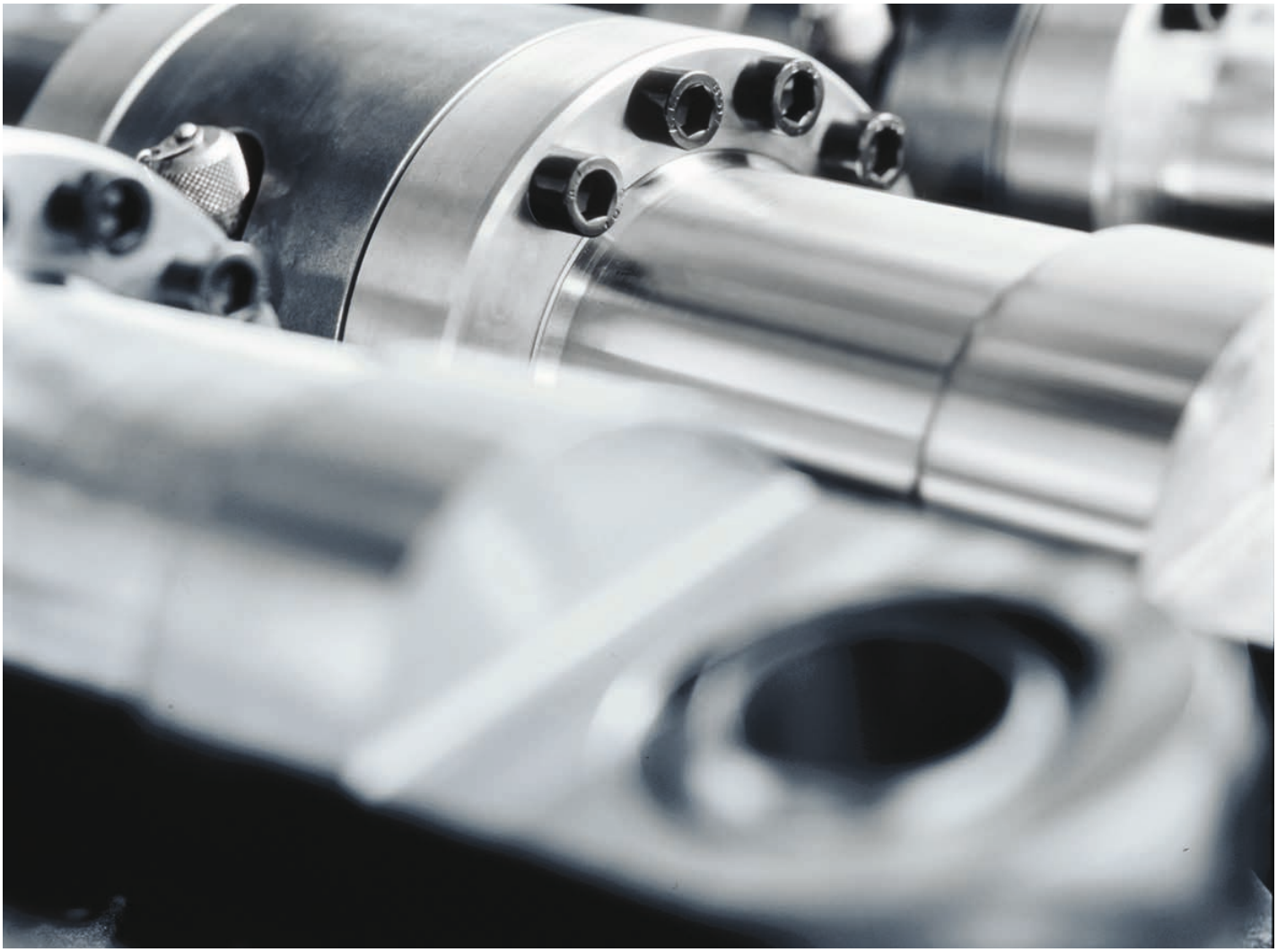
rexroth
A Bosch Company

Hydraulic cylinders

Tie rod design / Mill type
and
mill type for potentially explosive areas

Operating instructions
RE 07100-B/11.19

Replaces: 04.19
English



The data specified 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. Please note that our products are subject to a natural process of wear and aging.

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

The original operating instructions were prepared in German.

DE: Die Inbetriebnahme dieses Produkts darf erst dann erfolgen, wenn Sie diese Betriebsanleitung in einer für Sie verständlichen EU-Amtssprache vorliegen und den Inhalt verstanden haben. Ist dies nicht der Fall, wenden Sie sich bitte an Ihren Bosch Rexroth Ansprechpartner oder die zuständige Servicestelle. Diese finden Sie auch unter www.boschrexroth.com.

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FI: Tämän tuotteen saa ottaa käyttöön vasta kun olet saanut tämän käyttöohjeen ymmärtämälläsi EU-kielellä ja ymmärtänyt sen sisällön. Jos näin ei ole, ota yhteyttä Bosch Rexroth -yhteyshenkilöösi tai vastaavan palvelupisteeseen. Ne löytyvät myös osoitteesta www.boschrexroth.com.

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Contents

1 About this documentation

1.1 Validity of the documentation

This documentation applies to:
- Hydraulic cylinders in mill type and tie rod design
- Hydraulic cylinders in mill type for potentially explosive areas

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 completely and particularly chapter 2 "Safety instructions" and chapter 3 "General information on damage to property and damage to product" before working with the product.

The applicable documentation is the one included with the product at the time of delivery (digital and/or hardcopy).

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/various/utilities/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
🕮	Assembly, commissioning and maintenance of hydraulic systems	07900	Data sheet
	Hydraulic cylinder mill type, series CDL2	17326	Data sheet
	Hydraulic cylinder mill type, series CDM1 / CGM1 / CSM1	17329	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 for potentially explosive areas, series CDH2...XC / CGH2...XC / CSH2...XE	17335-X	Data sheet
	Hydraulic cylinder mill type, series CDH3 / CGH3 / CSH3	17338	Data sheet
	Hydraulic cylinder tie rod design, series CDT3 / CGT3 / CST3	17049	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

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

1.3.1 Safety instructions

In this documentation, safety instructions are given in chapter 2.6 "Product-specific safety instructions" and in chapter 3 "General information on damage to property and damage to product" and whenever 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:

⚠ SIGNAL WORD

Type and source of danger!
Consequences in case of non-compliance
- Hazard avoidance measures
- <Enumeration>

- **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
⚠ DANGER	Indicates a dangerous situation which will cause death or severe injury if not avoided.
⚠ WARNING	Indicates a dangerous situation which may cause death or severe injury if not avoided.
⚠ CAUTION	Indicates a dangerous situation which may cause minor or medium personal injury if not avoided.
NOTICE	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. 2. 3.	Numbered instruction: The numbers indicate that the actions must be carried out one after the other.

1.3.3 Abbreviations

The following abbreviations are used in this documentation:

Table 4: Abbreviations

Designation	Meaning
ATEX	EU Explosion Protection Directive (ATmosphère EXplosible)
EPL	Equipment Protection Level
Ex	Explosion protection mark according to RL 2014/34/EU
ICS	Interactive Catalog System (`www.boschrexroth.com/ICS`)
S	Center of gravity

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 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.

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 system / machine.
According to the Pressure Equipment Directive 2014/68/EU, the hydraulic cylinder is not to be classified as pressure equipment but as 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 only intended for industrial use and not for private use.
Intended use also includes having read and understood this documentation completely, especially chapter 2 "Safety instructions" and chapter 3 "General information on damage to property and damage to product".
Hydraulic cylinders may only be used and applied within the data and specifications included in the valid data sheets.

2.2.1 Intended use in potentially explosive areas

Hydraulic cylinders without Ex marking must not be used and operated in potentially explosive atmospheres.
Only hydraulic cylinders with type designation CDH2...XC | CGH2...XC | CSH2...XE (data sheet 17335-X) with Ex marking (see chapter 5.3 "Product identification") are suitable for use in potentially explosive areas. The products comply with the requirements of the EU explosion protection directive 2014/34/EU for the areas of application determined in Chapter 5.3.1 "Explosion protection marking". They can be used in a potentially explosive area according to the device group and category specified there.

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 intended 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 system / machine (see chapter 7.2 "Installation conditions").

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. An overview over the training contents can be found online at:
www.boschrexroth.com/en/xc/training/training

2.5 General 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 consume any alcohol, drugs or pharmaceuticals that may affect their ability to react.
- Only use accessories and spare parts approved by Bosch Rexroth in order to exclude any hazard 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, please only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product. For example, 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 system or machine) where the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.

2.6 Product-specific safety instructions

The installation of the hydraulic cylinders into the system may - due to the operation of the hydraulic cylinders and the overall system - result in risks which can only be identified and minimized by means of a risk assessment.

⚠ WARNING

Electrostatic charging and spark formation as well as hot surfaces!
Danger to life in the potentially explosive area!

- Before working with the hydraulic cylinder, ensure that no explosive atmosphere can occur during the work.
- By design and operation of the system make sure that the maximum surface temperature from the spherical and plain bearings is not exceeded, e.g. by limiting the swivel angle or frequency and / or lubrication.
- Make sure that the equipotential bonding of the hydraulic cylinder in ATEX version is always connected in order to prevent electrostatic charging. Please observe the information given in the data sheet for ATEX hydraulic cylinder 17335-X and, additionally, for version CSH2...XE the manufacturer operating instructions of the position measurement system.
- In explosive atmospheres, do not forcibly loosen seized parts e.g. due to corrosion or frost.
- When applying additional surface protection (e.g. coating), make sure that the overall layer thickness of the protective structure including condition as supplied may not exceed 200 µm.
- Protect attached components and electrical connections (position measuring system) against mechanical loads (e.g. impacts).

⚠ WARNING

(Pressurized) hydraulic fluid and oil mist leaking!
Danger to life! Risk of injury! Explosion hazard! Risk of fire! Environmental pollution! Damage to property!

- Switch the 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 (like e.g. safety goggles, protective gloves, suitable working clothes, safety shoes).
- Keep open fire and ignition sources away from the hydraulic cylinder.
- Make sure that the grounding (electric welding circuit) during welding work at the system is not lead via the hydraulic cylinder.
- When dealing with hydraulic fluids, you must imperatively observe the notices of the hydraulic fluid manufacturer.

⚠ WARNING

Danger due to pressurized hydraulic cylinder!
Risk of injury! Severe injury when working at systems that have not been stopped!
Damage to property!
- Make sure that the hydraulic cylinder has been completely depressurized.
- Observe the specifications of the system manufacturer and the system end-user.

⚠ 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 at hot surfaces. During or after the 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 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 end-user of the system must:
- guarantee the intended use of the hydraulic cylinder and its components 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 "Caution: 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.

3 General information on damage to property and damage to 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 of the hydraulic cylinder.
- Do not position or place the hydraulic cylinder onto attachment parts.
- Never use the hydraulic cylinder as handle or step. Do not place or position any objects on top of it.

Contamination of the hydraulic fluid by fluids and foreign particles!

Early wear! Malfunctions! 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 8.2 "Flushing the 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.
- Check the compatibility of the various hydraulic fluids and their compatibility with the components and seals. Mixing of hydraulic fluids may occur for example due to hydraulic fluid residues in the hydraulic cylinder.

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 easily inflammable 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, trunnions, 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 lack of 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 pollution 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 ports are closed by means of blanking plugs and/or cover plates. They exclusively serve as protection against contamination of the hydraulic cylinder during transport.

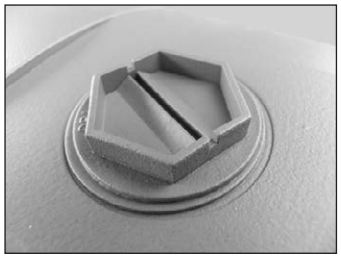

Fig. 1: Blanking plug

Fig. 2: Cover plate

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 cylinder.

5.2 Product description

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 16 "Technical data".

5.2.1 Mill type cylinders

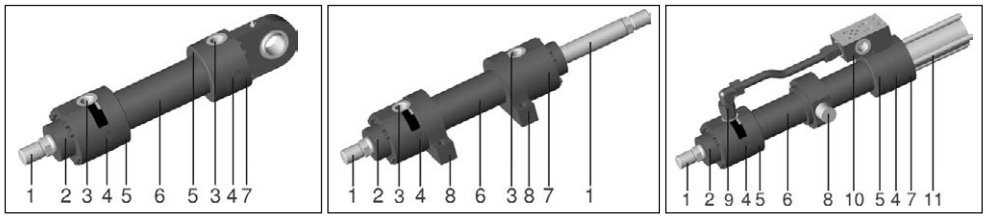

Fig. 3: H series (example: CDH2 / CGH2 / CSH2)

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

5.2.2 Tie rod cylinders

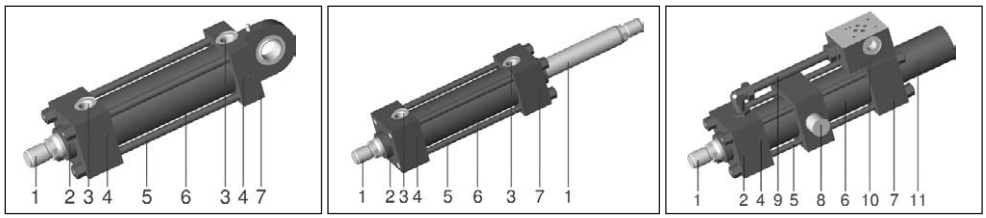

Fig. 4: T3 series (example: CDT3 / CGT3 / CST3)

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

5.3 Product identification

The unit is unambiguously identified by:
- the nameplate (name plate size and labeling depend on the series)
- the product-specific documentation
- the delivery note and accompanying documents

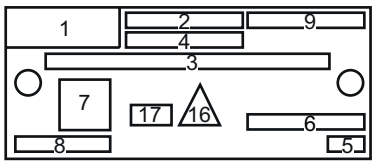

Fig. 5: Name plate example (original size 36 x 15 mm)

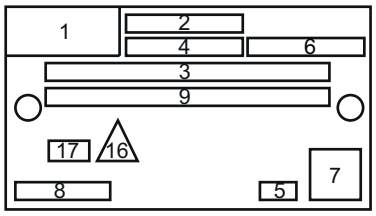

Fig. 6: Name plate example (original size 36 x 20 mm)

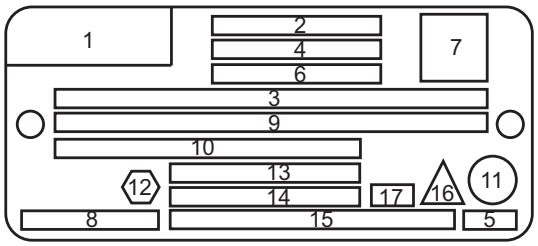

Fig. 7: Name plate example (original size 50 x 22 mm)

1 Manufacturer
2 Material number
3 Type designation
4 Serial number
5 Works number
6 Coded date of production
7 Bosch Rexroth QR code
8 Designation of origin
9 Customer, order or project number
10 Customer material number or additional information (optional)
11 CE mark (only with ATEX version)
12 Explosion protection mark (only with ATEX version)
13 Ex marking 1 (only with ATEX version)
14 Ex marking 2 (only with ATEX version)
15 Manufacturer address
16 Personal stamp of the inspector (or placed on cylinder head)
17 Personal stamp of the assembler (or placed on cylinder head)

5.3.1 Explosion protection marking

According to the directive 2014/34/EU, hydraulic cylinders for potentially explosive areas have the following marking:

Cylinders (without position measurement system) of the type: CDH2...XC / CGH2...XC
- II 2G Ex h IIC T4 Gb
- II 2D Ex h IIIC T135 °C Db

Cylinders (with position measurement system) of the type: CSH2...XE
- II 3G Ex ec IIC T4 Gc
- II 3D Ex tc IIIC T135 °C Dc

The user / machine end-user has to classify potentially explosive areas into zones according to EU directive 1999/92/EC. Table 5 lists the area of application of the hydraulic cylinders named above according to its device group and category and the equipment protection level of the zones.

Table 5: Area of application according to II 2G | II 3G | II 2D | II 3D

for hydraulic cylinders of the type:	Device group according to 2014/34/EU	Device category according to 2014/34/EU	Equipment protection level (EPL)	Area of application Properties	Usable in the following zones according to 1999/92/EC
CDH2...XC CGH2...XC	II	2G	Gb	Potentially explosive areas where explosive gases, mists or vapors (= device group II) are occasionally present. Corresponds to zone 1 according to directive 1999/92/EC. High safety level.	1, 2
CDH2...XC CGH2...XC CSH2...XE	II	3G	Gc	Potentially explosive areas where explosive gases, mists or vapors (= device group II) are normally not present or occur only rarely or short-time. Corresponds to zone 2 according to directive 1999/92/EC. Normal safety level.	2
CDH2...XC CGH2...XC	II	2D	Db	Potentially explosive areas where explosive dust/air mixtures (= device group II) are occasionally present. Corresponds to zone 21 according to directive 1999/92/EC. High safety level.	21, 22
CDH2...XC CGH2...XC CSH2...XE	II	3D	Dc	Potentially explosive areas where an explosive atmosphere due to stirred dust (= device group II) is normally not present or occurs only rarely or short-time. Corresponds to zone 22 according to directive 1999/92/EC. Normal safety level.	22

Type of protection

The type of protection describes the type of measures taken to prevent an ignition in the surrounding explosive atmosphere.

Table 6: Types of protection

Marking	Type of protection	CDH2...XC CGH2...XC	CSH2...XE
Ex h	Structural safety	X	-
Ex ec	Increased safety	-	X
Ex tc	Protected by the housing	-	X

Classification into explosion groups and dust groups

The classification (see tables 7 and 8) is based on the experimentally determined boundary gap width or the minimum ignition current ratio for the explosive atmosphere for which a device may be installed (see IEC 60079-20-1).

The explosion group IIA or dust group IIIA includes less hazardous substances, explosion group IIC or dust group IIIC includes the most hazardous substances. A product allocated to a certain explosion group or dust group may always be used in areas with a lower hazardousness.

Table 7: Examples for the categorization of gases, mists and vapors in explosion groups

Explosion group			Examples for gases, mists and vapors
IIA	IIB	IIC	Acetone, ammonia, petrol, benzene, carbon monoxide, ethylene alcohol, methane, hydrogen sulfide, propane
			Ethylene, city gas, acetaldehyde
			Hydrogen, carbon sulfide, acetylene

Table 8: Examples for the categorization dusts into dust groups

Dust group			Examples for dusts
IIIA	IIIB	IIIC	Flammable fibers
			Non-conductive dust
			Conductive dust

Temperature classes for device group II

The temperature classes provide information about the suitability of a hydraulic product for the use in a certain potentially explosive area due to explosive gases, mists or vapors as well as dusts.

Make sure that the maximum surface temperature of the hydraulic cylinder is below the ignition temperature of the surrounding explosive gas, mist, steam or dust.

Hydraulic product of the device group II, categories 2G and 3G are classified into the temperature classes T1 to T6 according to their maximum surface temperature. For hydraulic products of the device group II, categories 2D and 3D the maximum surface temperature is stated as temperature value [°C].

Table 9: Temperature class for device group II

Temperature class	Maximum permissible surface temperature
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C

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.
- For transporting the hydraulic cylinder, always use several attachment devices and attachment points.
- Do not stand or walk under lifted loads.
- Wear your personal protective equipment such as protective helmet, safety goggles, protective gloves, safety shoes and suitable working clothes.

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.

Uncontrolled extension of the piston rod and lifting of the hydraulic cylinder at attachment parts (subplates, piping, etc.)!
Risk of injury! Damage to property!
- Hydraulic cylinders may only be transported as described in chapter 6.1 "Transporting the hydraulic cylinder".
- During transport, leave the plastic 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 (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 requirements:

- 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.
- For the weight of the hydraulic cylinder (without packaging and oil filling), please refer to the name plate or the supplied package list, or the installation drawing, if required. Due to the tolerances, you must, during lifting, anticipate a weight of the hydraulic cylinder exceeding the one specified in the installation drawing or in the data sheets by 10%.

Hydraulic cylinders are delivered without oil filling. Due to the final test at Bosch Rexroth, there may, however, still be oil residues in the hydraulic cylinder (for variations refer to 6.2 "Storing the hydraulic cylinder").

6.1.1 Transport using a forklift

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.

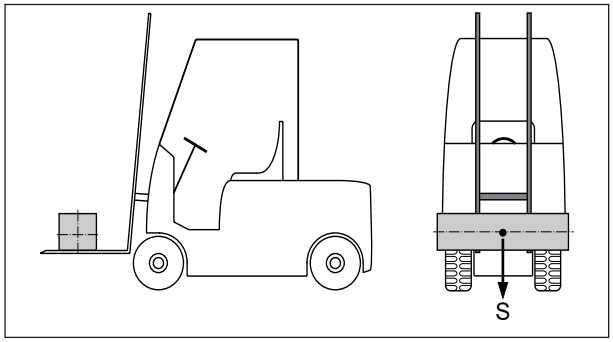

Fig. 8: Transport using a forklift

6.1.2 Transport using 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.

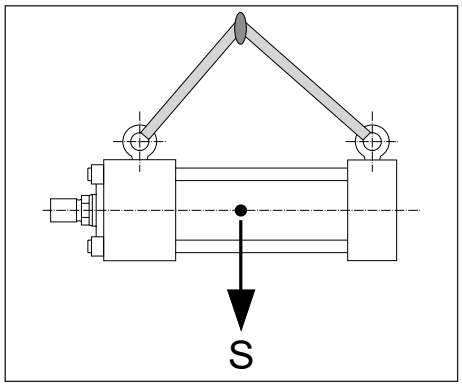

Fig. 9: Transport using ring bolts and lifting slings [1. a)]

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.

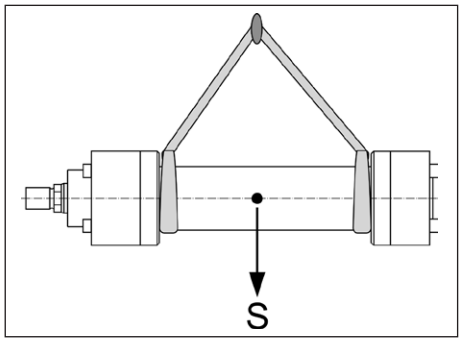

Fig. 10: Transport using lifting slings only [1. b)]

Observe the admissible lifting capacity of the attachment devices (ring bolts or load stands, lifting slings or load chains). Only fasten approved attachment devices with sufficient lifting capacity at the attachment points of the hydraulic cylinder.

2. Carefully lift the hydraulic cylinder to check 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 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 Manual transport

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

6.2 Storing the hydraulic cylinder

6.2.1 Corrosion protection applied at the factory

Primer coat

By default, hydraulic cylinders by Rexroth are primed with a primer coat (color gentian blue RAL 5010) of minimum 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 coupling
- Spherical / plain bearing
- Lubricating 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 base coat is sufficient as external preservation.

Internal preservation

By default, hydraulic cylinders 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 plug screws or flange covers.

Table 10: Storage conditions

Denomination	Area
Temperature range	–20 °C to +50 °C
Relative air humidity (no condensation)	Max. 65%
UV protection	100%
Condensation	None
Additional ozone formation near storage place	None

6.2.2 Storage times according to table 11

According to the values specified in table 11 "Storage times" the internal preservation of the hydraulic cylinder is achieved by testing / flushing or filling with corrosion protection oil.

Storing oil-filled hydraulic cylinders

When storing hydraulic cylinders filled with oil, a pipeline from the line connection of the annulus area to the line connection of the piston chamber has to be attached on the customer side.
Hydraulic cylinders filled with oil must not be exposed to direct solar radiation or other heat sources as due to the increase in the ambient temperature, the hydraulic pressure in the hydraulic cylinder increases.

Table 11: Storage times

Storage conditions	Packaging	Protective agent	Max. storage time in months	
			Test with protective agent	Filling with protective agent
Storage in dry rooms with 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
Test with protective agent		A = mineral oil		
Filling with protective agent		B = corrosion protection oil		

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 cylinder before the commissioning.
- Since deformations of seals cannot be excluded, initiate the exchange of the seals, see 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 in table 11 "Storage times".

In case of improper storage, seals may embrittle and the corrosion protection oil may resinify.

6.2.3 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 11 "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 or mechanical interfaces
- During the storage period, extend and retract the hydraulic cylinder several centimeters (at least once per year), see table 11 "Storage times", 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 at the seals, Bosch Rexroth recommends rotating the hydraulic cylinders by 90° every six weeks unless they are stored vertically.

6.2.4 Information on packed hydraulic cylinders

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

7 Assembly

To lifting and moving during installation of the hydraulic cylinder into the system / machine, 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 the country of use and/or your company-internal specifications.

7.2 Installation conditions

Mounting surfaces at systems / machines 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 during operation are avoided. Stroke length, load and mounting must be observed in order to avoid bending and kinking 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. The counter bearings for spherical bearing, trunnion, foot and flange mounting must be able to absorb the occurring forces.
- When installing the hydraulic cylinder with foot mounting into the system / machine 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 etc.

Bosch Rexroth recommends limiting the swivel angles / 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 system, the following enumeration 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

- Make sure that the "A - piston chamber" and "B - annulus area" line connections are not interchanged when connecting the hydraulic cylinders.

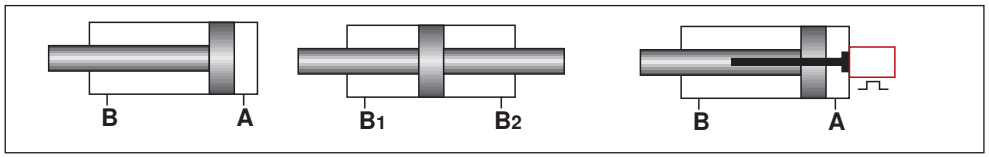

Fig. 11: Installation conditions

7.3 Assembling the hydraulic cylinder

CAUTION

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.
- Be careful when assembling the hydraulic cylinder.

- During installation into the system / machine remember that damage at the hydraulic cylinder particularly at 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 the swivel head to the stop.

Do not use connection elements to set installation differences.

- Remove the protective device like e.g. plug screws only 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 system / machine 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 system / machine.
2. Fasten the tie rod cylinder at the foot mounting and in the system / machine 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 MA listed in table 12 for this purpose.

Table 12: Tightening torques / wrench sizes

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

⚠ WARNING

Improper electrical connection in potentially explosive areas!

Danger to life! Explosion hazard!

- Carry out the electrical connections in the system properly and carefully.
  For version CSH2...XE, please observe additionally the operating instructions by the manufacturer for the position measurement system.
- Connect the equipotential bonding to the ATEX hydraulic cylinder.
  Please observe the information given in the data sheet for ATEX hydraulic cylinders 17335-X.

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

⚠ WARNING

Excess of the maximum surface temperature!
Danger to life in the potentially explosive area!
- Carry out a first lubrication of the hydraulic cylinder and its accessory parts (e.g. non-maintenance-free spherical bearings) at the (flat) lubricating nipples provided with standard anti-corrosion and pressure-resistant lubricants.

- Before the installation, clean all connection surfaces from dirt, scales, chips, etc. For that purpose, use industrial residue-free wipes.
  Particularly welded pipes must be blank on the inside and flushed.
- Observe the installation information of the fitting manufacturer.
  - Fittings with a soft seal at the screw-in stud are recommended (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.
  - Hose lines must satisfy all applicable national and/or international standards.
- The hydraulic lines should be dimensioned in accordance with the performance data in the hydraulic circuit diagram.
- Line connections: Check whether all flanges screws and fittings have been tightened.
- Check the system for leak-tightness.

8.2 Flushing the system

When flushing the system, the hydraulic cylinder must be disconnected from the system. Take measures in order to exclude the hydraulic cylinder when flushing the system.

In case of questions or doubt, please contact the Bosch Rexroth Service or your local Rexroth distribution organization in any case.
For the addresses, please refer to: `www.boschrexroth.com`

Before commissioning of the hydraulic cylinder, it has to be ensured that the maximum admissible cleanliness class of the hydraulic fluid (see chapter 8.3 "Filling the hydraulic cylinder with hydraulic fluid and bleeding it") for the overall 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 8.3 "Filling the hydraulic cylinder with hydraulic fluid and bleeding it".

8.3 Filling the hydraulic cylinder with hydraulic fluid and bleeding it

The basic contamination of the hydraulic fluid used 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.

- 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 3 "General information on damage to property and damage to the product".

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: `www.boschrexroth.com`

- Only operate the hydraulic cylinder at low pressure until the bleeding process of the hydraulic system is completed.
- Observe the fluid level in the oil tank and top up, if necessary.

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

1. Provide for an easily readable circuit diagram of the entire system.
2. The hydraulic fluid leaking during the bleeding procedure must be collected in a corresponding tank.
3. Open the bleed screw on the piston rod side (at the cylinder head) of the depressurized hydraulic cylinder (see following figures).
4. If there is a measuring coupling, you can bleed the hydraulic cylinder by connecting a corresponding hose to the measuring coupling (the measuring coupling has an internal check valve).
5. Switch the hydraulic system on.
6. 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.
7. 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.
10. Afterwards, the hydraulic cylinder is ready for operation.

- Only operate the hydraulic cylinder at low pressure until the bleeding process of the hydraulic system is completed.
- Observe the fluid level in the tank and top up, if necessary.

Filling and bleeding hydraulic cylinders with safety vent

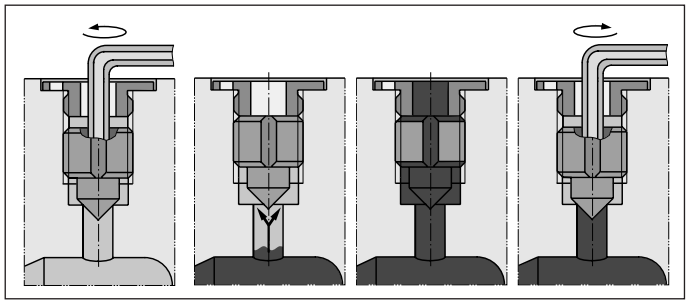

Fig. 12: Filling and bleeding hydraulic cylinders with safety vent

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

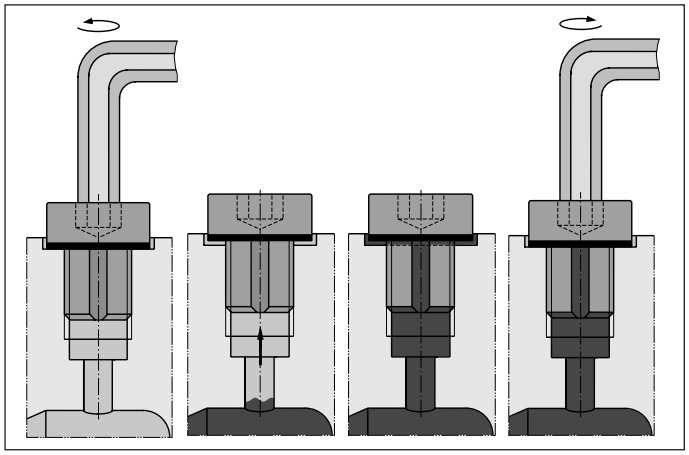

Fig. 13: Filling and bleeding hydraulic cylinders with internal hexagon bleed screw

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

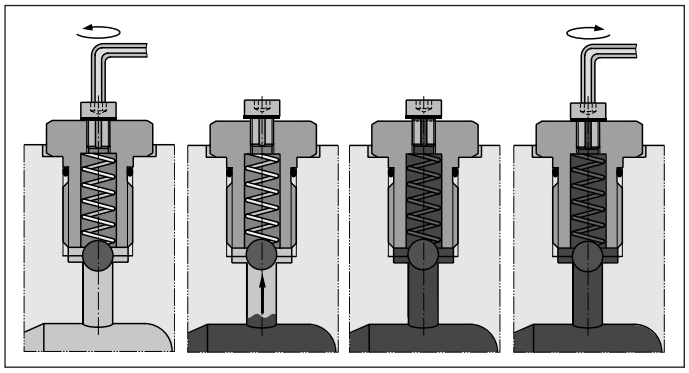

Fig. 14: Filling and bleeding hydraulic cylinders with check valve

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

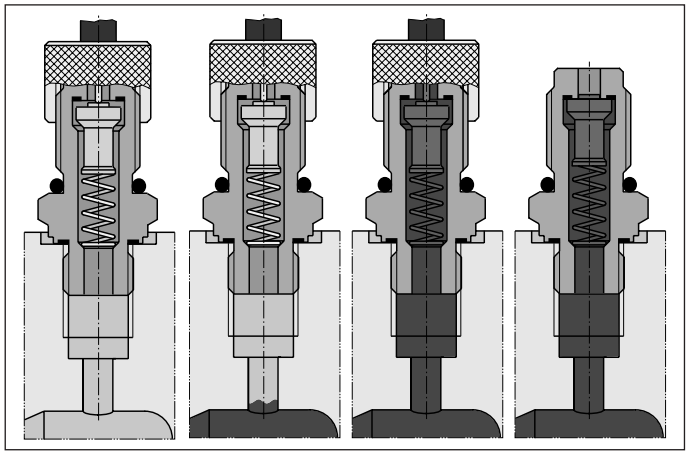

Fig. 15: Filling and bleeding hydraulic cylinders with measuring coupling

1. Connecting 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.

8.4 Commissioning the hydraulic cylinder

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

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

Problems during commissioning

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

8.5 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/various/utilities/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

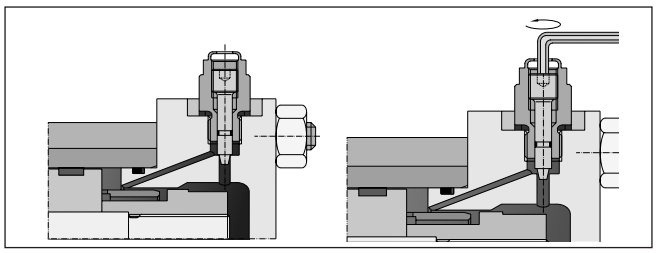

Fig. 16: Adjustable end position cushioning with locked throttle bolt

- 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

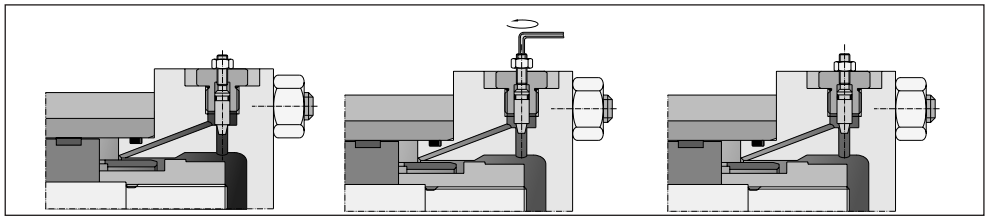

Fig. 17: Adjustable end position cushioning with countered throttle bolt

- 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.

8.6 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!

8.7 Re-commissioning after standstill

- In the re-commissioning, observe the commissioning instructions, see chapter 8.1 "First commissioning".

9 Operation

Information on operating the hydraulic cylinder can only be provided in connection with the system or machine.

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

Operating parameters, function and logics of the hydraulic cylinder are available to hydraulic specialists in the relevant valid data sheets and the relevant valid product-specific documentation (see chapter 16 "Technical data").

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

Due to these measures, the functionality of the system and the hydraulic cylinder can be ensured.
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.
- Cover all openings with suitable protective caps in order to prevent dirt from penetrating the system.

10.2 Inspection

Document 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 and repair

⚠ WARNING

Ignition risk of hydraulic cylinder with Ex marking due to insufficient maintenance or repair!

Danger to life! Explosion hazard! Risk of injury!

- Check regularly that the dust layer thickness of dust accumulations on the hydraulic cylinder stays below 5 mm or is regularly removed.
- Check regularly that the equipotential bonding at the hydraulic cylinder remains functional and connected at all times.
- Check after repair and maintenance works that the equipotential bonding at the hydraulic cylinder is connected.

Exceeding the maximum surface temperature due to lack of lubrication of spherical bearings requiring maintenance!

Danger to life in the potentially explosive area!

- In this connection, observe chapter 10.4.2 "Maintenance of spherical bearings requiring maintenance". Lubrication must be guaranteed at all times!

After a 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, trunnions, 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 lubricating 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 Bosch Rexroth or your local Rexroth distribution organization.
For the addresses, please refer to: www.boschrexroth.com

Hydraulic cylinders include the following wear parts: 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. Please send any enquiry to your nearest Bosch Rexroth service center or directly contact the headquarters.
For the addresses, please refer to: www.boschrexroth.com

10.7 Spare parts

NOTICE
Malfunction of the machine due to the use of incorrect spare parts! Damage to property! ▶ Only use components listed in the product-specific documentation (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 our homepage www.boschrexroth.com/ICS or directly contact your local Bosch Rexroth distribution organization.
For the addresses, please refer to: www.boschrexroth.com

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 parts list

11 Decommissioning

11.1 Preparing for decommissioning

⚠ WARNING

Danger caused by parts flying around or oil leakage!
Risk of injury! Damage to property!
- Make sure that the hydraulic cylinder has been depressurized.
- Depressurize hydraulic accumulators that might exist on the oil side.
- Unload the hydraulic cylinder from external forces.
- Observe the specifications of the system manufacturer and the system end-user.

For decommissioning and disassembly of the hydraulic cylinder from the industrial valve, the following must be observed:
1. For safety reasons, you must not loosen any lines, connections and components as long as the system is under pressure. Unload the hydraulic cylinder, switch off pumps and electric motors and secure the system against restarting.
2. Provide collecting tanks that are large enough to accommodate the total hydraulic fluid volume.

11.2 Decommissioning

- Drain the hydraulic fluid into the collecting tanks provided.
- In this connection, ensure complete draining of the lines and actuators.
- Carry out bleeding measures, if necessary, see chapter 8.3 "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 and suitable tools and a clean workplace.
- During the disassembly, no dirt must penetrate the hydraulic system. Seal the connection points using steel plugs, flange covers or special plastic plugs suitable for that purpose.
- 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 system / machine, the same rules apply as already described in chapter 6.1 "Transporting the hydraulic cylinder".

- When removing the hydraulic cylinder from the system / machine, please note that damage at the hydraulic cylinder and the attached components may impair the functionality / service life.
- Attach protective devices such as plug screws 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 re-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. Provide for good preparation. 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 largest possible extent. The hydraulic cylinder can be completely drained as soon as 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 stuck 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 when exchanging defective components, please contact Bosch Rexroth or your local Bosch Rexroth distribution organization in any case. For the addresses, please refer to: www.boschrexroth.com

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 safety data sheet of the used hydraulic fluid.
- For disposal of electric and electronic components (e.g. position measurement system, proximity switches) comply with the country-specific legal provisions and regulations.

13.1 Environmental protection

Careless disposal of the hydraulic cylinder, its components and the hydraulic fluid leads 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.

Declarations 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 local Rexroth distribution organization in any case. For the addresses, please refer to: www.boschrexroth.com

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 parts list (spare part list) by new, interchangeable and tested components in original equipment quality.

In case of questions regarding the repair of the defective hydraulic cylinder, please contact Bosch Rexroth or your local Bosch Rexroth distribution organization in any case.
For the addresses, please refer to: `www.boschrexroth.com`

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 system and clean and/or change the hydraulic fluid.

Table 13: Troubleshooting

Error	Possible cause of error	Troubleshooting
Stick-slip effect	Air in the hydraulic cylinder	▶ Bleed the hydraulic cylinder, see chapter 8.3 "Filling the hydraulic cylinder with hydraulic fluid and bleeding it".
	Seals are worn	▶ Initiate the exchange of the seals, see chapter 10.5 "Replacing wear parts".
	Introduced radial forces on piston rod and hydraulic cylinder	▶ In this connection, observe chapter 7.2 "Installation conditions".
Leakage at line connections	Fittings are loose	▶ Tighten the fittings firmly applying the corresponding tightening torque.
	Seals are worn	▶ Initiate the exchange of the seals, see chapter 10.5 "Replacing wear parts".
Leakage at the piston rod	Seals are worn	▶ Initiate the exchange of the seals, see chapter 10.5 "Replacing wear parts".
	Introduced radial forces on piston rod and hydraulic cylinder	▶ In this connection, observe chapter 7.2 "Installation conditions".
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 8.5 "Setting the end position cushioning".

16 Technical data

In this context, please refer to the applicable data sheets (listed in chapter 1.2 "Required and amending documentation") and the corresponding product-specific documentation (parts list) for hydraulic cylinders.
For applicable data sheets, please refer to our website at:
www.boschrexroth.com/various/utilities/mediadirectory/
or at
https://www.boschrexroth.com/en/xc/products/product-groups/industrial-hydraulics/cylinders

17 Appendix

Please refer to www.boschrexroth.com for addresses of our sales and service network.

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