

# Hydraulic cylinders

## Mill type / tie rod design



The data specified above only serve to describe the product. Due to the continuing development of our products, 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. Please note that our products are subject to a natural process of wear and aging.

© All rights are reserved to Bosch Rexroth AG, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

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

The original operating instructions were prepared in German.

# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>About this documentation .....</b>   | <b>5</b>  |
| 1.1      | Validity of the documentation .....   | 5         |
| 1.2      | Required and amending documentation .....   | 5         |
| 1.3      | Representation of information .....   | 6         |
| 1.3.1    | Safety instructions .....   | 6         |
| 1.3.2    | Symbols .....   | 7         |
| 1.3.3    | Abbreviations .....   | 7         |
| 1.3.4    | Designations .....  | 7         |
| <b>2</b> | <b>Safety instructions .....</b>  | <b>8</b>  |
| 2.1      | About this chapter .....  | 8         |
| 2.2      | Intended use .....  | 8         |
| 2.3      | Improper use .....  | 9         |
| 2.4      | Qualification of personnel .....  | 9         |
| 2.5      | Safety instructions .....   | 10        |
| 2.6      | Product- and technology-dependent safety instructions .....                             | 11        |
| 2.7      | Personal protective equipment .....   | 12        |
| 2.8      | Obligations of the machine end-user .....   | 12        |
| <b>3</b> | <b>General information on damage to property and damage to the product .....</b>        | <b>13</b> |
| <b>4</b> | <b>Scope of delivery .....</b>  | <b>15</b> |
| <b>5</b> | <b>Product information .....</b>  | <b>16</b> |
| 5.1      | Performance description .....   | 16        |
| 5.2      | Component overview .....  | 16        |
| 5.2.1    | Mill type cylinders .....   | 16        |
| 5.2.2    | Tie rod cylinders .....   | 16        |
| 5.3      | Product identification .....  | 17        |
| <b>6</b> | <b>Transport and storage .....</b>  | <b>19</b> |
| 6.1      | Transporting the hydraulic cylinder .....   | 19        |
| 6.1.1    | Transporting hydraulic cylinders by forklift truck .....                                | 20        |
| 6.1.2    | Transporting hydraulic cylinders with attachment devices .....                          | 21        |
| 6.1.3    | Manually transporting the hydraulic cylinder .....                                      | 22        |
| 6.2      | Storing the hydraulic cylinder .....  | 22        |
| 6.2.1    | Corrosion protection applied at the factory .....                                       | 22        |
| 6.2.2    | Storage conditions .....  | 23        |
| 6.2.3    | Storage times .....   | 23        |
| 6.2.4    | Inspection during the storage time .....  | 24        |
| 6.2.5    | Information on packed hydraulic cylinders .....   | 24        |
| <b>7</b> | <b>Assembly .....</b>   | <b>25</b> |
| 7.1      | Unpacking the hydraulic cylinder .....  | 25        |
| 7.2      | Installation conditions .....   | 25        |
| 7.2.1    | Cleanliness .....   | 25        |
| 7.2.2    | Information on fastening .....  | 25        |
| 7.3      | Assembling the hydraulic cylinder .....   | 27        |
| 7.3.1    | Installing a tie rod cylinder with foot mounting (MS2)<br>into the system/machine ..... | 28        |
| 7.3.2    | Hydraulically connecting the hydraulic cylinder .....                                   | 28        |
| 7.3.3    | Connecting the power supply .....   | 28        |

|           |   |           |
|-----------|---|-----------|
| <b>8</b>  | <b>Commissioning</b>  | <b>29</b> |
| 8.1       | First commissioning   | 29        |
| 8.1.1     | Before commissioning  | 29        |
| 8.1.2     | Flushing the machine/system   | 29        |
| 8.1.3     | Filling the hydraulic cylinder with hydraulic fluid and bleeding it | 30        |
| 8.1.4     | Commissioning the hydraulic cylinder                                | 33        |
| 8.2       | Setting the end position cushioning                                 | 34        |
| 8.3       | Proximity switch  | 35        |
| 8.4       | Re-commissioning after standstill                                   | 35        |
| <b>9</b>  | <b>Operation</b>  | <b>36</b> |
| 9.1       | Operating conditions  | 36        |
| <b>10</b> | <b>Maintenance and repair</b>                                       | <b>37</b> |
| 10.1      | Cleaning and care   | 37        |
| 10.2      | Inspection  | 37        |
| 10.3      | Maintenance schedule  | 37        |
| 10.4      | Maintenance   | 38        |
| 10.4.1    | Piston rod maintenance  | 38        |
| 10.4.2    | Maintenance of spherical bearings requiring maintenance             | 39        |
| 10.5      | Replacing wear parts  | 39        |
| 10.6      | Repair  | 40        |
| 10.7      | Spare parts   | 40        |
| <b>11</b> | <b>Decommissioning</b>  | <b>41</b> |
| 11.1      | Preparing for decommissioning                                       | 41        |
| 11.2      | Decommissioning the system  | 41        |
| 11.3      | Preparing for disassembly   | 41        |
| 11.4      | Disassembly of the product  | 42        |
| 11.5      | Preparing the hydraulic cylinder for storage/further use            | 42        |
| <b>12</b> | <b>Disassembly and replacement</b>                                  | <b>43</b> |
| 12.1      | Preparing for disassembly   | 43        |
| 12.2      | Disassembly of the product  | 43        |
| 12.3      | Exchanging components   | 43        |
| <b>13</b> | <b>Disposal</b>   | <b>44</b> |
| 13.1      | Environmental protection  | 44        |
| <b>14</b> | <b>Extension and modification</b>                                   | <b>44</b> |
| <b>15</b> | <b>Troubleshooting</b>  | <b>45</b> |
| 15.1      | How to proceed for troubleshooting                                  | 45        |
| <b>16</b> | <b>Technical data</b>   | <b>46</b> |
| <b>17</b> | <b>Appendix</b>   | <b>47</b> |
| 17.1      | List of addresses   | 47        |

# 1 About this documentation

## 1.1 Validity of the documentation

This documentation applies to the following products:

- Hydraulic cylinder in mill type
- Hydraulic cylinders in tie rod design

This documentation is intended for system manufacturers, assemblers, operators, service engineers and system end-users.

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

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

## 1.2 Required and amending documentation

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

For operating instructions and data sheets, please refer to our website at:

[www.boschrexroth.com/mediadirectory](http://www.boschrexroth.com/mediadirectory)

**Table 1: Required and amending documentation**

| Title   | Document number | Document type |
|---|-----------------|---------------|
|  Hydraulic fluids based on mineral oils and related hydrocarbons                         | 90220           | Data sheet    |
|  General product information on hydraulic products                                       | 07008           | Data sheet    |
|  General information on the assembly, commissioning and maintenance of hydraulic systems | 07900           | Data sheet    |
| Hydraulic cylinder mill type, series CDL2   | 17327           | Data sheet    |
| Hydraulic cylinder, mill type, series CDM1  | 17341           | Data sheet    |
| Hydraulic cylinder, mill type, series CGM1  | 17342           | Data sheet    |
| Hydraulic cylinder, mill type, series CSM1  | 17343           | Data sheet    |
| Hydraulic cylinder mill type, series CDH1 / CGH1 / CSH1   | 17332           | Data sheet    |
| Hydraulic cylinder mill type, series CDH2 / CGH2 / CSH2   | 17335           | Data sheet    |
| Hydraulic cylinder mill type, series CDH3 / CGH3 / CSH3   | 17338           | Data sheet    |
| Hydraulic cylinder, tie rod design, series CDT3...Z   | 17051           | Data sheet    |
| Hydraulic cylinder, tie rod design, series CGT3...Z   | 17052           | Data sheet    |
| Hydraulic cylinder, tie rod design, series CST3...Z   | 17053           | Data sheet    |
| Hydraulic cylinder tie rod design, series CD70 / CG70   | 17016           | Data sheet    |
| Hydraulic cylinder tie rod design, series CD210 / CG210   | 17017           | Data sheet    |

### 1.3 Representation of information

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

#### 1.3.1 Safety instructions

In this documentation, safety instructions are contained in chapter 2.6 "Product- and technology-dependent safety instructions" and in chapter 3 "General information on damage to property and damage to the product" and wherever a sequence of actions or instructions are explained which bear the danger of personal injury or damage to property. The hazard avoidance measures described must be observed.

Safety instructions are structured as follows:

|  <b>SIGNAL WORD</b>  |
|---|
| <p><b>Type and source of danger</b><br/>Consequences in case of non-compliance</p> <ul style="list-style-type: none"> <li>▶ Hazard avoidance measures</li> <li>▶ &lt;Enumeration&gt;</li> </ul> |

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

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

| Warning sign, signal word  | Meaning   |
|--|---|
|  <b>DANGER</b>  | Indicates a dangerous situation which will cause death or severe injury if not avoided.         |
|  <b>WARNING</b> | Indicates a dangerous situation which may cause death or severe injury if not avoided.          |
|  <b>CAUTION</b> | Indicates a dangerous situation which may cause minor or medium personal injury 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 notes which are not safety-relevant but increase the comprehensibility of the documentation.

**Table 3: Meaning of the symbols**

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

### 1.3.3 Abbreviations

The following abbreviations are used in this documentation:

**Table 4: Abbreviations**

| Designation | Meaning           |
|-------------|-------------------|
| QR          | Quick Response    |
| S           | Center of gravity |

### 1.3.4 Designations

The following designations are used in this documentation:

**Table 5: Designations**

| Designation        | Meaning                                 |
|--------------------|---|
| Attachment devices | Load stand, lifting slings, load chains |

## 2 Safety instructions

### 2.1 About this chapter

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

- ▶ Read this documentation completely and thoroughly before working with the 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 product on to third parties.
- ▶ In addition to the safety instructions contained in this documentation, also observe the documentation of the hydraulic cylinder components (see order-specific documentation).

### 2.2 Intended use

The product is a hydraulic system component.

According to EU Directive 2006/42/EC and DIN EN ISO 4413, the hydraulic cylinder is a component that is not ready for use.

The product is exclusively intended for integration into a machine/system.

According to the Pressure Equipment Directive 2014/68/EU (Article 1 / Section j), the hydraulic cylinder is not to be classified as pressure vessel but as hydraulic controlling equipment as the pressure is not the decisive factor for the design but rigidity, dimensional stability and stability against static and dynamic operating loads.

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

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

Hydraulic cylinders may only be used within the applicable technical data, performance limits, specifications, and operating and environmental conditions specified in the data sheets.

### 2.3 Improper use

Any use deviating from the intended use is improper and thus not admissible. Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

Improper use of the product includes the operation of the hydraulic cylinders:

- with higher operating pressures than specified in the data sheets and/or installation drawings.
- with hydraulic fluids not corresponding to the specifications of the data sheets
- with deviating operating and environmental conditions



The hydraulic cylinder must not be used as guide element in the machine/system, see chapter 7.2 "Connection lines."

### 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. For transporting and handling the product, additional knowledge of dealing with lifting gear and the related attachment devices is required. 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 assess the work to be undertaken, 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 regulations pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary electrical and hydraulic expert knowledge.



Bosch Rexroth offers measures supporting training in specific fields. Please find an overview of the training contents on the internet at: [www.boschrexroth.com/de/de/academy](http://www.boschrexroth.com/de/de/academy)

## 2.5 Safety instructions

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

## 2.6 Product- and technology-dependent safety instructions

Due to the installation of the hydraulic cylinders in the machine/system, risks can arise from the operation of the hydraulic cylinders in the overall machine/system which can only be detected and minimized by a risk assessment of the overall machine/system.

### **WARNING**

#### **Danger due to pressurized hydraulic cylinder!**

Risk of injury! Severe injury when working at machines/systems that have not been stopped! Damage to property!

- ▶ Make sure that the hydraulic cylinder has been completely depressurized.
- ▶ Observe the specifications of the machine/system manufacturer and the machine/system end-user.

#### **Leakage of (pressurized) hydraulic fluid and oil mist!**

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

- ▶ Switch the machine/system off immediately (emergency off switch).
- ▶ Identify and remedy the leakage.
- ▶ Never try to stop or seal the leakage or the oil jet using a cloth.
- ▶ Avoid direct contact with the leaking hydraulic fluid.
- ▶ Use your personal protective equipment, see chapter 2.7 "Personal protective equipment").
- ▶ Keep open fire and ignition sources away from the hydraulic cylinder.
- ▶ Make sure that the grounding (electric welding circuit) during welding work at the machine/system is not led via the hydraulic cylinder.
- ▶ When dealing with hydraulic fluids, the information of the hydraulic fluid manufacturer must always be complied with.

### **CAUTION**

#### **Danger due to hot surfaces!**

Risk of injury! Risk of burning!

- ▶ Only touch the surfaces of the hydraulic cylinder with protective gloves or do not work on or near hot surfaces.  
During or after operation, temperatures may rise to values higher than 60 °C (140 °F), depending on the operating conditions.
- ▶ Allow the hydraulic cylinder to cool down sufficiently before touching it.
- ▶ Observe the protective measures of the machine/system manufacturer.

## **2.7 Personal protective equipment**

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

- Protective gloves
- Ear protection
- Safety shoes
- Safety goggles
- Protective helmet

## **2.8 Obligations of the machine end-user**

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

- ensure that the hydraulic cylinder and its components are used as intended according to chapter 2.2 "Intended use."
- instruct the operating personnel regularly in all items of the operating instructions and make sure that they are observed.
- put up an easily visible "Warning: hot surface" warning sign at the place of installation of the hydraulic cylinder.

The machine end-user is responsible for compliance with the specified safety measures for the specific application of the hydraulic cylinder and its components.

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

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

#### **NOTICE**

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

Damage to property!

- ▶ The product may only be operated according to chapter 2.2 "Intended use."
- ▶ Do not hit function-relevant areas (e.g. piston rod surfaces, mounting surfaces) and attachment parts (e.g. position measurement system) of the hydraulic cylinder.
- ▶ Protect attached components and electrical connections (position measurement system) against mechanical loads (e.g. impacts).
- ▶ Do not position or place the hydraulic cylinder onto attachment parts.
- ▶ Never use the hydraulic cylinder as handle or step.
- ▶ Do not position or place any objects on the hydraulic cylinder.

##### **Contamination of the hydraulic fluid by fluids and foreign particles!**

Early wear! Malfunctions! Risk of damage! Damage to property!

- ▶ During assembly and disassembly of the hydraulic cylinder, provide for cleanliness in order to prevent foreign particles like e.g. welding beads or metal chips from getting into the hydraulic lines and causing product wear or malfunctions.
- ▶ Make sure that all connections, hydraulic lines and attachment parts (e.g. measuring devices) are free from dirt.
- ▶ Check before commissioning whether all hydraulic and mechanical connections are connected and tight and that all the seals and caps of the plug-in connections are correctly installed and undamaged.
- ▶ Keep the piston rod free from contamination.
- ▶ For removing lubricants or any other contamination, use industrial residue-free wipes.
- ▶ Only complete cleaning processes at the hydraulic cylinder if the hydraulic connections are closed.
- ▶ For connecting the hydraulic cylinder, use sealants which are approved of for industrial use and do not lead to contamination in the hydraulic system.
- ▶ Only use hydraulic fluids complying with the requirements and the cleanliness class, see chapter 8.1.2 "Flushing the machine/system." For example, use additional filters attached to the unit in order to clean the hydraulic fluid and achieve the required cleanliness class.

## **NOTICE**

### **Mixing hydraulic fluids!**

Damage to property!

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

### **Improper cleaning!**

Damage to property!

- ▶ Cover all openings with the appropriate protective threads in order to prevent cleaning agents from penetrating the system.
- ▶ Check that all seals of the hydraulic system and all caps of the electric plug-in connection are firmly fitted to prevent the penetration of cleaning agents.
- ▶ Do not use aggressive and/or highly flammable cleaning agents for cleaning. Clean the product using a suitable cleaning liquid and residue-free industrial wipes.
- ▶ Do not use high-pressure washers.
- ▶ Do not use compressed air for the cleaning at functional interfaces like e.g. spherical bearings, trunnion mounting, piston rods and in sealing areas.
- ▶ Keep the warning signs on the hydraulic cylinder always in a legible condition. Replace damaged and illegible signs.

### **Operation with insufficient hydraulic fluid!**

Damage to property!

- ▶ Observe the system manufacturer's specifications regarding the point "Control of the hydraulic fluid" and the prescribed remedial measures for the control result.

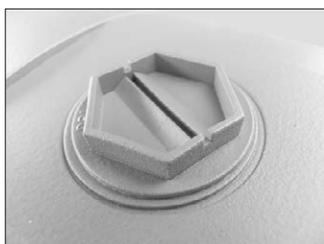
### **Leaking or spilt hydraulic fluid!**

Environmental pollution and contamination of the ground water!

- ▶ Use an oil binding agent in order to bind the leaked hydraulic fluid.
- ▶ Immediately remedy possible leakage.
- ▶ When filling and draining the hydraulic fluid, always put a collecting pan with sufficient capacity under the hydraulic cylinder.
- ▶ Observe the information in the safety data sheet of the hydraulic fluid and the system manufacturer's provisions.
- ▶ Dispose of the hydraulic fluid in accordance with the national regulations in the country of use.

## 4 Scope of delivery

The scope of delivery comprises the hydraulic cylinder including accessories as ordered by the customer and confirmed in the order confirmation. In addition, the line connections are closed with blanking plugs, e.g. plugs made of plastic, see Fig. 1, or flange covers, see Fig. 2. They exclusively serve as protection against contamination of the hydraulic cylinder during transport.



**Fig. 1: Blanking plug**



**Fig. 2: Flange cover**



In addition to the delivery note, further documents are supplied at the customer's request or in the event of deviations from the standard.

## 5 Product information

### 5.1 Performance description

A hydraulic cylinder converts hydraulic energy into a linear movement. The drive power is determined by the hydraulic pressure in the cylinder chamber on the piston and/or annulus area of the hydraulic cylinder.

### 5.2 Component overview

In the following, the main and functional parts of mill type and tie rod cylinders are displayed.

- For the types of mounting, please refer to the valid data sheet, see chapter 1.2 "Required and amending documentation."

#### 5.2.1 Mill type cylinders

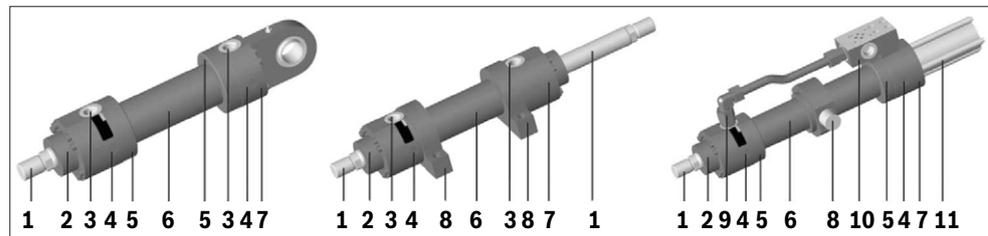


Fig. 3: H series (example: CDH2 / CGH2 / CSH2)

- |                          |   |
|--------------------------|---|
| <b>1</b> Piston rod      | <b>7</b> Cylinder base<br>(CD: self-aligning clevis at the cylinder base) |
| <b>2</b> Cylinder head   | <b>8</b> Fastening  |
| <b>3</b> Line connection | <b>9</b> Piping   |
| <b>4</b> Safety vent     | <b>10</b> Subplate  |
| <b>5</b> Flange          | <b>11</b> Position measurement system with protective pipe                |
| <b>6</b> Cylinder pipe   |   |

#### 5.2.2 Tie rod cylinders

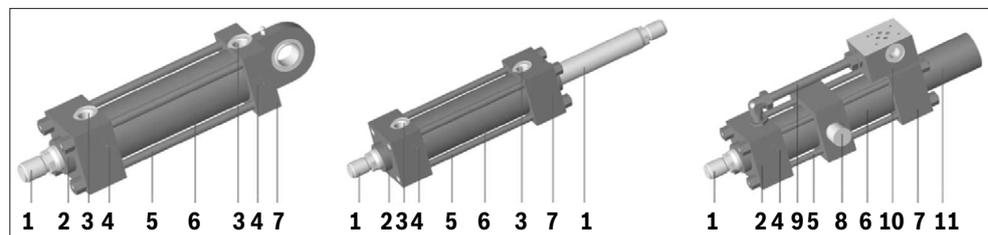


Fig. 4: T3 series (example: CDT3 / CGT3 / CST3)

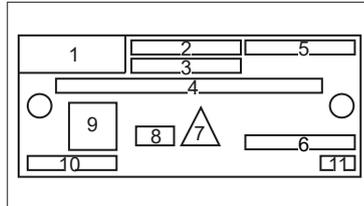
- |                          |   |
|--------------------------|---|
| <b>1</b> Piston rod      | <b>7</b> Cylinder base<br>(CD: self-aligning clevis at the cylinder base) |
| <b>2</b> Cylinder head   | <b>8</b> Fastening  |
| <b>3</b> Line connection | <b>9</b> Piping   |
| <b>4</b> Safety vent     | <b>10</b> Subplate  |
| <b>5</b> Tie rod         | <b>11</b> Position measurement system with protective pipe                |
| <b>6</b> Cylinder pipe   |   |

### 5.3 Product identification

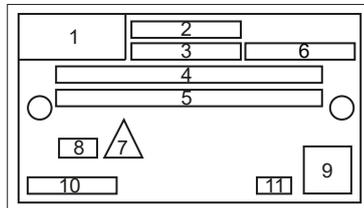
The unit is unambiguously identified by:

- the nameplate (name plate size and content depend on the series)
- the order-specific documentation
- the delivery bill and, if applicable, the accompanying documents

The following name plate variants are possible:



**Fig. 5: Name plate example (original size 36 x 15 mm)**



**Fig. 6: Name plate example (original size 36 x 20 mm)**

- |  |  |
|--|--|
| <b>1</b> Manufacturer  | <b>7</b> Personal stamp of the inspector<br>(or placed on cylinder head) |
| <b>2</b> Material number   | <b>8</b> Personal stamp of the assembler<br>(or placed on cylinder head) |
| <b>3</b> Serial number   | <b>9</b> QR code   |
| <b>4</b> Type designation  | <b>10</b> Designation of origin  |
| <b>5</b> * information, e.g. customer, order,<br>or project number | <b>11</b> Area number / works number                                     |
| <b>6</b> Coded date of production                                  |  |
- \* order-dependent

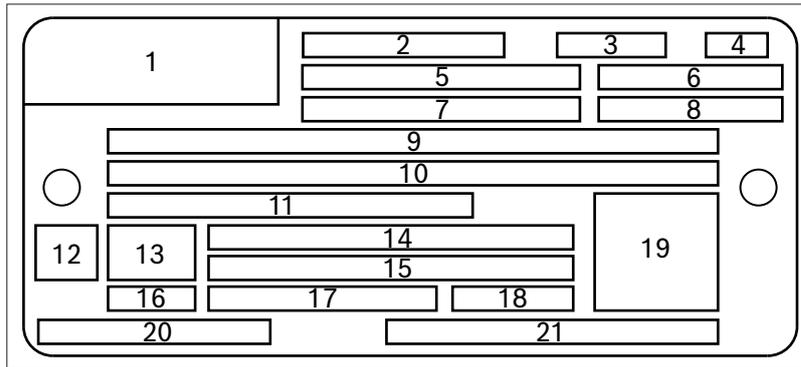


Fig. 7: Name plate example (original size 50 x 22 mm)

- |  |  |
|--|--|
| <b>1</b> Manufacturer                                  | <b>11</b> Customer order number *              |
| <b>2</b> Material number                               | <b>12</b> UKCA marking *                       |
| <b>3</b> Coded date of production                      | <b>13</b> CE mark *                            |
| <b>4</b> Area number / works number                    | <b>14</b> Performance characteristics *        |
| <b>5</b> Serial number                                 | <b>15</b> Ambient temperature specifications * |
| <b>6</b> Customer order number<br>(SAP commission no.) | <b>16</b> Identification number *              |
| <b>7</b> Customer serial number *                      | <b>17</b> Maximum rated pressure *             |
| <b>8</b> Supplier code *                               | <b>18</b> Weight *                             |
| <b>9</b> Type designation                              | <b>19</b> QR (quick response) code             |
| <b>10</b> Customer material number *                   | <b>20</b> Designation of origin                |
| * order-dependent                                      | <b>21</b> Company address *                    |

## 6 Transport and storage

### 6.1 Transporting the hydraulic cylinder

#### **WARNING**

##### **Falling of the hydraulic cylinder or individual components!**

Danger to life! Risk of injury! Damage to property!

- ▶ Use lifting gear (e.g. load stands, lifting slings) as attachment devices, which can safely bear the weight of the hydraulic cylinder.
- ▶ Always use several attachment devices and attachment points for transporting the hydraulic cylinder.
- ▶ Do not stand or walk under lifted loads.
- ▶ Wear your personal protective equipment, see chapter 2.7

#### **CAUTION**

##### **Uncontrolled rolling and tilting of the hydraulic cylinder or individual components!**

Risk of injury! Damage to property!

- ▶ Observe the lifting capacity of the lifting gear.
- ▶ Ensure a stable center of gravity position.
- ▶ Secure the hydraulic cylinder or the individual components against rolling or falling/tilting.

##### **Uncontrolled extension of the piston rod when lifting the hydraulic cylinder in general and lifting the hydraulic cylinder at attachment parts (subplates, piping, etc.)!**

Risk of injury! Damage to property!

- ▶ Only transport the hydraulic cylinder as described in chapter 6.1 "Transporting the hydraulic cylinder."
- ▶ During transport, leave the blanking plugs in the line connections.

#### **NOTICE**

##### **Force effect caused by lifting gear on attachments (subplates, piping, etc.) during lifting!**

Damage to property!

- ▶ Fasten the lifting gear (e.g. load chains, lifting slings) at the hydraulic cylinder so that during lifting, the lifting gear is free, i.e. does not rest against attachments.

Depending on the size and the situation on site, the hydraulic cylinder can be transported using a forklift, a crane or any other lifting gear.

When moving and lifting the hydraulic cylinder, please observe the following rules:

- ▶ Transport the hydraulic cylinder only in horizontal position, in its original packaging, if possible, or on wooden blocks (prism-shaped squared timber) holding the hydraulic cylinder in a stable position and bearing its weight.
- ▶ Make sure that when transporting the hydraulic cylinder on wooden blocks, there are no force effects on attachment parts (subplates, piping, measuring coupling, proximity switch, etc.).



Bosch Rexroth recommends using lifting slings in order to prevent damage to coated or primed components.

- ▶ Be very careful when transporting the hydraulic cylinder.
- ▶ Read the weight of the hydraulic cylinder (without packaging and without oil filling) off the name plate or, if not specified on the name plate, off the provided package list, the installation drawing or the associated data sheet.



The hydraulic cylinder is supplied without oil filling as standard. Due to the final inspection at Bosch Rexroth, however, there may still be oil residues in the hydraulic cylinder (for deviations, see chapter 6.2 "Storing the hydraulic cylinder").

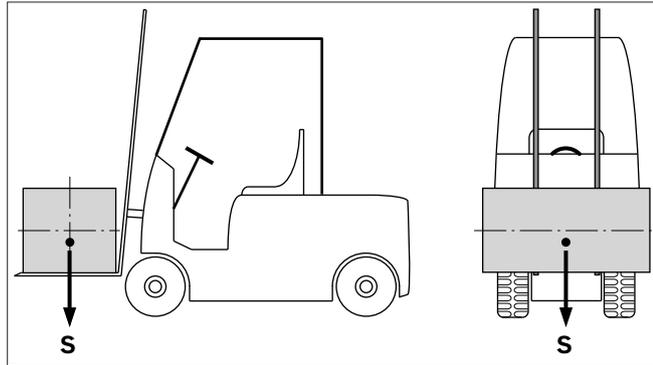
Due to the tolerances, you must expect a weight that is approx. 10% higher than specified on the name plate, the package list, the installation drawing or in the associated data sheet when lifting the hydraulic cylinder.

### 6.1.1 Transporting hydraulic cylinders by forklift truck

To transport the hydraulic cylinder using a forklift, proceed as follows:

1. Move the fork of the forklift under the packaging of the hydraulic cylinder or under the hydraulic cylinder secured for transport.
2. Carefully lift the load for checking the center of gravity position.  
Ensure a stable center of gravity position (S).
3. Make sure that the hydraulic cylinder cannot move out of the intended position.
4. Secure the hydraulic cylinder against the occurring acceleration forces and the related undesired movements of the hydraulic cylinder.

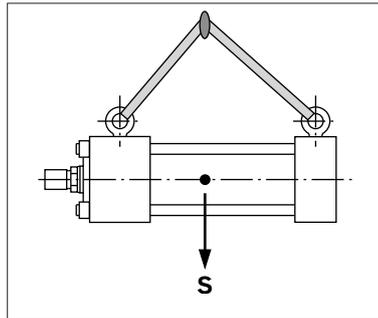
5. During transport, only lift the hydraulic cylinder as far off the floor as necessary for the transport.



**Fig. 8: Transport using a forklift**

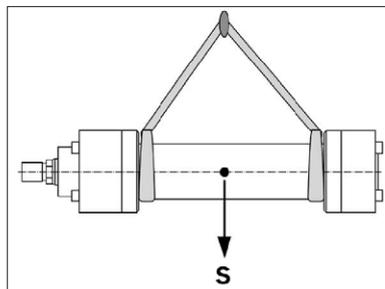
### 6.1.2 Transporting hydraulic cylinders with attachment devices

1. **a)** Fasten the attachment devices at the hydraulic cylinder so that you can safely lift it at a minimum of two points. To do so, select tapped holes on two opposite sides.



**Fig. 9: Transport using ring bolts and lifting slings [1. a)]**

1. **b)** Fasten two lifting slings of equal length at both ends of the cylinder pipe of the hydraulic cylinder by forming loops. Make sure that the lifting slings do not slip to the inside during lifting.



**Fig. 10: Transport using lifting slings only [1. b)]**



Observe the admissible lifting capacity of the attachment devices (ring bolts or load stands, lifting slings or load chains).

Only fasten approved attachment devices, such as load stands and lifting slings with sufficient lifting capacity at the attachment point at the hydraulic cylinder.

2. Slowly and carefully lift the hydraulic cylinder to check the center of gravity position (S). Ensure a stable center of gravity position.
3. Make sure that the hydraulic cylinder cannot move out of the intended position and that the lifting slings do not slip during lifting.
4. During transport, only lift the hydraulic cylinder as far off the floor as necessary for the transport.

### 6.1.3 Manually transporting the hydraulic cylinder

- ▶ If possible, use suitable lifting aids like lifting slings.

## 6.2 Storing the hydraulic cylinder

### 6.2.1 Corrosion protection applied at the factory

**External preservation** Rexroth hydraulic cylinders are primed as standard with a primer (color gentian blue RAL 5010) of at least 40 µm.

With hydraulic cylinders and attachment parts, the following surfaces are not primed or painted:

- All fit diameters and connection surfaces to the customer side
- Sealing surfaces for line connection
- Sealing surfaces for flange connection
- Connection surface for valve mounting
- Inductive proximity switches
- Position measurement system
- Measuring couplings
- Spherical / plain bearing
- Grease nipples

The surfaces that are not primed are protected by means of corrosion protection oil. For short-time storage in dry rooms with constant temperature, the priming is sufficient as external preservation.

**Internal preservation** By default, hydraulic cylinders from Rexroth are tested with mineral oil according to DIN 51524, part 2. The oil film remaining in the interior after the test provides for short-time internal corrosion protection.

The line connections are closed after the test by blanking plugs or flange covers.

### 6.2.2 Storage conditions

**Table 6: Storage conditions**

| Denomination                                    | Range            |
|---|------------------|
| Temperature range                               | -20 °C to +50 °C |
| Relative air humidity (no condensation)         | Max. 65%         |
| UV protection                                   | 100%             |
| Condensation                                    | None             |
| Additional ozone formation close to the storage | None             |

### 6.2.3 Storage times

The maximum storage times indicated in Table 7 "Storage times" are achieved with internal preservation, i.e. testing, flushing and filling of hydraulic cylinders with corrosion protection oil.

#### **Storage of filled hydraulic cylinders**

When storing hydraulic cylinders filled with hydraulic fluid, a pipeline from the line connection of the annulus area to the line connection of the piston chamber has to be attached by the customer.

Hydraulic cylinders filled with hydraulic fluid must not be exposed to direct solar radiation or other heat sources as the increase in the ambient temperature would cause the hydraulic pressure in the hydraulic cylinder to increase.

**Table 7: Storage times**

| Storage conditions   | Packaging                        | Protective agent | Max. storage time in months |                               |
|--|----------------------------------|------------------|-----------------------------|-------------------------------|
|  |                                  |                  | Test with protective agent  | Filling with protective agent |
| Storage in dry rooms at a constant temperature                                     | For carriage overseas            | A                | 12                          | 24                            |
|  | Not for carriage overseas        | A                | 9                           | 24                            |
|  |                                  | B                | 12                          | 24                            |
| Outdoor storage (protected against damage, exposure to sunlight and water ingress) | For carriage overseas            | A                | 6                           | 12                            |
|  |                                  | B                | 9                           | 24                            |
|  | Not for carriage overseas        | A                | -                           | 12                            |
|  |                                  | B                | 6                           | 24                            |
|  | Inspection with protective agent | A = Mineral oil  |                             |                               |
| Filling with protective agent  | B = Corrosion protection oil     |                  |                             |                               |

**Storage for more than six months**

In case of storage of more than six months, the surface of the hydraulic cylinder must be coated or treated with corrosion protection oil. Unprotected parts like fitting surfaces or mechanical interfaces must be protected with corrosion protection oil.

- ▶ Protect spherical bearings and fitting surfaces from humidity.
- ▶ In case of storage with corrosion protection oil, completely empty the hydraulic cylinders before the commissioning.
- ▶ Since deformation of seals cannot be ruled out, arrange for the seals to be replaced.



Also observe chapter 10.5 "Replacing wear parts."

- ▶ Contact Bosch Rexroth for the preservation and later commissioning of the hydraulic cylinder if the hydraulic cylinder must be stored for a period exceeding the durations specified in Table 7 "Storage times."



Improper storage may lead to embrittlement of seals, resinification of corrosion protection oil and potential leakage.

**6.2.4 Inspection during the storage time**

In order for the hydraulic cylinder to remain in perfect condition during the storage time, the following conditions have to be met:

- ▶ During the storage period, subject the hydraulic cylinder to a careful inspection (at least once per year), see Table 7 "Storage times." While doing so, observe in particular the following:
  - External preservation: visual inspection for damage and rust formation
  - Hydraulic fluid: control with regard to oxidation or acidification
  - Inspection and lubrication of maintenance-free spherical bearings
  - Inspection of the preservation of fitting surfaces of mechanical interfaces
- ▶ Extend and retract the hydraulic cylinder several centimeters at least once per year in order to prevent the seals from bonding. Depending on the results, you may have to take corrective measures, see chapter 15 "Troubleshooting."



In order to prevent damage to the seals, Bosch Rexroth recommends rotating hydraulic cylinders by 90° around the cylinder axis every six weeks, unless they are stored vertically.

**6.2.5 Information on packed hydraulic cylinders**

- ▶ If you open the packaging for control purposes, you have to close it again carefully.
- ▶ In case of packaging for carriage overseas, enclose a new drying agent.

## 7 Assembly



For lifting and moving during installation of the hydraulic cylinder into the machine/system, the same rules apply as already described in chapter 6.1 "Transporting the hydraulic cylinder."

### 7.1 Unpacking the hydraulic cylinder

- ▶ Remove the packaging of the hydraulic cylinder.
- ▶ Check the delivery for completeness using the delivery documents.
- ▶ Carry out a visual inspection for transport damage at the hydraulic cylinder.
- ▶ Dispose of the packaging material in accordance with the national regulations in your country and/or your company-internal specifications/procedures.

### 7.2 Installation conditions

#### 7.2.1 Cleanliness

- ▶ It is imperative to ensure absolute cleanliness.
  - Install the hydraulic cylinder and all other parts used free from dirt.
  - Make sure that the installation surfaces are clean.
  - Also check the hydraulic lines.
  - Before the installation, clean the lines and all connection surfaces from dirt, scales, chips, etc.
  - Use residue-free industrial wipes for cleaning.
  - Ensure welded pipes are bare inside and that they are flushed.

#### 7.2.2 Information on fastening

#### Mounting surfaces

Mounting surfaces at machines and systems must be designed so that any torsion of the hydraulic cylinder in the installed condition is avoided. The hydraulic cylinder must be installed so that unwanted lateral loads / radial forces during operation are avoided. Stroke length, loads and cylinder mounting must be observed in order to avoid bending and buckling in every stroke position (extract from: DIN EN ISO 4413: 2011-04/5.4.2.1).

- ▶ Fasten the hydraulic cylinder so that the load acts axially on the center line of the hydraulic cylinder.
- ▶ Make sure that the hydraulic cylinder and particularly the piston rod are not damaged during installation.
- ▶ Also, make sure that the spherical bearing, trunnion mounting, foot and flange mounting brackets can accommodate any forces that occur.

- ▶ When installing the hydraulic cylinder with foot mounting into the machine/system, make sure to attach an additional fitting strip, if applicable, in order to reduce the shear stress of the mounting screws.
- ▶ When installing hydraulic cylinders and assemblies with spherical or plain bearings, it has to be ensured that when installing the bolt, the bolt and/or spherical or plain bearing are not damaged (cool down the bolt during installation, if necessary).
  - Design the bolts for cylinder mounting according to the forces to be expected.
  - Only use the genuine bolts when using accessories like clevis brackets.



Bosch Rexroth recommends limiting the swivel/tilting angles at the spherical bearings on the customer side in order to prevent undesired force effects on the mounting elements.

In the fastening of the hydraulic cylinder at the machine/system, the following enumerations must be kept to a minimum (extract from: DIN EN ISO 4413: 2011-04/5.4.2.7):

- Excessive deformation of the hydraulic cylinders due to pushing or pulling load
- Introduction of lateral or bending loads
- Swiveling velocities in the trunnion assembly requiring continuous external lubrication

#### Fittings

- ▶ Observe the installation information of the fitting manufacturers.
  - Bosch Rexroth recommends fittings with a soft seal at the screw-in stud (pipe thread DIN EN 228-1, metric thread DIN ISO 261).
  - Sealants like hemp and kit are not admissible as they may cause contamination and thus malfunctions.
  - Connection lines must satisfy all applicable European and/or international standards.

#### Line connections

- ▶ Ensure that line connections "A (piston chamber)" and "B (annulus area)" are correctly connected to the hydraulic cylinder.

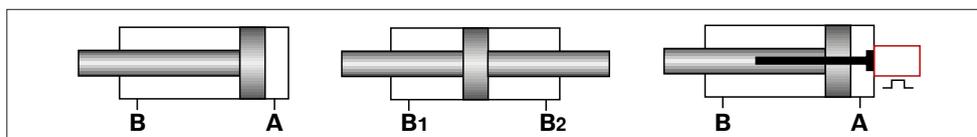


Fig. 11: Line connections

- Connection lines**
- ▶ In case of connection lines at inlets or outlets of the hydraulic cylinder, e.g. for connecting components, observe the relevant standards and country-specific rules.
  - ▶ When designing the connection lines, assume the possible hydraulic and mechanical maximum loads considering the necessary safety allowances that may crop up in the different operating conditions. The latter have to be determined separately, like e.g. pressure peaks.
  - ▶ The connection lines should be dimensioned in accordance with the performance data in the hydraulic circuit diagram.
  - ▶ Moreover, observe the operating and maintenance instructions of the components and connection lines.

### 7.3 Assembling the hydraulic cylinder



**Unintended motion of the hydraulic cylinder during installation!**

Risk of injury! Danger of crushing! Damage to property!

- ▶ Keep the hydraulic cylinder in a stable and secured position until it is fixedly mounted.
- ▶ Take care during the installation process.

- ▶ During installation into the machine system remember that damage to the hydraulic cylinder, particularly to the piston rods and mounting faces, may reduce the functionality / service life.
- ▶ When assembling swivel heads or other customer connection elements at the hydraulic cylinder, screw these parts to the stop.



Do not use connection elements to set installation differences.

- ▶ Only remove the protective devices, e.g. blanking plug, when establishing the corresponding connection.

### 7.3.1 Installing a tie rod cylinder with foot mounting (MS2) into the system/machine

When installing tie rod cylinders with foot mounting, it may – depending on the version – be necessary to screw out the throttle valve and/or the measuring coupling of the adjustable end position cushioning in order to install the tie rod cylinder into the machine/system using mounting screws.

In this connection, proceed as follows:

1. Loosen the complete throttle valve of the adjustable end position cushioning and/or the measuring coupling of the tie rod cylinder using a corresponding tool, such as socket or open-end wrench, before installation into the machine/system.
2. Fasten the tie rod cylinder at the foot mounting and in the machine/system using mounting screws.
3. Afterwards, re-install the throttle valve of the adjustable end position cushioning and/or the measuring coupling in the intended position (as supply state) using a manual torque wrench. Please observe the tightening torques  $M_A$  listed in Table 8 for this purpose.

**Table 8: Tightening torques / wrench sizes**

| Component  | Piston Ø<br>in mm | $M_A$ in Nm<br>(+/- 5%) | Wrench size<br>SW |
|--|-------------------|-------------------------|-------------------|
| Throttle valve of the adjustable end position cushioning, both sides | 25 ... 63         | 4.5                     | 7                 |
|  | 80 ... 200        | 20                      |                   |
| Measuring coupling, on both sides                                    | 25 ... 63         | 18                      | 17                |
|  | 80 ... 200        | 40                      |                   |

### 7.3.2 Hydraulically connecting the hydraulic cylinder

The hydraulic connection has to be established according to the specifications of the hydraulic circuit diagram.

### 7.3.3 Connecting the power supply

Components that might be available such as proximity switches or position measurement systems must be connected to the power supply according to the specifications of the electric circuit diagram.

# 8 Commissioning

## 8.1 First commissioning

### 8.1.1 Before commissioning

- ▶ Check the machine/system for leak-tightness.
- ▶ Check the safe condition of electric and hydraulic lines.
  - Make sure that all flange screws and fittings of the line connections are tightened to the stop.

### 8.1.2 Flushing the machine/system

When flushing the machine/system, the hydraulic cylinder must be disconnected from the machine/system since it will otherwise be permanently damaged by dirt particles. Take measures in order to exclude the hydraulic cylinder from the flushing procedure of the machine/system.



In case of questions or doubt, please contact the Bosch Rexroth Service or your local Bosch Rexroth distribution organization in any case.

For the addresses, please refer to chapter 17.1 "List of addresses."

Before commissioning the hydraulic cylinder, it has to be ensured that the maximum admissible cleanliness class of the hydraulic fluid, see chapter 8.1.3 "Filling the hydraulic cylinder with hydraulic fluid and bleeding it," for the machinery/system is not exceeded.

As many different situations are imaginable due to different installation situations, hydraulic functions of the hydraulic cylinder or the hydraulic system options, please observe chapter 8.1.3 "Filling the hydraulic cylinder with hydraulic fluid and bleeding it."

### 8.1.3 Filling the hydraulic cylinder with hydraulic fluid and bleeding it

#### General information



The basic contamination of the hydraulic fluid filled must not exceed the maximum admissible cleanliness class according to ISO 4406 (c) class 20/18/15. The cleanliness classes specified for the components (like valves) must be adhered to in hydraulic systems.



If you are not sure how your hydraulic cylinder is to be filled and bled, please contact the Bosch Rexroth Service or your local Bosch Rexroth distribution organization.

For the addresses, please refer to chapter 17.1 "List of addresses."



Note the following points when filling and bleeding the hydraulic cylinder:

- Fill and bleed the hydraulic cylinder in several switching processes (retraction and extension of the hydraulic cylinder) and through the measuring coupling, if necessary.
- Observe the relevant hydraulic circuit diagram and the safety instructions of these operating instructions, see chapter 2.6 "Product- and technology-dependent safety instructions" and 3 "General information on damage to property and damage to the product."
- Only operate the hydraulic cylinder at low pressure until the bleeding process of the hydraulic system is completed.
- Observe the hydraulic fluid level in the tank and top up, if necessary.

#### Procedure

For filling and bleeding the hydraulic cylinder, proceed as follows (the starting point is a retracted hydraulic cylinder in horizontal position):

- 1.** Make sure that the hydraulic circuit diagram of the machinery/system is easy to read.
- 2.** Place a suitable collecting tank to collect the hydraulic fluid leaking during the bleeding procedure.
- 3.** Open the bleed screw on the piston rod side (at the cylinder head) of the depressurized hydraulic cylinder (see following figures).
- 4.** If a measuring coupling is available, connect a hose to the measuring coupling of the hydraulic cylinder and bleed the hydraulic cylinder via the measuring coupling (the measuring coupling has an internal check valve).
- 5.** Set the hydraulic system so that the pressure at the hydraulic cylinder does not exceed 5 bar.
- 6.** Switch the hydraulic system on.

7. Switch the control valves so that the hydraulic cylinder wants to retract at very low velocity (pressure at the piston rod side).
  - The annulus area on the piston rod side of the hydraulic cylinder is now filled with hydraulic fluid and the existing air exits via the bleed port or the measuring coupling.

As soon as the hydraulic fluid does not contain air any more, i.e. it exits free from bubbles, the hydraulic cylinder has been sufficiently bled.

This is, however, only true if the bleeding point is at the highest point.

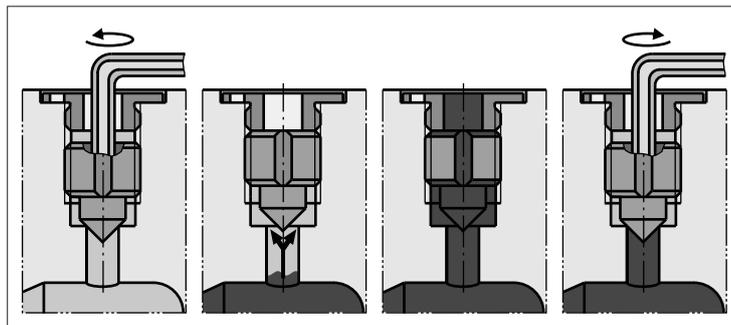


8. Then, switch off the hydraulic system and close the bleed screw.
9. After bleeding of the hydraulic fluid at the piston rod side of the hydraulic cylinder, bleed the base side in the same way.

Afterwards, the hydraulic cylinder is ready for operation.

### Information on different cylinder designs

#### Filling and bleeding hydraulic cylinders with safety vent



**Fig. 12: Filling and bleeding hydraulic cylinders with safety vent**

1. Opening: Screw out the bleeding bolt maximally to the stop, to the safety plug screw using a hexagon wrench.
2. Filling: Fill the hydraulic cylinder with hydraulic fluid, air and hydraulic fluid exit.
3. Bleeding: The air has been completely removed from the hydraulic cylinder if the hydraulic fluid exits without bubbles.
4. Closing: Tighten the bleeding bolt to the internal stop using a hexagon wrench until no more hydraulic fluid leaks.

### Filling and bleeding hydraulic cylinders with internal hexagon bleed screw

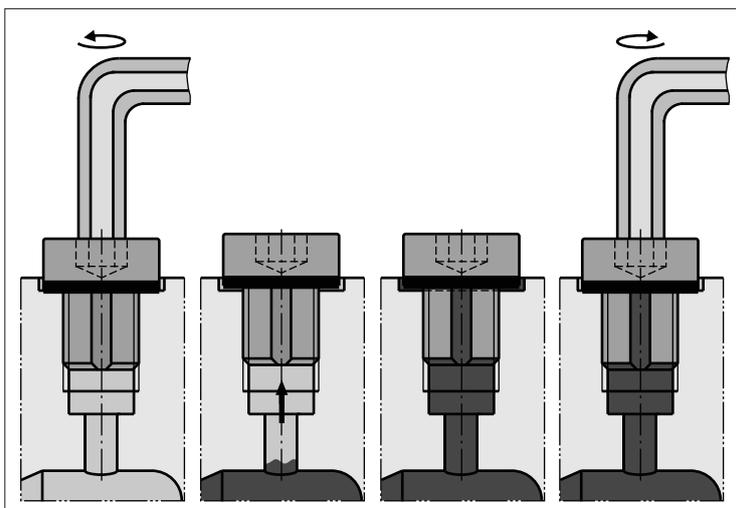


Fig. 13: Filling and bleeding hydraulic cylinders with internal hexagon bleed screw

1. Opening: Screw out the internal hexagon bleed screw half a rotation using a hexagon wrench.
2. Filling: Fill the hydraulic cylinder with hydraulic fluid, air and hydraulic fluid exit.
3. Bleeding: The air has been completely removed from the hydraulic cylinder if the hydraulic fluid exits without bubbles.
4. Closing: Screw in the internal hexagon bleed screw using a hexagon wrench and close it in an oil-tight manner.

### Filling and bleeding hydraulic cylinders with check valve

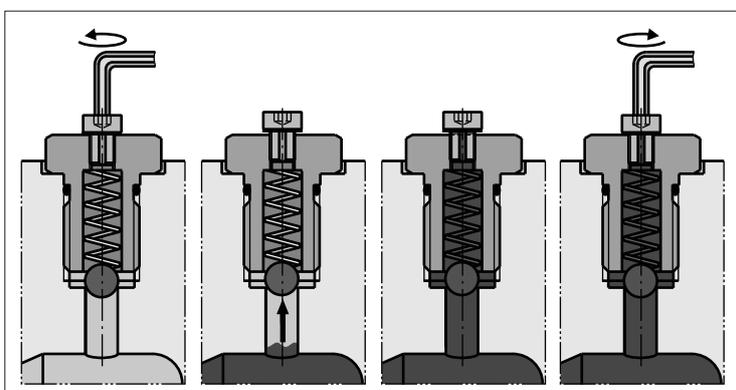


Fig. 14: Filling and bleeding hydraulic cylinders with check valve

1. Opening: Screw out the internal hexagon bleed screw at the check valve half a rotation using a hexagon wrench.
2. Filling: Fill the hydraulic cylinder with hydraulic fluid, air and hydraulic fluid exit.
3. Bleeding: The air has been completely removed from the hydraulic cylinder if the hydraulic fluid exits without bubbles.
4. Closing: Close the internal hexagon bleed screw at the check valve in an oil-tight manner using a hexagon wrench.

### Filling and bleeding hydraulic cylinders with measuring coupling

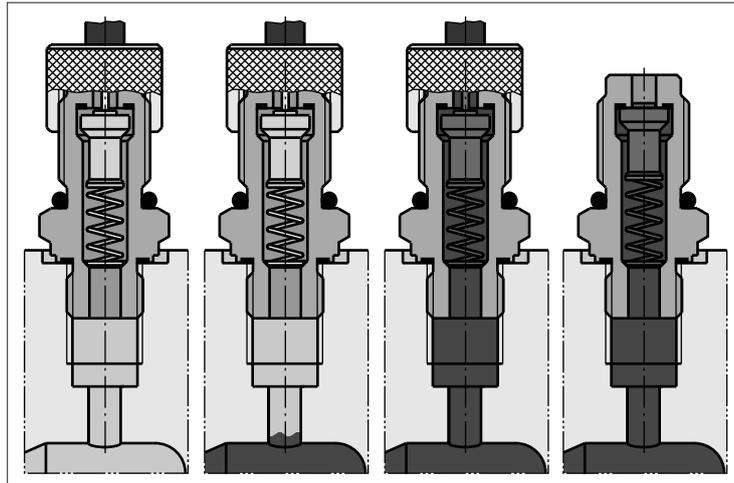


Fig. 15: Filling and bleeding hydraulic cylinders with measuring coupling

1. Connect the pressure tapping hose: Screw off the end cap of the measuring coupling and screw the pressure tapping hose with fitting onto the measuring coupling to the stop.
2. Filling: Fill the hydraulic cylinder with hydraulic fluid. Air and hydraulic fluid exit and are discharged via the pressure tapping hose.
3. Bleeding: The air has been completely removed from the hydraulic cylinder if the hydraulic fluid exits without bubbles.
4. Closing: When you screw off the pressure tapping hose, the spring presses the valve poppet back onto its seat. Screw the end cap of the measuring coupling on again in order to protect the device from dirt and damage.

#### 8.1.4 Commissioning the hydraulic cylinder

After the hydraulic cylinder has been installed into the machine/system, the hydraulic system has been filled with the correct hydraulic fluid and the hydraulic cylinder has been bled correctly, you can commission the hydraulic cylinder.



#### Problems during commissioning

Observe the product-specific and system-specific operating instructions!

Identical hydraulic cylinders may exhibit different functions or malfunctions after the installation into a machine/system due to machine-/system-specific conditions (weights, velocities, friction, electrical control, command value presetting, etc.).

## 8.2 Setting the end position cushioning

### **! WARNING**

#### **Throttle valve flying out in an uncontrolled manner!**

Danger to life! Risk of injury! Damage to property!

- ▶ Do not screw out the complete throttle valve.
- ▶ Only set the throttle valve by adjusting the throttle bolt.

With the adjustable end position cushioning, it has to be observed that the full damping capacity can only be achieved when the throttle valve is closed. In this connection, you must always comply with the specifications in the valid data sheets.



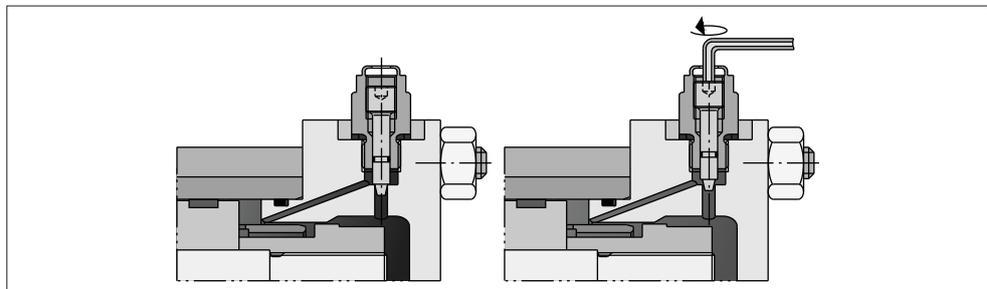
The information on the data sheet is contained in the name plate of the hydraulic cylinder (see chapter 5.3 "Product identification") or on the Internet at: [www.boschrexroth.com/mediadirectory](http://www.boschrexroth.com/mediadirectory)

Hydraulic cylinders are supplied with highest effect of the end position cushioning, i.e. the throttle bolt of the throttle valve is screwed in to the stop and closes the oil channel of the adjustable end position cushioning. By screwing the throttle bolt out, the velocity in the area of the end position cushioning is increased.



Consider the higher end stop velocity.

#### **Adjustable end position cushioning with locked throttle bolt**



**Fig. 16: Adjustable end position cushioning with locked throttle bolt**

- ▶ To change the factory setting of the end position cushioning, screw out the throttle bolt by means of a hexagon wrench until the desired damping behavior is achieved. Due to the locking, the throttle bolt cannot be completely screwed out of the throttle valve.

### Adjustable end position cushioning with countered throttle bolt

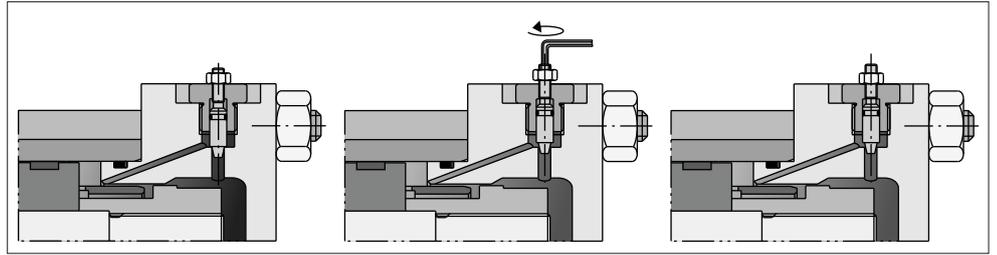


Fig. 17: Adjustable end position cushioning with countered throttle bolt

- ▶ Loosen the lock nut of the throttle valve using a suitable tool (ring or open-end wrench) and screw out the throttle bolt by means of a hexagon wrench until the desired damping behavior is achieved.
- ▶ Afterwards, tighten the lock nut of the throttle valve. By tightening the lock nut, you position the throttle bolt.

### 8.3 Proximity switch

Inductive proximity switches are used as reliable end position control for hydraulic cylinders. The proximity switch which is high-pressure resistant up to 500 bar works in a contactless manner. Consequently, it is wear-free. The proximity switch has been set at the factory. The switching distance must not be adjusted. The lock nut of the proximity switch is marked at the factory using sealing wax. On versions with proximity switch, the cylinders are equipped with proximity switches on both sides.



Adjustment of the proximity switches at the hydraulic cylinder will invalidate the warranty claim!

### 8.4 Re-commissioning after standstill

- ▶ When re-commissioning, observe the commissioning information, see chapter 8.1 "First commissioning."

## 9 Operation

### 9.1 Operating conditions

Information on the operation of the hydraulic cylinders can only be provided in connection with the machine or system.

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

Hydraulic specialists can find the operating parameters and function of the hydraulic cylinders in the relevant data sheets, see chapter 1.2 "Required and amending documentation," and the relevant order-specific documentation.

# 10 Maintenance and repair

According to DIN 31051, maintenance means all measures for maintaining and restoring as well as for determining and evaluating the actual condition of technical systems.

The tasks are divided into three partial areas:

- Maintenance: Measures for maintaining the command condition
- Inspection: Measures for determining and evaluating the actual condition
- Repair: Measures for restoring the command condition

These measures help ensure the functionality of the hydraulic system and the hydraulic cylinders.

Rexroth hydraulic cylinders have the structural prerequisites for high functionality (operational safety, life cycle). They only require little maintenance work. The latter is, however, indispensable in order to ensure functionality. Experience has shown that 70% of the faults and damage in hydraulic systems and hydraulic cylinders are indirectly caused by the hydraulic fluids. Consequently, the primary inspection and maintenance task is the examination and completion of measures to maintain the functionality (condition, cleanliness class) of the hydraulic fluid.



Ensure that no foreign substance can enter the hydraulic circuit.

## 10.1 Cleaning and care

- ▶ Ensure absolute cleanliness in all work.
- ▶ Before loosening fittings and components, clean the external environment using industrial residue-free wipes.
- ▶ Close all openings with suitable blanking plugs to prevent dirt from entering the hydraulic system.

## 10.2 Inspection

Bosch Rexroth recommends documenting the inspection results

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

## 10.3 Maintenance schedule



For the scope and time intervals of maintenance and inspection work, please refer to the system manufacturer's maintenance schedule.

## 10.4 Maintenance

After a new hydraulic system has been commissioned, regular checks are required in order to determine whether the hydraulic cylinder functions perfectly.

During these checks, you must particularly watch out for the following:

- Possible hydraulic fluid leaks at the line connections.
- Check with regard to "interference marking" or mechanical damage at the surface of the stroke-related piston rod running surface. Interference marking may be an indication of a contaminated hydraulic system or of inadmissible traverse loads of the hydraulic cylinder.
- Damage to the coatings.
- Possible leakage at the cylinder head or cylinder base.
- Extreme temperatures and contamination shorten the life cycle of the hydraulic cylinder. You should therefore provide for regular maintenance of the entire hydraulic system. For possible amending requirements, please refer to the installation and maintenance instructions of the hydraulic system and the data sheets of the hydraulic fluids used.
- The replacement intervals for wear parts like e.g. seals and guide sockets depend on the relevant application, the application conditions, temperatures, etc. and on the hydraulic fluid quality. No fixed time has been determined for the exchange of these wear parts.
- Leakage in the area of the piston rod and the cylinder head is an indication of the necessity to exchange the wear parts.
- Keep the piston rod free from contamination. According to the operating requirements, the lubrication intervals for spherical bearings, trunnion mountings, etc. must already be determined in the project planning of the hydraulic cylinder. The lubrication intervals are contained in the system manufacturer's maintenance schedule.

### 10.4.1 Piston rod maintenance

In order to prevent corrosion at the piston rod, the piston rod should always be retracted during standstill times.

If hydraulic fluids are used in hydraulic cylinders, such as HFD-R (phosphoric acid ester), HFA (oil-water-emulsion) or HFC (water glycol), the following works are to be completed during maintenance:

- General information**
- ▶ The piston rod must always be covered by a protective oil film.
    - Ensure compatibility with the medium used.
  - ▶ In areas with high humidity or considerably varying conditions (e.g. temperature variations or outdoor installation), check the protective oil film on a weekly basis. In areas with moderate conditions, the protective oil film may be checked on a monthly basis.

The protective oil film is required in order to ensure corrosion protection of the exposed piston rod. For this purpose, the following preventative maintenance has to be performed:

**Preventative piston rod maintenance**

- 1.** If possible, the preventative maintenance work should be completed in a dry environment.
  - Use fresh water to loosen and remove all salt, sand and machining residues as well as other contamination from the piston rod.
  - Do not use steam cleaners or high-pressure water jets.
- 2.** The preventative maintenance can only be completed with a clean and dry piston rod. If there is not sufficient time in order to let the piston rod dry completely, let it dry as long as possible before the maintenance. Repeat the maintenance as soon as you have sufficient time.
- 3.** Soak an industrial residue-free wipe with protection oil of low viscosity. Using the cloth, apply the protection oil to the entire piston rod.

**Immediate maintenance for hydraulic cylinders and piston rods after contact with chemicals**

After contact with chemicals, an immediate maintenance cycle has to be completed as fast as possible. The immediate maintenance comprises the following works:

- 1.** Loosen and remove all chemical residues using a suitable cleaning agent.
- 2.** Perform the work steps of the preventative maintenance.

**Maintenance frequency**

The preventative maintenance described here should be completed before the first commissioning of the hydraulic cylinder or after standstill times.

**10.4.2 Maintenance of spherical bearings requiring maintenance**

With spherical bearings requiring maintenance, the re-lubrication has to be effected periodically, either by means of a grease nipple or a lubrication hole in the housing. Use standard, anti-corrosion, pressure-resistant lubricants. Coordinate the suitable lubricant as well as the lubrication intervals with the lubricant manufacturer.

**10.5 Replacing wear parts**



In case of questions or doubt, please contact the Bosch Rexroth Service or your local Bosch Rexroth distribution organization in any case. The addresses can be found in the chapter 17.1 "List of addresses." Seal kits can be ordered and advice requested online in the Rexroth Store on our homepage [www.boschrexroth.com](http://www.boschrexroth.com) under Quick Links.

Wear parts in hydraulic cylinders are seals, guide belts and guide sockets. Those are excluded from the warranty!

Opening the hydraulic cylinder will invalidate the warranty claim!

## 10.6 Repair

Bosch Rexroth offers a wide range of repair services for your hydraulic cylinder. Send an inquiry to Bosch Rexroth Service or to your local Bosch Rexroth distribution organization. For the addresses, please refer to chapter 17.1 "List of addresses."

## 10.7 Spare parts

### **NOTICE**

#### **Malfunction of the system/machine due to the use of incorrect spare parts!**

Damage to property!

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



For ordering spare parts or in case of consultation requests, visit the Rexroth Store on our homepage [www.boschrexroth.com](http://www.boschrexroth.com) under Quick Links or directly contact your local Bosch Rexroth distribution organization. For the addresses, please refer to chapter 17.1 "List of addresses."

Opening the hydraulic cylinder will invalidate the warranty claim!

- ▶ Please provide the following information when ordering spare parts:
  - Material number and order number of the hydraulic cylinder (name plate)
  - Item number of the relevant component according to the spare parts list

# 11 Decommissioning

## 11.1 Preparing for decommissioning

### **WARNING**

#### **Danger caused by flying parts or oil leakage!**

Risk of injury! Damage to property!

- ▶ Make sure that the hydraulic cylinder has been depressurized.
- ▶ Depressurize any hydro-pneumatic accumulators on the oil side.
- ▶ Unload the hydraulic cylinder from external forces.
- ▶ Observe the specifications of the machine/system manufacturer and the machine/system end-user.

For decommissioning and disassembly the hydraulic cylinder from the hydraulic system, the following must be observed:

1. For safety reasons, do not loosen/disconnect any lines, connections and components as long as the machine/system is under pressure. Unload the hydraulic cylinder, switch off pumps and electric motors and secure the machine/system against restarting.
2. Provide collecting tanks that are large enough to accommodate the total hydraulic fluid volume.

## 11.2 Decommissioning the system

- ▶ Drain the hydraulic fluid into the collecting tanks provided.
- ▶ In this connection, ensure complete draining of the lines and actuators.
- ▶ If necessary, carry out bleeding measures, see chapter 8.1.3  
"Filling the hydraulic cylinder with hydraulic fluid and bleeding it."

## 11.3 Preparing for disassembly

Before starting the works at the hydraulic cylinder, take the following measures:

- ▶ Provide for an easily readable assembly drawing / spare parts list.
- ▶ Provide for clean, professional tools and a clean workplace.
- ▶ Due to the tolerances, when lifting the hydraulic cylinder, expect the weight to be approx. 10% higher than specified on the name plate, the packing list, the installation drawing or in the associated data sheet.
- ▶ Make sure that dirt cannot enter the hydraulic system when removing the hydraulic cylinder. Seal the connection points with plastic plugs specially designed for this purpose (if applicable, the original supplied) or replacement steel plugs, or flange covers.
- ▶ Make sure that the hydraulic cylinder, the attached components and particularly the piston rod are not damaged.
- ▶ Use a stable support for putting down the hydraulic cylinder and the removed parts.

### **11.4 Disassembly of the product**

For lifting and moving during removal of the hydraulic cylinder from the machine/system, the same rules apply as already described in chapter 6.1 "Transporting the hydraulic cylinder."

- ▶ When removing from the machine/system, please note that damage to the hydraulic cylinder and the attached components may impair the functionality / service life.
- ▶ Attach protective devices such as blanking plugs at the line connections directly after removal from the system in order to prevent contamination particles from getting into the hydraulic cylinder.

### **11.5 Preparing the hydraulic cylinder for storage/further use**

- ▶ For storing the hydraulic cylinder for later use, complete the necessary steps according to chapter 6.2 "Storing the hydraulic cylinder."

## 12 Disassembly and replacement

### 12.1 Preparing for disassembly

Before starting the disassembly of the hydraulic cylinder, the general conditions according to chapter 11 "Decommissioning" have to be met. In order for the spare parts of the hydraulic cylinder to be exchanged, it must be disassembled.

### 12.2 Disassembly of the product

For disassembly, you should proceed as follows:

- ▶ Drain the hydraulic fluid from the hydraulic cylinder that is still installed to the greatest possible extent. The hydraulic cylinder can be completely drained once it has been removed.
- ▶ Disassemble the cylinder head.
  - Pull the cylinder head off the pipe and let the rest of the hydraulic fluid run out of the pipe.
  - Afterwards, pull the piston rod out of the hydraulic cylinder, using lifting slings, if necessary.
  - Put the piston rod onto the especially prepared, stable blocks that prevent the piston rod from rolling away (wooden blocks, prism-shaped square timber or blocks with soft, rotating support, without contamination).
- ▶ If necessary, remove the lock between cylinder eye and piston rod and plug the key into the intended bore or area. Put a lifting sling around the cylinder eye so that it will get caught if it gets loose from the piston rod. Now turn the piston rod by means of the key until the cylinder eye gets loose from the piston rod.
- ▶ Fasten lifting slings at the cylinder head and slowly push it off the piston rod (if it is difficult to push the cylinder head over the piston rod, you must rotate the latter slowly).
- ▶ Remove the seals and thoroughly remove contamination such as residual adhesive, dust particles, etc. from the cylinder head using a de-greasing agent. Also clean the piston rod thoroughly as every dirt particle may damage the seal during the assembly. Also remember to clean the piston rod thread, the cylinder eyes and the protective cover.

### 12.3 Exchanging components



In case of questions or doubt, please contact the Bosch Rexroth Service or your local Bosch Rexroth distribution organization in any case. The addresses can be found in the chapter 17.1 "List of addresses." Accessory parts and seal kits can be ordered and advice requested online in the Rexroth Store on our homepage [www.boschrexroth.com](http://www.boschrexroth.com) under Quick Links.

Opening the hydraulic cylinder will invalidate the warranty claim!

## 13 Disposal

- ▶ Dispose of the individual materials according to the legal regulations. Particular attention is necessary when disposing of components with hydraulic fluid residues.
- ▶ Observe the disposal information in the hydraulic fluid safety data sheet.
- ▶ When disposing of electric and electronic components (e.g. position measurement system, proximity switches) observe the country-specific legal provisions and regulations.

### 13.1 Environmental protection

Careless disposal of the hydraulic cylinder, its components and the hydraulic fluid could lead to environmental pollution.

Please observe the following points:

- ▶ Dispose of the product/components in accordance with the national regulations in your country and/or your company-internal specifications.
- ▶ Dispose of the hydraulic fluid according to the legal regulations and moreover observing the safety data sheet of the hydraulic fluid used.

## 14 Extension and modification

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

### **Any declarations shall become invalid**

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

- ▶ In case of questions, please contact Bosch Rexroth or your Bosch Rexroth distribution organization in any case.  
For the addresses, please refer to chapter 17.1 "List of addresses."

# 15 Troubleshooting

## 15.1 How to proceed for troubleshooting

Troubleshooting primarily refers to the replacement of defective components.



Only replace the components mentioned in the spare parts list by new, interchangeable and tested components in original equipment quality.

Regarding the repair of the defective hydraulic cylinder, please contact the nearest Bosch Rexroth service center or directly the headquarters. For the addresses, please refer to chapter 17.1 "List of addresses."

Opening the hydraulic cylinder will invalidate the warranty claim!

After remedy of the actual damage, you should imperatively remove the causes and/or consequential damage as well. After a component failure caused by wear, you must, for example, flush the machine/system and clean and/or change the hydraulic fluid.

**Table 9: Troubleshooting**

| Error  | Possible troubleshooting  | Troubleshooting  |
|--|---|--|
| Stick slip effect  | Air in the hydraulic cylinder   | ▶ Bleed the hydraulic cylinder, see chapter 8.1.3 "Filling the hydraulic cylinder with hydraulic fluid and bleeding it."                           |
|  | Seals are worn  | ▶ Arrange for the exchange of the seals, see chapter 10.5 "Replacing wear parts."  |
|  | Introduced radial forces on piston rod and hydraulic cylinder                     | ▶ Also observe chapter 7.2 "Installation conditions."  |
| Leakage at the piston rod  | Seals are worn  | ▶ Arrange for the exchange of the seals, see chapter 10.5 "Replacing wear parts."  |
|  | Introduced radial forces on piston rod and hydraulic cylinder                     | ▶ Also observe chapter 7.2 "Installation conditions."  |
| Leakage at line connections  | Fittings are loose  | ▶ Securely tighten the fittings to the specified tightening torque.<br>▶ For this, observe the installation drawing or the corresponding standard. |
|  | Seals are worn  | ▶ Arrange for the exchange of the seals, see chapter 10.5 "Replacing wear parts."  |
| Hydraulic cylinder does not show any damping effect / moves hard into the end position | The setting of the end position cushioning does not comply with the requirements. | ▶ Set the adjustable end position cushioning, see chapter 8.2 "Setting the end position cushioning."   |

## 16 Technical data



The technical data can be found in the valid data sheets, see list in chapter 1.2 "Required and amending documentation" and in the respective valid order-specific documentation (spare parts list).

The valid data sheets can be found on our website at:  
[www.boschrexroth.com/mediadirectory](http://www.boschrexroth.com/mediadirectory)

# 17 Appendix

## 17.1 List of addresses

**Contacts for service  
and spare parts:** Bosch Rexroth AG  
Industrial Hydraulics Service  
Bürgermeister-Dr.-Nebel-Straße 8  
97816 Lohr am Main  
Germany

Phone: +49 (0) 9352/40 50 60

Email: [service@boschrexroth.com](mailto:service@boschrexroth.com)

For service representatives in your area outside of Germany, please refer to [www.boschrexroth.com](http://www.boschrexroth.com).

**Headquarters:** Bosch Rexroth AG  
Zum Eisengießer 1  
97816 Lohr am Main  
Germany

Phone: +49 (0) 9352/18 0

**For questions  
about the product:** Bosch Rexroth AG  
Online Customer Support

Phone: +49 (0) 9352/40 30 20

Email: [my.support@boschrexroth.com](mailto:my.support@boschrexroth.com)

The addresses of our sales and service network and sales organizations can be found at [www.boschrexroth.com](http://www.boschrexroth.com).

**Bosch Rexroth AG**

Industrial Hydraulics

Zum Eisengießer 1

97816 Lohr a. Main

Germany

Tel. +49 (0) 9352/40 30 20

[my.support@boschrexroth.com](mailto:my.support@boschrexroth.com)

[www.boschrexroth.com](http://www.boschrexroth.com)