instructions.
- ▶ Make sure that the power brake valve is depressurized. To do so, observe the specifications of the machine manufacturer.
- ▶ Do not disconnect lines, connections or components as long as the power brake valve is under pressure.
- ▶ Observe the specifications of the machine manufacturer regarding machine shut-down.

#### **Leaking oil mist!**

Explosion hazard, risk of fire, allergic reactions, inhalation, environmental pollution!

- ▶ Depressurize the power brake valve and repair the leak.
- ▶ Keep open fire and sources of ignition away from the power brake valve.

#### **Electrical voltage!**

Danger to life, risk of injury and damage to property due to electric shock!

- ▶ Always switch off power supply to the mating connectors before assembling the product or when connecting and disconnecting connectors.
- ▶ Safeguard the machine according to the manufacturer's instructions.

## **WARNING**

### **Incorrect energy supply!**

Danger to life and risk of injury due to uncontrolled valve positions! These may cause unexpected behavior of the power brake valve.

- ▶ Secure the power brake valve against unintended electrical and mechanical actuation.
- ▶ Always comply with the country-specific regulations.

## **CAUTION**

### **Risk of injury due to sharp edges and rough surfaces!**

When working at the power brake valve and transporting it, there is a risk of injury, e.g. due to sharp edges at the valve housing, at threads, at the pedal or at attachments.

- ▶ Wear safety boots with steel caps.
- ▶ Wear protective gloves and suitable work clothes as protection against cuts.

### **Danger due to heavy loads!**

When carrying power brake valves, there is a risk of health hazards.

- ▶ Use a suitable lifting, putting down and moving technique.
- ▶ Use your personal protective equipment (e.g. safety goggles, protective gloves, suitable working clothes, safety shoes).

### **Risk to limbs due to crushing and impact!**

There is a risk of injury in the gap between the actuation element and the valve housing.

- ▶ Keep your limbs away from the gap between the actuation element/pedal/hand lever and the valve housing.

### **The power brake valve has hot surfaces!**

Risk of burning!

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

### **Contact with hydraulic fluid!**

Health hazard/impairment of health, e.g. eye injuries, skin lesions, poisoning due to inhalation!

- ▶ Avoid contact with hydraulic fluids.
- ▶ When dealing with hydraulic fluids, you must imperatively observe the safety instructions of the lubricant manufacturer.
- ▶ Use your personal protective equipment (e.g. safety goggles, protective gloves, suitable working clothes, safety shoes).
- ▶ If hydraulic fluid comes into contact with the eyes or enters the bloodstream or is swallowed nevertheless, consult a doctor immediately.

 **CAUTION****Escaping hydraulic fluid due to leakage!**

Risk of burning and risk of injury due to escaping oil!

- ▶ Depressurize the power brake valve and repair the leak.

**Escaped hydraulic fluid due to leakage!**

Slip hazard!

- ▶ Pay attention to escaped hydraulic fluid on the ground around the machine.
- ▶ If hydraulic fluid is spilled, use an oil binding agent.
- ▶ Dispose of the hydraulic fluid in accordance with the applicable national regulations in your country.

## 2.7 Personal protective equipment

The user of the power brake valve is responsible for the personal protective equipment. Observe the safety regulations and provisions in your country.

Bosch Rexroth recommends using personal protective equipment for users of the product consisting of:

- Heat-resistant protective clothing, e.g. protective gloves for working at the power brake valve.
  - Safety shoes, protective gloves, protective goggles and suitable work clothes for working at the power brake valve.
- 
- ▶ Wear heat-resistant protective clothing, e.g. protective gloves, when touching a power brake valve that has heated up.
  - ▶ When handling hydraulic fluids, wear protective gloves, safety goggles and suitable work clothes.

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

The following safety instructions apply to chapters 6 to 14.

#### **NOTICE**

##### **Danger due to improper handling!**

The product may be damaged!

- ▶ Do not apply any inadmissible mechanical, hydraulic or electrical loads to the product.
- ▶ Never use the product as a handle or step.
- ▶ Do not transport the power brake valve using sensitive attachments (e.g. actuation elements, sensors, solenoids, or valves).
- ▶ Carefully place the power brake valve on the surface so that it is not damaged and secure it against falling.
- ▶ Do not place any objects on top of the product.
- ▶ Do not place the power brake valve on actuation elements.
- ▶ Avoid impacts against sensitive attachments (e.g. sensors, solenoids, or actuation elements).
- ▶ Avoid impacts against sensitive sealing surfaces (e.g. at the operating ports).
- ▶ Leave the protective covers on the power brake valve until shortly before connecting the lines.
- ▶ Disconnect all electrical connector plugs prior to painting.
- ▶ Make sure that the electronic components (e.g. sensors) are not charged electrostatically (e.g. due to painting).

##### **If the power brake valve falls down**

The surface coating may be damaged and attachments may come off or bend. Impaired functionality.

- ▶ Use a suitable lifting, putting down and moving technique.
- ▶ Place the product on a clean, bearing surface.

##### **Intrusion of fluids and foreign particles due to missing seals and caps!**

Loss of the protection class and risk of short circuit!

- ▶ Prior to installation, ensure that all seals and caps of the plug-in connections are tight.

## **NOTICE**

### **Contamination of the hydraulic fluid!**

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

- ▶ It is imperative that the working environment at the site of installation is free of dust and foreign substances in order to prevent foreign particles (e.g. welding beads or metal chips) from getting into the hydraulic lines and causing product wear or malfunctions. The power brake valve must be protected from dirt during installation.
- ▶ Only use clean connections, hydraulic lines and attachments (e.g. measuring devices).
- ▶ No pollutants must enter when closing the connections.
- ▶ Ensure before commissioning that all hydraulic connections are tight and that all the seals and caps of the plug-in connections are installed correctly and undamaged in order to prevent fluids and foreign particles from penetrating the product.

### **Improper cleaning!**

The product may be damaged!

- ▶ Cover all openings with appropriate safeguards in order to prevent cleaning agents from penetrating the power brake valve.
- ▶ Never use solvents or aggressive cleaning agents. Only clean the power brake valve with water and a mild cleaning agent, if necessary.
- ▶ Do not point high-pressure washers at sensitive components, e.g. rubber components (bellows), electrical connections (solenoids, sensors) and actuation elements.
- ▶ Use fiber-free cleaning cloths for cleaning.

### **Environmental pollution caused by incorrect disposal!**

Careless disposal of the power brake valve, the hydraulic fluid and the packaging material can pollute the environment.

- ▶ Dispose of the power brake valve, the hydraulic fluid and the packaging in accordance with the applicable national regulations in your country.

### **Leaking or spilt hydraulic fluid!**

Environmental pollution and pollution of the ground water!

- ▶ When draining the hydraulic fluid, always put a collecting pan under the power brake valve.
- ▶ If hydraulic fluid is spilled, use an oil binding agent.
- ▶ Dispose of the hydraulic fluid in accordance with the applicable national regulations in your country.

The warranty only applies to the delivered configuration.

The claim to warranty expires in case of:

- Incorrect assembly, commissioning and operation
- Improper use
- Removal of protection caps and lead seals (e.g. for pressure adjustments)
- Alteration of the factory settings
- Modifications and attachments
- Opening the valve
- Improper handling
- Using third party spare parts

## 4 Scope of delivery

The scope of delivery includes:

- Power brake valve according to the order confirmation

Upon delivery, the following parts are additionally mounted depending on the model:

- Protective covers
- Protective plugs/plug screws

## 5 About these products

### 5.1 Performance description

Heavy construction, agriculture and forestry machinery as well as municipal vehicles, vehicles for material handling and special vehicles require braking systems with a high level of operational safety with low operating forces, in particular if they are used in difficult terrain. These vehicles require servo-assisted or power brake systems to comply with the statutory braking action.

Please find technical data, operating conditions and limitations of use of the power brake valves in the data sheet and the order confirmation.

Regarding which power brake valves are covered in which data sheets, see chapter 1.2 "Required and amending documentation" on page 6.

### 5.2 Product description

There are power brake valves with modular and compact design.

For the description of the set-up and function as well as instructions on the adjustment and installation of the individual power brake valves, see the data sheet.

Regarding which power brake valves are covered in which data sheets, see Table 1 "Required and amending documentation" on page 6.

5.2.1 Power brake valves with modular design

|                                                                                   |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |
| 1 circuit brake valve LT 05                                                       | Accumulator charging valve LT 06                                                  | 2 circuit brake valve LT 07                                                        | Hand brake valve LT 08                                                              |
|  |  |  |                                                                                     |
| Relay valve LT 09                                                                 | Steering brake valve LT 10                                                        | Inching brake valve LT 31                                                          |                                                                                     |

Fig. 1:    Components with modular design



For brake pedal versions, see the respective data sheet.

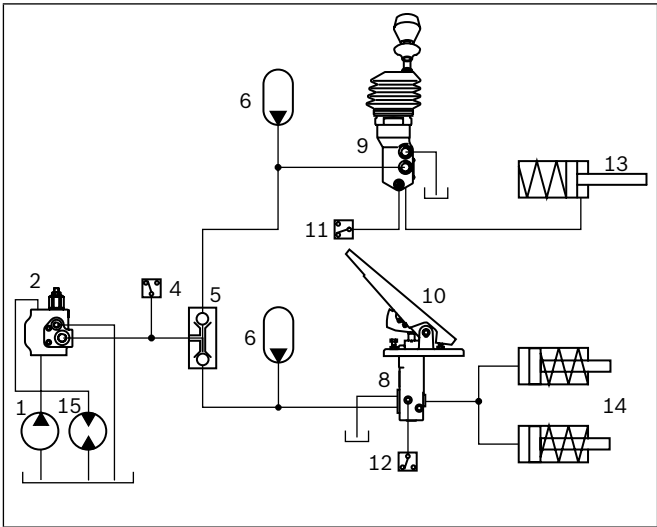


Fig. 2:    Schematic illustration of an example application:  
1 circuit power brake system

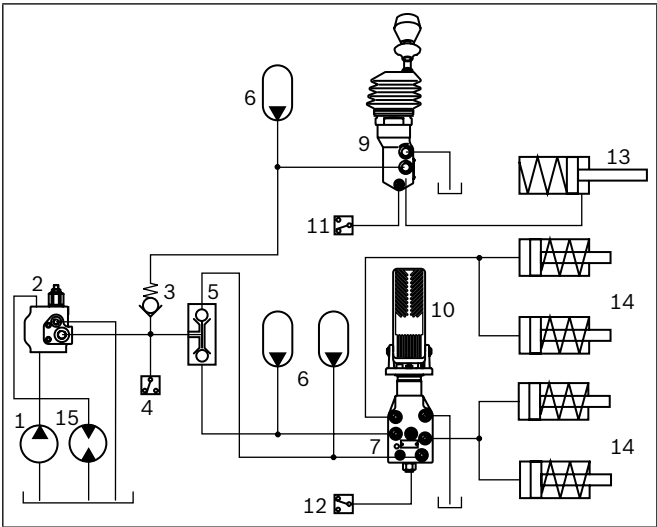


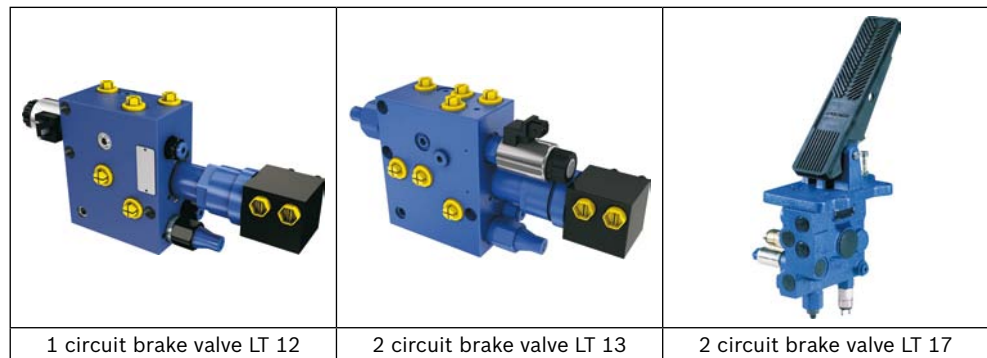
Fig. 3:    Schematic illustration of an example application:  
2 circuit power brake system

- |                                         |                                     |                                     |                                           |
|-----------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------------|
| 1 Pump                                  | 5 Inverted shuttle valve            | 8 1 circuit power brake valve LT 05 | 12 SBS pressure switch                    |
| 2 Accumulator charging valve LT 06      | 6 Hydraulic accumulator             | 9 Hand brake valve LT 08            | 13 PBS spring-loaded accumulator cylinder |
| 3 Check valve                           | 7 2 circuit power brake valve LT 07 | 10 Brake pedal                      | 14 Brake cylinder (wheel)                 |
| 4 Pressure switch, accumulator pressure |                                     | 11 PBS pressure switch              | 15 Downstream actuators                   |

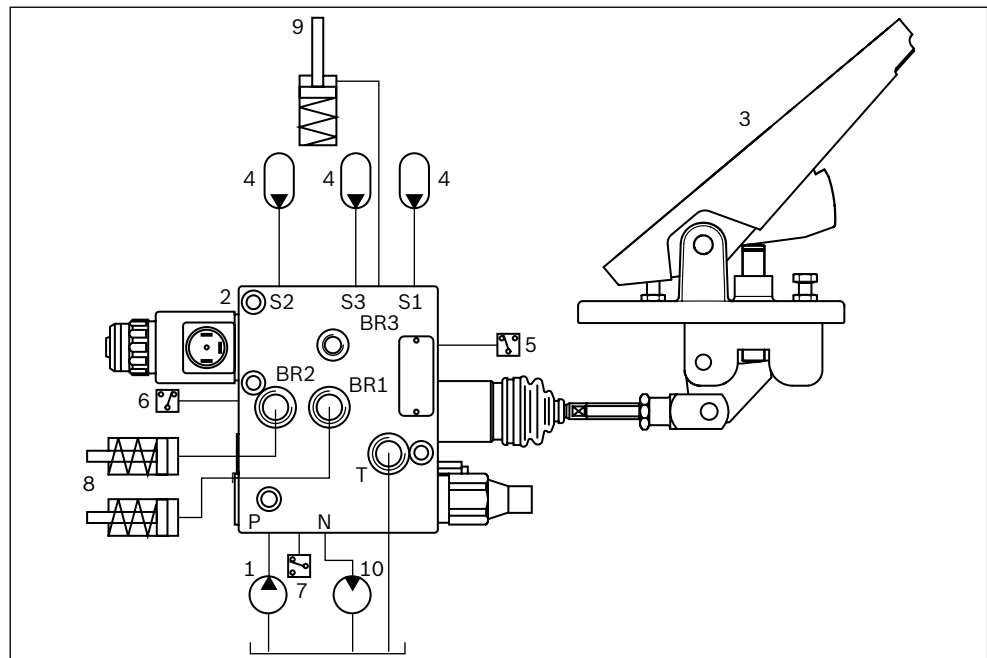
|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Optional accessories</b>                        | <ul style="list-style-type: none"> <li>• Pressure switch</li> <li>• Hydraulic accumulator</li> <li>• Inverted shuttle valve</li> <li>• Check valve</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Accumulator charging process</b>                | <p>The hydraulic accumulators (6) are supplied with a higher priority than other actuators by the accumulator charging valve LT 06 (2), which is directly downstream of the pump (1). This happens as soon as the accumulator pressure falls below a limit value. When the set charging pressure for the hydraulic accumulators is reached, the accumulator charging valve LT 06 applies the entire pump delivery volume to the downstream actuators (15).</p> <p>The two service brake circuits are separated by an inverted shuttle valve (5). Therefore, if one brake circuit fails, the other remains operational. The charging state of the hydraulic accumulators has to be monitored by pressure switches (4) so that the driver is warned by a visual signal if the energy supply fails, e.g. motor stop.</p> |
| <b>Operation of the service brake system (SBS)</b> | <p>If the service brake is actuated, the 2 circuit power brake valve LT 07 (7) regulates the pressure in the brake cylinders (14) in proportion to the actuating force and actuating path of the pedal (10). The vehicle is decelerated by the wheel brakes. When the braking process is completed, the hydraulic fluid flows back into the tank. If one of the brake circuits fails, the other one remains operational due to the mechanical contact of the two control spools in the 2 circuit power brake valve LT 07 and the circuit separation of the two hydraulic accumulators. The actuating force remains unchanged. The brake light of the vehicle is controlled via the pressure switch (12).</p>                                                                                                          |
| <b>Operation of the parking brake system (PBS)</b> | <p>If the vehicle is in in parking position, the wheel brake is operated with the force of the highly pre-tensioned spring of the spring-loaded accumulator cylinder (13). If the hand brake valve LT 08 (9) is actuated in the "release" position, hydraulic fluid flows into the spring-loaded accumulator cylinder and opens the parking brake. The pressure switch (11) indicates if pressure is built up or reduced. The check valve (3) prevents unintended pressure reduction in the PBS pressure supply. The mechanical hand brake valve LT 08 (9) regulates the pressure sensitively. Therefore, the "auxiliary brake" function is also fulfilled.</p>                                                                                                                                                       |
| <b>Auxiliary brake system (ABS)</b>                | <p>The auxiliary brake system has to be designed according to the legal regulations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### 5.2.2 Power brake valves with compact design

Power brake valves with compact design combine all required functions in one valve housing.



**Fig. 4: Components with compact design**



**Fig. 5: Schematic illustration of an example application: 2 circuit power brake system**

- |                                            |                                                |                                                 |
|--------------------------------------------|------------------------------------------------|-------------------------------------------------|
| <b>1</b> Pump                              | <b>4</b> Hydraulic accumulator                 | <b>8</b> Brake cylinder (wheel)                 |
| <b>2</b> 2 circuit power brake valve LT 13 | <b>5</b> PBS pressure switch                   | <b>9</b> PBS spring-loaded accumulator cylinder |
| <b>3</b> Brake pedal                       | <b>6</b> SBS pressure switch                   | <b>10</b> Downstream actuators                  |
|                                            | <b>7</b> Pressure switch, accumulator pressure |                                                 |

### 5.3 Product identification

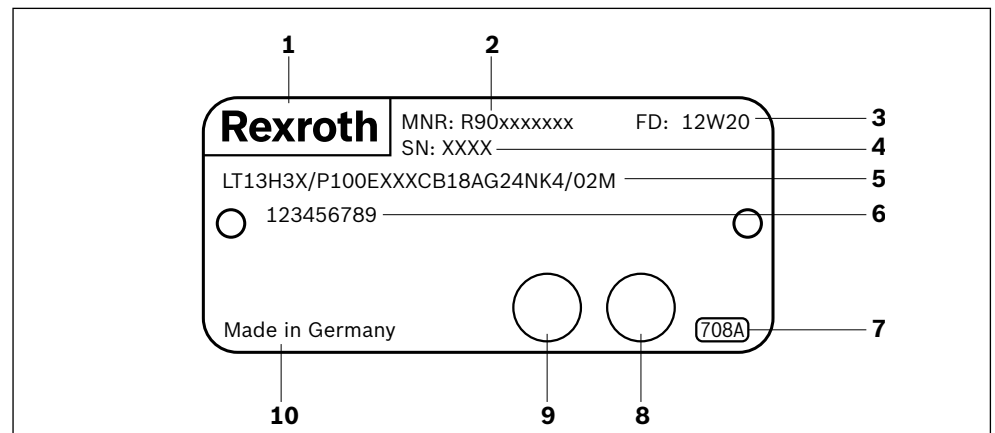
Use the name plate to identify the power brake valve.



The details on the name plate apply to the power brake valve in the condition as supplied. If the power brake valve was modified as compared to the condition as supplied, the details on the name plate may possibly not be true for the present power brake valve.

- Take care not to damage the existing name plates.
- Compare the material number of the power brake valve indicated on the name plate with the details on the quotation drawing to make sure that the operating instructions apply to the product available to you.

If in doubt, contact Bosch Rexroth.



**Fig. 6: Name plate LT (example)**

- |                                                   |                                              |
|---------------------------------------------------|----------------------------------------------|
| <b>1</b> Word mark (manufacturer)                 | <b>6</b> Customer material number (optional) |
| <b>2</b> Material number of the power brake valve | <b>7</b> Area/works number                   |
| <b>3</b> Date of manufacture                      | <b>8</b> Installation stamp                  |
| <b>4</b> Serial number                            | <b>9</b> Test stamp                          |
| <b>5</b> Material short text                      | <b>10</b> Designation of origin              |



Depending on the order, there might be deviations from the name plates shown above. On customer-specific name plates, it is possible to replace the Rexroth logo with the customer logo, for example.

## 6 Transport and storage

- Always comply with the required environmental conditions with regards to transport and storage, see chapter 6.2 "Storing a power brake valve" on page 22.



Failure to comply causes premature aging of components and reduces the service life.

For unpacking instructions, see chapter 7.1 "Unpacking" on page 24.

### 6.1 Transporting a power brake valve

The power brake valve may be transported by hand for a short time.

The dimensions and weight vary according to the model. For the values applicable to your power brake valve, see the quotation drawing and the data sheet.

### 6.2 Storing a power brake valve

#### Requirements

- The storage facilities must be free from corrosive substances, fumes and gases.
- In order to avoid damage to seals, do not operate any ozone-generating devices in the storage facilities, such as mercury vapor lamps, copiers, printers, high-voltage devices, electric motors, electric radio sources and/or discharges.
- The storage facilities must be dry and free from dust.
- Optimum storage temperature: +5 °C to +20 °C
- Minimum storage temperature: -25 °C
- Maximum storage temperature: +60 °C
- UV protection: 100%  
Avoid high light irradiation (e.g. bright windows or direct neon light).
- Relative air humidity (no condensation): Max. 65%
- Store the power brake valve in such a way that it is protected from shocks, do not stack it.
- Do not store the power brake valve on sensitive attachment parts, e.g. actuation elements, sensors, solenoids or valves.
- Do not remove any protective covers and protective plugs.

- Check the correct storage of the power brake valves on a monthly basis.

#### Following delivery

As a standard, the power brake valves are coated with a priming (single coat paint) or protected against corrosion by electroplating at the factory.

Mineral oil is used for internal corrosion protection of closed valves. Surfaces of the power brake valve that are not coated or electroplated (e.g. flange surfaces) are not protected against corrosion.

Delayed commissioning, long transport and storage periods or decommissioning for an extended period of time may lead to the formation of rust on Rexroth power brake valves. In order to prevent this, take additional corrosion protection measures.

Recommended procedure following an extended storage time:

1. Check the complete power brake valve for damages and corrosion prior to installation.
2. In a test run, check the power brake valve for correct operation and tightness.



The claim to warranty expires if the requirements and storage conditions are not complied with.

Following an extended storage period, we recommend having the power brake valve checked by your local Bosch Rexroth service.

For questions regarding repair and spare parts, contact your local Bosch Rexroth service or the service department of the power brake valve manufacturer, see chapter 10.4 "Spare parts" on page 38.

#### **Following disassembly**

If a dismantled power brake valve is to be stored, it has to be preserved for the time of storage to protect it against corrosion.



The following instructions only refer to power brake valves that are operated with a mineral oil-based hydraulic fluid. Other hydraulic fluids require preservative measures that are specifically designed for them. In this case, consult the Bosch Rexroth service. For the address, see chapter 10.4 "Spare parts" on page 38.

Bosch Rexroth recommends the following procedure:

1. Clean the power brake valve.
2. Drain the power brake valve.
3. Close all connections air tightly.
4. Wet the unpainted flange-mounting surfaces and exterior seals of the power brake valve with mineral oil.
5. Protect sensitive attachments (e.g. actuation elements, sensors, solenoids or valves) using suitable measures as in the condition as supplied.
6. Pack the power brake valve with a suitable desiccant air-tightly in corrosion protection film.
7. Store the power brake valve in such a way that it is protected from shocks. For further conditions, see section "Requirements" on page 22 in this chapter.
8. If required, send the power brake valve to the Bosch Rexroth service for repair.

## 7 Assembly

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

- Quotation drawing (installation drawing) of the power brake valve (available from your contact at Bosch Rexroth)
- Hydraulic circuit diagram of the power brake valve (see the quotation drawing)
- Hydraulic circuit diagram of the machine (available from the machine manufacturer)
- Order confirmation (contains the order-specific technical data of your power brake valve)
- Data sheet of the power brake valve (contains the admissible technical data)

### 7.1 Unpacking

**CAUTION!** Danger due to falling parts!

If the packaging is opened improperly, parts may fall out and cause damage to the parts and even injuries!

- ▶ Put the packaging on level ground with sufficient load carrying capacity.
- ▶ Only open the packaging from above or at the intended place.

1. Remove the power brake valve packaging.
2. Check the power brake valve for transport damages and completeness, see chapter 4 "Scope of delivery" on page 17.
3. Dispose of the packaging in accordance with the currently applicable national regulations in your country.
4. Return reusable packagings to the sending Bosch Rexroth factory.

### 7.2 Painting the power brake valve



#### CAUTION

##### Escape of aerosols during painting!

Risk of inhaling harmful substances.

- ▶ Wear inhalation protection and protective clothing during painting.

Complete the following steps if the power brake valve is to be painted prior to installation:

- ▶ Completely protect the hydraulic ports against paint application by screwing-in plastic threaded plugs beforehand.
- ▶ Protect the mounting threads against paint application by screwing-in bolts.
- ▶ Avoid paint being applied to the contacts of the electrical connections and make sure not to cause any damage to the connector.
- ▶ Protect attachments (e.g. actuation elements, sensors, solenoids) against paint application.

- ▶ Protect plastic and rubber parts (e.g. shaft seal ring, bellows, pedal rubber) against paint application.
- ▶ Protect name plates against the application of paint using a foil which can be removed after coating.
- ▶ When removing the plastic threaded plugs after coating, make sure that no paint chips enter the power brake valve.

### 7.3 Installation conditions

The installation position determines the installation and commissioning procedure (e.g. during bleeding the power brake valve).

- ▶ Mount the power brake valve in such a way that the forces and torques to be expected can be transmitted without risk. The machine manufacturer is responsible for the design of the mounting elements and screw connections.
- ▶ Ensure that the power brake valve is air-free and filled with hydraulic fluid during commissioning and operation. The power brake valve must not drain hydraulically in case of standstill.
- ▶ It is imperative that the working environment at the site of installation is free of dust and foreign substances. The power brake valve must be protected from dirt during installation. Contamination of the hydraulic fluid may considerably reduce the service life of the power brake valve.

### 7.4 Installation position

The positioning and adjustment of the power brake valve in the machine has to comply with the applicable provisions on ergonomics and occupational safety. The power brake valve has to be freely accessible and it must be possible to actuate it completely in order to ensure full functionality.

Observe the installation position according to the specification. In this context, observe the specifications in the data sheet and in the quotation drawing. If not indicated otherwise in the technical documents, the power brake valves can be installed in any position.

7.5    Installing the power brake valve

7.5.1    Required tools

Installation can be carried out using standard tools. No special tools are required. Also observe the instructions of the manufacturers of the other hydraulic components when selecting the required tools.

7.5.2    Preparation

- 1. Compare the material number and the designation (type key) with the details in the order confirmation.



If the material number of the power brake valve does not match the number in the order confirmation, contact the Bosch Rexroth service, for the address see chapter 10.4 "Spare parts" on page 38.

- 2. Drain the power brake valve prior to installation to avoid mixing with the hydraulic fluid of the machine.

7.5.3    Dimensions

The quotation drawing contains the dimensions for all connections of the power brake valve.

7.5.4    Fastening the power brake valve

For fastening, the power brake valve is provided with mounting bores which can be seen in the quotation drawing and the data sheet. The required mounting hole image (dimensions and tolerances) for the mounting bores on the machine can also be found in the quotation drawing or on the data sheet. Select the tightening torques according to the usual standard values for each bore size and bolt property class. Too much tightening torque might cause the valve spool to jam. If this is the case, reduce the mounting torque accordingly. Observe the adequate residual clamping force of the screws. Regarding the design of the screw connections and the mounting elements, observe the material specifications in Table 5.

Table 5: Material specifications

| Component                                                              | Material       | Material abbreviation/no. |
|------------------------------------------------------------------------|----------------|---------------------------|
| Valve housing                                                          | Cast steel     | GG-30 / EN-GJL-300        |
| Brake pedal base plate for<br>LT 05, LT 07, LT 17, LT 19, LT 20, LT 31 | Aluminum alloy | GK-ALSi9Cu3               |
| Mounting flange (clamping ring) for<br>LT 07, LT 31 without pedal      | Steel          | S235JR (St37) / 1.0037    |
| Hydraulic actuation for<br>LT 07, LT 09, LT 12, LT 13                  | Steel          | 11SMn30 / 1.0715          |

1. Observe the contact surface requirements from the quotation drawing.
2. Always fasten the power brake valve at all mounting points provided. Depending on the type of mounting, use screws and/or hexagon nuts with one of the property classes listed in Table 6 according to EN ISO 4762 or EN ISO 4014.

Bosch Rexroth recommends using a screw connection with the following parameters:

**Table 6: Mounting screws and nuts**

| Series | Dimension | Property class |
|--------|-----------|----------------|
| LT 05  | M8        | 8.8 / 10.9     |
| LT 06  | M6        | 8.8 / 10.9     |
| LT 07  | M8        | 8.8 / 10.9     |
| LT 08  | M8        | 8.8 / 10.9     |
| LT 09  | M8        | 8.8 / 10.9     |
| LT 10  | M8        | 8.8 / 10.9     |
| LT 12  | M8        | 8.8 / 10.9     |
| LT 13  | M8        | 8.8 / 10.9     |
| LT 17  | M8        | 8.8 / 10.9     |
| LT 31  | M8        | 8.8 / 10.9     |

### 7.5.5 Completing installation

#### **CAUTION!** Operation with protective plastic plugs!

Operating the power brake valve with protective plugs may cause injuries or damage to the power brake valve.

- Prior to commissioning, remove all protective plugs and replace them by line connections or suitable pressure-resistant, metal plug screws.
- Remove the transport protection.  
The power brake valve is delivered with protective covers and protective plugs, where appropriate. They are not pressure-resistant and therefore have to be removed prior to connection. Use suitable tools to avoid damage to the sealing and functional surfaces. If the sealing or functional surfaces are damaged, contact your Bosch Rexroth service or the service department of the manufacturer of the power brake valve.



Connections intended to connect lines are equipped with protective plugs or plug screws that serve as transport protection. All connections required for operation have to be connected. Non-compliance may cause malfunctions or damages. If a connection is not connected, it has to be closed with a plug screw as the protective plugs are not pressure-resistant.

### 7.5.6 Mechanically connecting the power brake valve

For the assembly instructions regarding the connection of the mechanical actuation elements, see the data sheet.

### 7.5.7 Hydraulically connecting the power brake valve

## NOTICE

#### Damage caused by incorrect assembly!

During operation, hydraulic lines and hoses installed under mechanical stress create additional mechanical forces, which reduces the service life of the power brake valve and the complete machine.

- Assemble lines and hoses without mechanical stress.

The machine manufacturer is responsible for the design of the lines. The power brake valve has to be connected to the remaining hydraulic system according to the hydraulic circuit diagram of the machine manufacturer.

The connections and the mounting threads are designed for the peak pressure indicated in the data sheet. The machine manufacturer has to make sure that the connection elements and lines comply with the intended application conditions (pressure, flow, hydraulic fluid, temperature) including the required safety factors.

Select the cross-sections of the hydraulic transmission elements (pipes, hoses) in such a way that the pressure drop between the hydraulic accumulator and the brake cylinder remains low with low temperatures and the function of the power brake valve remains intact.



Only connect hydraulic lines that match the power brake valve connection (pressure level, size, system of units).

## Instructions on the installation of lines

Observe the following instructions regarding the installation of hydraulic lines.

- Lines and hoses have to be installed without preload so that there are no additional mechanical forces that reduce the service life of the power brake valve and possibly the entire machine.
- Remove any resinifications caused by incorrect storage.
- Use suitable seals as sealants.
  - Observe the compatibility of seals with the hydraulic fluid used.
  - Use the provided seal at each hydraulic connection.
  - Make sure that the connections are clean and intact.
- Make sure that the connections and connection elements are air-tight.
- Pressure lines
  - Use only pipes, hoses and connection elements as pressure lines that are rated for the operating pressure range indicated in the data sheet. They also have to be pressure-resistant with respect to the external air pressure.
- Tank line
  - Always install tank lines in such a way that the power brake valve is always filled with hydraulic fluid and cannot drain hydraulically in case of an extended standstill.
  - The tank pressure must not exceed the application pressure of the brake.

## Risk of confusion with threaded connections

The power brake valves are used in applications with metric and US systems of units. Both the system of units and the size of the threaded hole and the screw-in stud (e.g. plug screw) have to match.

Due to little visual differences, there is a risk of confusion. In this regard, observe the specifications in the quotation drawing. The SI units usually apply, unless stated otherwise.

### **WARNING!** Leaking or ejected screw-in studs!

If a screw-in stud whose system of units and size do not match the threaded hole is pressurized, it may come loose and even be ejected with high speed from the hole. This may cause serious injuries and damage to property. Hydraulic fluid may escape from this leakage point.

- ▶ Use the drawings (quotation drawing) to check the required screw-in stud for all fittings.
- ▶ Make sure that there is no confusion when installing armatures, mounting screws and plug screws.
- ▶ Use a screw-in stud with the same system of units and the right size for the respective threaded hole.

- Connection overview** For an overview of the line connections, see the respective data sheet and the quotation drawing.
- Tightening torques** Observe the specifications in standards and/or the manufacturer's specifications for the screw-in studs, fittings, armatures, plug screws, etc. used. Adapt the tightening torques to the material of the power brake valve component (see Table 5 "Material specifications" on page 26).  
In addition, keep in mind that tightening torques may also depend on the admissible pressure and temperature range and on the application conditions.
- Procedure** Connecting the power brake valve to the hydraulic system:
1. Remove the protective plugs and/or plug screws from the connections that are to be connected according to the hydraulic circuit diagram.
  2. Make sure that the sealing surfaces of the hydraulic connections and functional surfaces are not damaged.
  3. Only use clean hydraulic lines or rinse them prior to installation.
  4. Connect the lines according to the quotation drawing and the machine diagram. Check if all connections are piped or closed with plug screws.
  5. Correctly tighten the fittings (observe the tightening torques!). Mark all correctly tightened fittings, e.g. with a permanent marker.
  6. Check all pipes and hose lines and all combinations of connection pieces, couplings, or connection points with hoses or pipes for their operational safety.

### 7.5.8 Electrically connecting the power brake valve

## NOTICE

### Functional impairment caused by wrong plug-in connections!

Only the plug-in connections listed in the data sheet/quotation drawing may be used for the electrical connection.

- Comply with the assembly instructions of the plug-in connection manufacturer.
- Before commissioning, check the power supply as to whether the voltage complies with the details of the quotation drawing and whether the total of the currents to be expected is less than or equal to the capacity of the power supply.
- The plug-in connections may only be contacted when deenergized. The installation process must not be repeated more than 10 times.

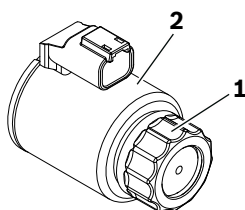
The machine manufacturer is responsible for the design of the electric control. Electrically controlled power brake valves have to be connected according to the electric circuit diagram of the machine. Regarding power brake valves with electric adjustment device and/or attachment sensors, observe the specifications in the data sheet and the quotation drawing, e.g.:

- The admissible voltage range
- The admissible current
- The correct pin assignment

For details on the correct connection assignment, the connector, the protection class, and the matching mating connector, see the data sheet and the quotation drawing. The mating connector is not included in the scope of delivery.

1. De-energize the plug-in connections of the power brake valve.
2. Connect the power brake valve to the electrical system (12 V or 24 V). Prior to connection, check that the connector and all its seals are intact.

### Changing the connector position



If required, change the position of the connector by turning the solenoid body (coil). This does not depend on the connector model.

Proceed as follows:

1. Loosen the mounting nut (1) of the solenoid using a suitable tool. For this purpose, turn the mounting nut (1) by one turn in counterclockwise direction.
2. Turn the body of the solenoid (2) to the desired position.
3. Re-tighten the mounting nut. Tightening torque of the mounting nut: 4+1 Nm.

## 8 Commissioning

### **WARNING**

#### **Danger due to working in the danger zone of a machine!**

Danger to life, risk of injury or severe injury!

- ▶ Pay attention to potential sources of danger of danger and remove them before commissioning the power brake valve.
- ▶ When commissioning, comply with the instructions of the machine manufacturer.

### **CAUTION**

#### **Commissioning an incorrectly installed product!**

Confusing the connections or cable connectors causes unexpected functions and/or irreparable damage to the power brake valve and thereby endangers persons and equipment.

- ▶ Make sure that all electrical and hydraulic connections are either connected correctly or closed.
- ▶ Prior to the functional test, check if the required piping was installed according to the hydraulic circuit diagram.
- ▶ Check that the cable connectors are correctly assigned to the respective electric components.
- ▶ Commission the product only if it is installed completely.

#### **Risk of injury due to enclosed air**

Air enclosed in the power brake valve might cause components to vibrate during operation so that they hit the end stops hard and are damaged. Unexpected movements of the actuators may cause injuries.

- ▶ Prior to commissioning, make sure that any enclosed air is completely removed from the power brake valve.
- ▶ Always observe the instructions on bleeding in the operating instructions of the machine.

#### **Impaired functionality due to low inlet pressure**

If the inlet pressure is too low while commissioning the power brake valve, the built up brake pressure is too low or it is built up too slowly.

- ▶ When commissioning or re-commissioning a machine, make sure that the power brake valve is supplied with the required inlet pressure. This information is also contained in the data sheet.

## **NOTICE**

### **Impaired functionality resulting from a lack of pressure fluid**

If the power brake valve is commissioned without or with too little hydraulic fluid, the built up brake pressure is too low or it is built up too slowly.

- ▶ When commissioning or re-commissioning a machine, make sure that the power brake valve is filled with hydraulic fluid and remains filled during operation. To do so, observe the specifications of the machine manufacturer.

## **8.1 First commissioning**



For all commissioning work on the power brake valve observe the general safety instructions and the intended use in chapter 2 "Safety instructions" on page 9.

- ▶ Let the power brake valve acclimate itself for several hours before commissioning, as otherwise water may condense in the housing.
- ▶ Make sure that all electrical and hydraulic connections are either used or covered. Commission the power brake valve only if it is installed completely.
- ▶ Avoid temperature shocks. There may be no temperature differences of more than 20 °C between the power brake valve and the pressure fluid. Otherwise, there is a risk of jammed spools. With temperatures below –20 °C the power brake valve has to be warmed up.
- ▶ Only use a hydraulic fluid that complies with the following requirements:  
For information on minimum requirements for hydraulic fluids, see Table 1 "Required and amending documentation" on page 6.

Proceed as follows for the first commissioning of the power brake valve:

1. Ensure the hydraulic supply of the power brake valve.
2. Ensure the power supply of the power brake valve.
3. Check the electrical connections of the power brake valve.

Electrical connections must be checked for their proper condition by or under the guidance and supervision of a specialized electrician before first commissioning or any recommissioning.



Observe the operating instructions of the machine where the power brake valve is installed.

**4. Bleeding the power brake valve.**

Prior to operation, slowly actuate the power brake valve several times in all directions of actuation under operating pressure. This expels any remaining air from the power brake valve. Mechanical damage due to inadmissibly high acceleration of the hydraulic fluid and the valve spool is thereby avoided and the service life of the power brake valve is increased.

Also observe the instructions on bleeding in the operating instructions of the machine.

**5. Leakage testing.**

Check that no hydraulic fluid leaks at the power brake valve and at the connections during operation.

**6. Functional testing.**

The functional test must be made according to the specifications of the machine manufacturer, see operating instructions of the machine.

In any case: Slowly increase pressure; stop the functional test immediately in case of leakage!

**7. Commission the power brake valve.****8. Check the operating temperature of the power brake valve after several hours of continuous operation. Too high operating temperatures indicate errors which must be analyzed and removed.****8.2 Re-commissioning after standstill**

- Carry out re-commissioning as described in chapter 8.1 "First commissioning" on page 33.



Also observe the instructions for (re-)commissioning after standstill in the machine operating instructions.

## 9 Operation

### **WARNING**

#### **Impaired mechanical operation due to contamination or objects!**

Danger to life, risk of injury, damage to property!

The power brake may block in an undefined position or its movability may be impaired due to external contamination or objects. As a result, the driven actuator is no longer under the operator's control.

- ▶ With power brake valves with mechanical operation, the movability and accessibility of the operating elements (e.g. pedal, hand lever) always has to be ensured and must not be impaired or blocked due to contamination or objects.
- ▶ It must always be possible to set the power brake valve to the intended end position and back to the initial position.

No adjustments or modifications to the product are required during operation. As a result, this chapter of the instructions does not contain any information on adjustment options. Only use the product within the performance range provided in the technical data. The machine manufacturer is responsible for the correct project planning of the hydraulic system and its control.

# 10 Maintenance and repair

## NOTICE

### Delayed inspections and maintenance works!

Damage to property!

- Perform the prescribed inspections and maintenance works at the power brake valve at the intervals specified in these instructions.



Also observe the instructions for maintenance and repair in the machine operating instructions.

## 10.1 Inspection

For reliable operation of the power brake valve, Bosch Rexroth recommends checking it on a regular basis and recording and archiving the following operating conditions:

Table 7: Inspection plan

| Work to be carried out at the power brake valve                                                                                                           | Interval                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Check the operating temperature.                                                                                                                          | Weekly                                 |
| Hydraulic fluid analysis: Viscosity, time deterioration and contamination                                                                                 | Annually or every 2000 operating hours |
| Check the power brake valve for external leakage (visual inspection).                                                                                     | Daily                                  |
| Check the power brake valve for strange noises.                                                                                                           | Daily                                  |
| Check the mounting elements for tight fit.<br>All mounting elements have to be checked when the power brake valve is depressurized, deenergized and cool. | Monthly                                |

## 10.2 Maintenance

If used as intended, the power brake valve is low-maintenance.

The service life of the power brake valve decisively depends on the hydraulic fluid quality. We therefore recommend exchanging the hydraulic fluid at least once a year or every 2000 operating hours or to have it analyzed for further usability by the hydraulic fluid manufacturer or a laboratory.



Observe the following general rule:

From a hydraulic fluid temperature of  $>70\text{ }^{\circ}\text{C}$ , the aging speed doubles with every  $10\text{ }^{\circ}\text{C}$  temperature increase.

For the maximum admissible degree of contamination of the hydraulic fluid, see the data sheet in chapter "Technical data".

Also observe the information on the hydraulic fluid in the operating instructions of the machine.

## 10.3 Repair

Bosch Rexroth offers a wide range of repair services for the Rexroth power brake valves.

The power brake valve may only be repaired by Bosch Rexroth certified service centers or by the machine manufacturer.

For questions regarding repair, contact your local Bosch Rexroth service or the service department of the power brake valve manufacturer, see chapter 10.4 "Spare parts" on page 38.

## 10.4 Spare parts



### CAUTION

#### **Use of unsuitable spare parts!**

Spare parts that do not meet the technical requirements specified by Bosch Rexroth may cause personal injuries and damage to property.

- Exclusively use Rexroth original spare parts to repair the Rexroth power brake valves. Otherwise, the function of the power brake valve is no longer ensured and you lose your claim to warranty.

Regarding which power brake valves are covered in which spare parts list, see Table 1 "Required and amending documentation" on page 6.

Indicate the material and serial numbers of the power brake valve as well as the material numbers of the spare parts when ordering spare parts.

In case of questions regarding spare parts, please contact your local Bosch Rexroth service or the service department of the power brake valve manufacturer.

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[www.boschrexroth.de/adressen](http://www.boschrexroth.de/adressen).

# 11 Disassembly and replacement

## CAUTION

### **Stored energy in the hydraulic accumulators!**

Danger to life, risk of injury, severe injury when working on pressurized machines!

- After decommissioning the overall system, the hydraulic accumulators may still be pressurized. Ensure that the power brake valve is depressurized and deenergized. In this regard, also observe the specifications in the operating instructions of the machine.

### **11.1 Required tools**

Disassembly can be carried out with standard tools. No special tools are required.

### **11.2 Preparing for disassembly**

1. Decommission the overall system as described in the machine operating instructions.
  - Depressurize and unload the hydraulic system as described by the machine manufacturer.
  - Ensure that the power brake valve is depressurized and deenergized.
2. Secure the overall system according to the manufacturer's instructions.

### **11.3 Disassembling the product**

Proceed as follows to disassemble the power brake valve:

1. Let the power brake valve cool down until it can be disassembled without risks.
2. Make sure that no hydraulic fluid can escape unintentionally from the system due to the disassembly of the power brake valve.
3. Place a clean collecting pan below the power brake valve to collect any escaping residual hydraulic fluid.
4. Disconnect the lines and collect any escaping residual hydraulic fluid in the collecting pan.
5. Remove the power brake valve according to the manufacturer's instructions.
6. Place the product on a clean, bearing surface.
7. Completely drain the power brake valve.
8. Close all openings.

### **11.4 Preparing the components for storage/further use**

- Proceed as described in chapter 6.2 "Storing a power brake valve", section "Following disassembly" on page 23.

## 12 Disposal

### CAUTION

**Spring preloaded components!**

Risk of injury due to ejected components when the valve is disassembled into its individual components!

- Slowly unscrew screwed-in parts and hold them in place.

Careless disposal of the power brake valve, the hydraulic fluid and the packaging material may pollute the environment.

For the disposal of the power brake valve, comply with the following instructions:

1. Completely drain the power brake valve.
2. Dispose of the power brake valve and the packaging material in accordance with the applicable national regulations in your country.
3. Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.
4. Disassemble the power brake valve into its individual components in order to recycle them.
5. Separate for example:
  - Steel
  - Aluminum
  - Non-ferrous metal
  - Electrical and electronic parts (solenoids, sensors, coils)
  - Plastic
  - Rubber (seals, bellows, pedal rubber)

## 13 Extension and modification

Modifications to the power brake valve are not admissible. This includes changing the set screws.



The Bosch Rexroth warranty applies only to the configuration supplied. Following an extension or a modification, the claim to warranty expires.



Adjusting the set screws causes the claim to warranty to expire. If you require the settings to be adjusted, contact your local Bosch Rexroth service. For the address, see chapter 10.4 "Spare parts" on page 38.

### **Optional accessories**

For available accessories, see the respective data sheet.

Accessories are available from your Rexroth specialist dealer. For addresses of our foreign subsidiaries, see [www.boschrexroth.de/adressen](http://www.boschrexroth.de/adressen).

## 14 Troubleshooting

Use Table 8 for troubleshooting. This table is not exhaustive.  
In practice, there may be problems that are not included here.

### 14.1 How to proceed for troubleshooting

- ▶ Work systematically and in a targeted way.
- ▶ First get a general idea of how your product works in conjunction with the overall system.
- ▶ Try to find out whether the product has worked properly in conjunction with the overall system before the error occurred.
- ▶ Try to determine any changes of the overall system into which the product is integrated:
  - Were the product's operating conditions or its area of application changed?
  - Was any maintenance work performed? Is there an inspection or maintenance record?
  - Were modifications (e.g. refittings) or repair works done on the overall system (machine, electrics, control) or on the product?
  - Was the hydraulic fluid changed?
  - Was the product or machine used as intended?
  - How did the fault become apparent?
- ▶ Try to get a clear idea of the cause of the error. If necessary, ask the actual (machine) operator.
- ▶ Document all work done.
- ▶ For support, see: [www.boschrexroth.de/adressen](http://www.boschrexroth.de/adressen).

## 14.2 Fault table

The power brake valve is not sensitive to faults if the specified operating conditions are met, particularly the quality of the hydraulic fluid and the maximum admissible pressure values.

**Table 8: Fault table - power brake valve in general**

| <b>Fault</b>                                          | <b>Possible causes</b>                                                                                                                                                                                                                         | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hydraulic fluid leaks from the power brake valve      | The plug screws and/or reducing pieces leak                                                                                                                                                                                                    | Carefully tighten the plug screws until they fit tightly.<br>If leakage persists:<br>Check the sealing surfaces/seals for damages and dirt.<br>If required, disassemble the power brake valve and replace it by a new one.                                                    |
|                                                       | The brake valve housing leaks                                                                                                                                                                                                                  | Disassemble the power brake valve and replace it by a new one.                                                                                                                                                                                                                |
|                                                       | The line connections (fittings) leak                                                                                                                                                                                                           | Check seals and replace the fittings, if necessary. Check the tightening torque, see information of the fitting manufacturer.<br>If leakage persists:<br>Disassemble the power brake valve and replace it by a new one.                                                       |
|                                                       | Screw-in cartridge valve leaks                                                                                                                                                                                                                 | Tighten the screw-in cartridge valve applying the prescribed torque.<br>If leakage persists:<br>Check the sealing surfaces/seals for damages and dirt.<br>If required, replace the screw-in cartridge valve or disassemble the power brake valve and replace it by a new one. |
|                                                       | The bleed screw leaks                                                                                                                                                                                                                          | Tighten the bleed screw applying the prescribed torque.<br>If leakage persists:<br>Check the sealing surfaces/seals for damages and dirt.<br>If required, replace the bleed screw or disassemble the power brake valve and replace it by a new one.                           |
|                                                       | The actuation leaks                                                                                                                                                                                                                            | Carefully tighten until it fits tightly.<br>If leakage persists:<br>Disassemble the power brake valve and replace it by a new one.                                                                                                                                            |
| The control spool cannot be controlled mechanically   | The hydraulic fluid temperature is too high and/or the temperature difference between the hydraulic fluid and the valve housing is too high, this causes the spool valve and valve housing to block as a result of different thermal expansion | Take external measures to ensure the hydraulic fluid temperature.<br>Avoid a temperature shock.                                                                                                                                                                               |
|                                                       | Dirt or foreign matter that entered during installation or connection jam the control spool                                                                                                                                                    | Rinse the power brake valve.<br>Make sure the hydraulic fluid is clean.<br>If the fault persists:<br>Disassemble the power brake valve and replace it by a new one.                                                                                                           |
| The control spool does not reset or resets too slowly | The control spool jams                                                                                                                                                                                                                         | See "The control spool cannot be controlled mechanically".                                                                                                                                                                                                                    |

**Table 8: Fault table - power brake valve in general**

| <b>Fault</b>                                         | <b>Possible causes</b>                                             | <b>Remedy</b>                                        |
|------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------|
| The temperature at the power brake valve is too high | The ambient temperature is too high                                | System-related; remedy by means of external measure. |
|                                                      | The hydraulic fluid temperature is too high                        | Decrease the hydraulic fluid temperature.            |
|                                                      | The flow is too large                                              | Reduce the flow.                                     |
| Not functional or malfunctioning                     | The power brake valve is connected incorrectly                     | Correct the hydraulic connections.                   |
|                                                      | An electric component is connected incorrectly                     | Correct the electrical connections.                  |
|                                                      | No pressure supply                                                 | Ensure the hydraulic fluid supply.                   |
|                                                      | There is dirt or foreign matter in the power brake valve or system | Make sure the hydraulic fluid is clean.              |
|                                                      | No energy supply                                                   | Ensure the energy supply.                            |
|                                                      | An actuating element does not function or is incorrectly mounted   | Check the actuation element.                         |



The following system error descriptions and remedies serve only for additional support.

**Table 9: Fault table - hydraulic system**

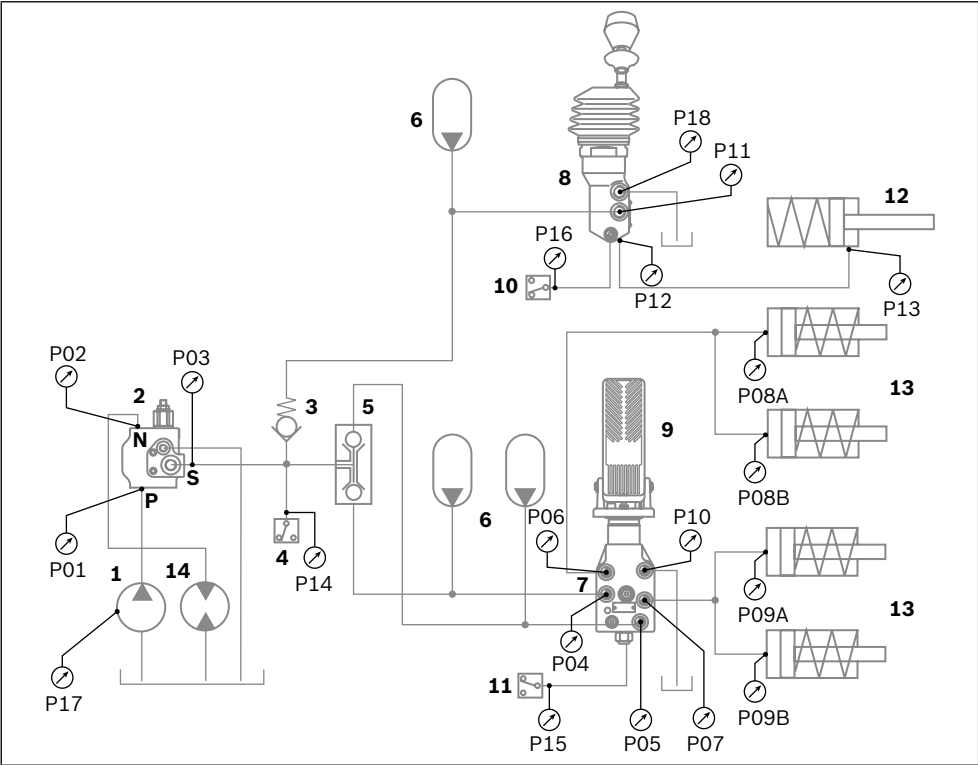
| <b>Fault</b>                                                          | <b>Possible causes</b>                                                                                                                           | <b>Remedy</b>                                                                                                                         |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Hydraulic fluid leaks from the lines leading to the power brake valve | The piping or hose assemblies are damaged                                                                                                        | Replace piping or hose assemblies.                                                                                                    |
|                                                                       | The piping or hose assemblies are loose                                                                                                          | Tighten the fittings applying the prescribed tightening torque according to the applicable assembly instructions of the manufacturer. |
| The accumulator charging valve does not switch off                    | The control spool is blocked by dirt                                                                                                             | Replace the accumulator charging valve                                                                                                |
|                                                                       | There are flow and pressure fluctuations at port P, the flow of the pump is insufficient                                                         | Measure the speed, flow and pressure at measuring point <b>P01</b> , see chapter 14.3.                                                |
|                                                                       | Internal leakage at the downstream components after ports <b>S1</b> and <b>S2</b> and/or internal leakage at port <b>X</b> (LS port) is too high | Deactivate the downstream components one after another and localize the damaged part. Replace the defective component.                |
| The accumulator charging valve is often activated                     | The accumulator capacity is too low or the accumulator is defective                                                                              | Check the accumulator, check the project planning.                                                                                    |
|                                                                       | The displacement of the brake cylinders is too large compared to the accumulator capacity                                                        | Check the design, increase the accumulator capacity, if required.                                                                     |
| The hydraulic function is impaired                                    | There is air in the hydraulic fluid and the system                                                                                               | Bleed the hydraulic system, see page 34.                                                                                              |
| Unusual noise                                                         | There is air in the hydraulic fluid                                                                                                              | Avoid aeration. Bleed the hydraulic system, see page 34.<br>Change the tank array.                                                    |
| Flow noise                                                            | The line cross-sections are too small with high flow                                                                                             | Increase the nominal width of the hydraulic lines and avoid narrow curves and small bending radiuses.                                 |
| Vibrations                                                            | Pressure fluctuations in the system                                                                                                              | Bleed the hydraulic system, see page 34.                                                                                              |
|                                                                       | There is dirt or foreign matter in the system                                                                                                    | Make sure the hydraulic fluid is clean.                                                                                               |

**Table 9: Fault table - hydraulic system**

| <b>Fault</b>                                                                          | <b>Possible causes</b>                                                                                          | <b>Remedy</b>                                                                                                                           |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| The brake pressure builds up too slowly or the required brake pressure is not reached | The accumulator capacity is too low or the accumulator is defective                                             | Check the accumulator, check the project planning.                                                                                      |
|                                                                                       | The displacement of the brake cylinders is too large compared to the accumulator capacity                       | Check the design, increase the accumulator capacity, if required.                                                                       |
|                                                                                       | The hydraulic lines are too long and/or the cross-section is too small                                          | Take measurements at measuring points <b>P06</b> , <b>P07</b> , <b>P08</b> and <b>P09</b> and replace the hydraulic lines, if required. |
|                                                                                       | The pedal actuation is impaired                                                                                 | Check the pedal movement and restore free pedal actuation.                                                                              |
|                                                                                       | The control spool jams                                                                                          | See "The control spool cannot be controlled mechanically".                                                                              |
|                                                                                       | The hydraulic fluid temperature is too low, viscosity is too high                                               | Comply with the correct viscosity range, see data sheet.                                                                                |
| The brake pressure decreases too slowly, brake pressure remains                       | The hydraulic lines are too long and/or the cross-section is too small                                          | Take measurements at measuring points <b>P06</b> , <b>P07</b> , <b>P08</b> and <b>P09</b> and replace the hydraulic lines, if required. |
|                                                                                       | The pedal actuation is impaired                                                                                 | Check the pedal movement and restore free pedal actuation.                                                                              |
|                                                                                       | The control spool jams                                                                                          | See "The control spool cannot be controlled mechanically".                                                                              |
| The number of required decelerations is not reached                                   | The accumulator capacity is too low<br>The accumulator is too small or defective                                | Check the accumulator, check the project planning.                                                                                      |
| The brake gets hot, drags, cannot be completely released                              | The return flow from the brake cylinder to the tank is impaired, the tank pressure is too high                  | Take a measurement at measuring point <b>P10</b> .                                                                                      |
|                                                                                       | The pedal does not return to the initial position                                                               | Check the mechanical system and the area around the pedal.                                                                              |
| The accumulator warning light keeps illuminating                                      | The pressure switch is defective or chosen incorrectly                                                          | Check the pressure switch.                                                                                                              |
|                                                                                       | The accumulator capacity is too low<br>The accumulator is too small or defective                                | Check the accumulator, check the project planning.                                                                                      |
| The spring-loaded accumulator parking brake cannot be released                        | The parking brake valve (hand brake valve) generates no pressure on the spring-loaded accumulator parking brake | Take a measurement at measuring point <b>P13</b> and compare it to the specifications of the brake manufacturer.                        |
|                                                                                       | The accumulator for the parking brake is too small or defective                                                 | Check the accumulator, check the project planning.                                                                                      |
|                                                                                       | The electric actuation of the PBS is insufficient, the power supply is interrupted or the coil is defective     | Check the power supply, check the plug-in connections for contact and tight fit. Replace the coil, if required.                         |

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

14.3 Suggestion for measuring points

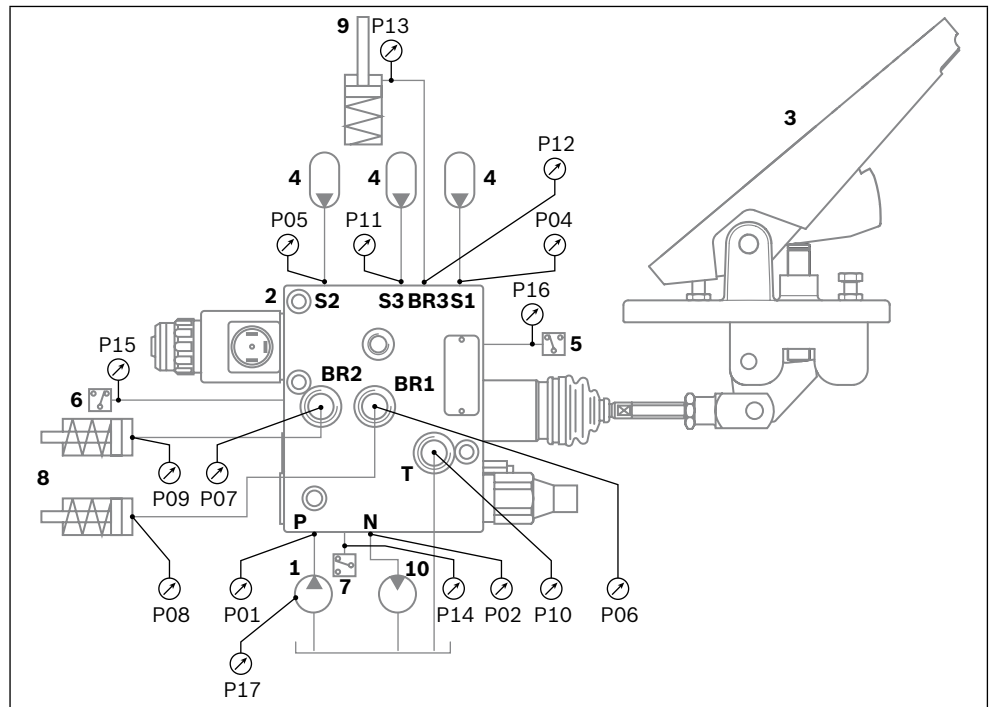


**Fig. 7: Schematic illustration of an example application with modular design with suggestions for measurement points**

- |                                         |                                     |                                           |
|-----------------------------------------|-------------------------------------|-------------------------------------------|
| 1 Pump                                  | 6 Hydraulic accumulator             | 10 PBS pressure switch                    |
| 2 Accumulator charging valve LT 06      | 7 2 circuit power brake valve LT 07 | 11 SBS pressure switch                    |
| 3 Check valve                           |                                     | 12 PBS spring-loaded accumulator cylinder |
| 4 Pressure switch, accumulator pressure | 8 Hand brake valve LT 08            | 13 Brake cylinder (wheel)                 |
| 5 Inverted shuttle valve                | 9 Brake pedal                       | 14 Downstream actuators                   |

**Table 10: Measuring point for modular design**

| No. | Measuring point                         | Connection |
|-----|-----------------------------------------|------------|
| P01 | Accumulator charging valve              | P          |
| P02 | Accumulator charging valve              | N          |
| P03 | Accumulator charging valve              | S          |
| P04 | Brake valve                             | SP1        |
| P05 | Brake valve                             | SP2        |
| P06 | Brake valve                             | BR1        |
| P07 | Brake valve                             | BR2        |
| P08 | Brake cylinder, 1st circuit, front axle |            |
| P09 | Brake cylinder, 2nd circuit, rear axle  |            |
| P10 | Brake valve                             | T          |
| P11 | Hand brake valve                        | S          |
| P12 | Hand brake valve                        | B          |
| P13 | PBS spring-loaded accumulator cylinder  |            |
| P14 | Accumulator pressure switch, no. 4      |            |
| P15 | SBS pressure switch, no. 12             |            |
| P16 | PBS pressure switch, no. 11             |            |
| P17 | Pump speed                              |            |
| P18 | Hand brake valve                        | T          |



**Fig. 8: Schematic illustration of an example application with compact design with suggestions for measurement points**

- |                                     |                                         |                                          |
|-------------------------------------|-----------------------------------------|------------------------------------------|
| 1 Pump                              | 4 Hydraulic accumulator                 | 8 Brake cylinder (wheel)                 |
| 2 2 circuit power brake valve LT 13 | 5 PBS pressure switch                   | 9 PBS spring-loaded accumulator cylinder |
| 3 Brake pedal                       | 6 SBS pressure switch                   | 10 Downstream actuators                  |
|                                     | 7 Pressure switch, accumulator pressure |                                          |

**Table 11: Measuring points for compact design**

| No. | Measuring point                         | Connection |
|-----|-----------------------------------------|------------|
| P01 | Brake valve                             | P          |
| P02 | Brake valve                             | N          |
| P03 | –                                       |            |
| P04 | Brake valve                             | S1         |
| P05 | Brake valve                             | S2         |
| P06 | Brake valve                             | BR1        |
| P07 | Brake valve                             | BR2        |
| P08 | Brake cylinder, 1st circuit, front axle |            |
| P09 | Brake cylinder, 2nd circuit, rear axle  |            |
| P10 | Brake valve                             | T          |
| P11 | Brake valve                             | S3         |
| P12 | Brake valve                             | BR3        |
| P13 | PBS spring-loaded accumulator cylinder  |            |
| P14 | Accumulator pressure switch, no. 7      |            |
| P15 | SBS pressure switch, no. 6              |            |
| P16 | PBS pressure switch, no. 5              |            |
| P17 | Pump speed                              |            |

## 15 Technical data

For the admissible technical data of the power brake valves, see the respective data sheet. Regarding which power brake valves are covered in which data sheets, see Table 1 "Required and amending documentation" on page 6.

The data sheets are available on the Internet at  
[www.boschrexroth.com/variouS/utilities/mediadirectory](http://www.boschrexroth.com/variouS/utilities/mediadirectory)

For further information, refer to the online product catalog  
Mobile hydraulics: [www.boschrexroth.de/mobilhydraulik-katalog](http://www.boschrexroth.de/mobilhydraulik-katalog)

The order-specific technical data of your power brake valve are available in the order confirmation.

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