# Operating instructions for hydraulic cylinders

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## 1 General remarks

These instructions relate to the hydraulic cylinders produced by the Büter Group.

Before our hydraulic cylinders are put into operation, account must always be taken of the following information and the supplementary information contained in the descriptions of the pressure equipment and the design drawings, along with technical limit values and dimensions, as well as a bill of materials where applicable. Further information may need to be taken into account.

The diversity of product types that we manufacture on a customer-specific basis and their varying usage mean that this document can make no claim to be exhaustive and that the risk assessment carried out by the customer must always take account of the individual purpose/application and of external factors. In this context, readers are explicitly referred to § 10, “Machine Directive”, of our General Terms and Conditions of Sale and Delivery.

Please note that the guidance relating to the Machinery Directive 2006/42/EC and the Pressure Equipment Directive 2014/68/EU makes it clear that hydraulic cylinders do not fall within the scope of application of these directives. Accordingly, these directives are not directly applicable to the “hydraulic cylinder” product.

Nevertheless, we will on request issue a declaration of incorporation pursuant to the Machinery Directive 2006/42/EC that is equivalent to the previous manufacturer’s declaration for partly completed machinery (under the former Machinery Directive 98/37/EC). We satisfy the requirement to provide assembly instructions by issuing the technical documentation at the time of order approval (design drawing with technical limit values and dimensions, as well as a bill of materials where applicable).

Accordingly, we are also not permitted to issue declarations of conformity for our hydraulic cylinders or to affix a CE marking.

The customer must take account of the safety-relevant standard DIN EN ISO 4413 for hydraulic systems and of other standards where applicable. Furthermore, account must be taken of the contents of standard EN 14121-1 (EN 1050) in relation to risk assessment.

The next section provides information on possible hazards, or rather safety instructions in relation to reasonably foreseeable circumstances, with a view to minimising the risk of personal injury and damage to property as a result of the customer’s use of hydraulic systems.

We reserve the right to make technical changes/ improvements.

We reserve the right to supply you the rest quantities of the frame orders.

## 2 Safety instructions

There is a risk of crushing or trapping depending on how moving parts are attached. Potential crushing or trapping points must be made safe by the customer using structural measures in the form of fixed guards.

It must be ensured that system faults cannot result in hazards to persons or property. This applies in particular when hydraulic cylinders are used in any vehicles or equipment circulating on public roads, as well as in lifting devices for persons. It is particularly important to take account of factors due to acceleration, braking, or lifting and holding masses.

System faults can cause loads supported by or associated with the moving parts to fall. Standing within the range of motion or beneath moving loads is therefore prohibited.

The customer therefore has sole responsibility for the assessment and safe operation of all hydraulic circuits realised using our hydraulic cylinders and of the associated valves are.

The operation of hydraulic circuits for the hydraulic locking of moving parts is the sole responsibility of the customer. In particular, the need for an (additional) locking mechanism must be investigated and implemented by the customer where applicable.

If an assessment indicates that a hydraulic cylinder's performance fails to comply with the regulations, the cylinder must immediately be rendered inoperative and secured against further use.

Pressure peaks and pressure fluctuations must not result in hazards. The maximum operating pressure must not be exceeded.

The customer must ensure that buckling is prevented in all lifting positions.

Shear forces on the hydraulic cylinders must be avoided.

Torsion on the hydraulic cylinders must be avoided.

In the case of differential cylinders, master/slave cylinder pairs, and hydraulic cylinders with end position cushioning, account must be taken of potential pressure intensification based on the area ratios.

## 3 Start-up/operation

The machine or partially completed machine into which the hydraulic cylinder is installed must not be started up until the machine or partly completed machine into which the equipment is installed satisfies the provisions of the Machinery Directive. Furthermore, the customer must take account of the following points:

- Installation and start-up must only be carried out professionally by an instructed and trained fitter or by appropriate operating and maintenance personnel.
- Personal protective equipment must always be worn.
- The hydraulic cylinder is pressurised during operation. The operating pressure must be protected with a safety device.
- Contaminated fluid must not be used. To this end, filtration of the working fluid is strongly recommended.
- Pipes and connections must be rinsed before start-up.
- It must be ensured that the hydraulic cylinder and the entire hydraulic system are vented.
- The system must not be operated without a complete set of hydraulic and electric lines connected.
- The risk of fire due to electrical components must be avoided.
- The customer must take measures in the system's emergency shut-off system to prevent potential hazards resulting from the hydraulic cylinder, such as measures to counter the risk of oil squirting out of the hydraulic line if this is ruptured.
- There is a risk of burns due to temperatures that can arise on the surface of the hydraulic cylinder and the attached components.
- The customer must ensure that all components mounted on the hydraulic cylinder or joined to it are attached in such a way that they do not come loose independently as a result of impacts or vibrations. This also applies to external travel stops.
- In designing and operating travel stops or end position cushioning, the customer must consider the effects of decelerating masses.
- The customer must ensure that the materials and surface treatment of piston rods and other components on the cylinder are designed to minimise wear, corrosion and foreseeable damage due to impacts. We must be notified of corresponding parameters.
- The customer must protect piston rods from foreseeable damage such as nicks, scratches, corrosion, etc.

- Following installation, the customer must verify correct connection in order to prevent malfunction.
- Where welding work is carried out on parts after installation, care must always be taken to prevent earthing via the piston rod.
- In the case of hydraulic cylinders with an integrated electronic position detection system, the customer shall ensure static discharge prior to installation in order to avoid signal errors and damage to the electronics.
- The customer must have a correct electrical connection established by an instructed and trained fitter or by appropriate operating and maintenance staff.
- Breakages of the control leads for sensors or valves, or defects in these components, can lead to uncontrolled movements or incorrect feedback depending on external conditions and loading. The customer must plan safeguards in relation to this.
- Defective regulation or control (including due to wear, for example) can lead to uncontrolled or jerky movements or jamming of the piston rod. The customer must plan appropriate safeguards.
- Wear on sealing elements and valves can lead to uncontrolled or jerky movements or jamming of the piston rod. The customer must plan appropriate safeguards.
- The customer shall provide a hardware-based safeguard in the circuit design in order to avoid malfunctions or unexpected start-up in the event of faults in regulation or control.
- The customer shall ensure the EMC-compliant installation of the hydraulic cylinders with integrated sensors and/or valves in order to avoid signal errors.
- The customer must ensure that a pressure loss or a critical drop in pressure, possibly caused by leakage, does not result in a risk to persons or damage to the machine.
- The customer must take measures to minimise the risk due to noise emissions.
- Hydraulic oil escaping due to leakage results in a slipping hazard.
- In particular, the customer must ensure compliance with limit values and tolerances in respect of humidity, electrical voltage, atmospheric pressure, and sources of contamination, vibration, fire, explosions or other hazards.
- The customer must ensure that corresponding emergency equipment is available.
- The customer is responsible for the maintenance and operation, as well as the arrangement and installation, of the components and hydraulic systems in order to ensure their stability and safety in the workplace.

The hydraulic cylinders must only be operated for the intended use. Modifications must be approved by the manufacturer. The specified permissible values for pressure, force, piston speed and temperature, etc. must not be exceeded under any circumstances (see description of pressure equipment/drawing). Only the specified working fluids may be used (mineral oil-based as a rule, HL

or HLP oils). Changes of working fluid are only permitted with our approval. The change of working fluid must not adversely affect the safety and service life of the pressure equipment.

## 4 Transport and storage

Hydraulic cylinders should be stored in a dry, dust-free room.

The connections must be sealed in a dust-proof manner during storage and transport.

When hydraulic cylinders are stored for a longer period of time, it is advisable to fill them with mineral oil or with a suitable fluid providing corrosion protection. The information on the associated data sheet must be taken into account here!

Do not hang hydraulic cylinders by the cylinder eye brackets/connections, as this can lead to unintended extension of the piston rods.

Do not transport hydraulic cylinders with the piston rod extended, as this may lead to damage to the surface of the piston rod.

External threads must be protected during transport.

Suitable priming and paintwork are to be applied at the customer's premises if the machine has been delivered in an untreated condition (without paintwork or priming). This must be done with the oil connections securely sealed.

## 5 Maintenance and inspection

In general, hydraulic cylinders are maintenance-free. Lubrication of the bearing positions on the connections must be ensured if necessary.

However, as a precautionary measure, we would like to point out that maintenance and inspection of the entire hydraulic system must be carried out at regular intervals, especially in order to verify that everything is connected correctly and to rule out leaks.

The pressure equipment must be depressurised before opening. If pipes carrying ingoing and outgoing fluids have not been detached, these must be removed for safety reasons.

Soft seals are wearing parts. If their condition requires replacement, a seal kit replacement must be carried out. The seal kit replacement must always involve replacing all of the sealing elements. Please contact us if you have any questions on the specific procedure for the various product types.

**Warning:** Hydraulic cylinders are high security products. They may only be repaired by trained specialists.

## 6 FMEA

Below, we have compiled a list of possible causes for a range of faults relating to the handling and operation of hydraulic cylinders following delivery to the customer, so that these faults can be avoided as far as possible. However, because of the varying applications of our product types, it is not possible to consider the effect of the faults or the cost of possible damage. Nevertheless, serious risks to the safety of persons and property must be expected in the event of failure to take account of this information in particular cases. It is therefore essential that this information be referred to before handling and operating the hydraulic cylinders. This list does not claim to be exhaustive.

| Fault | | | Causes |
|---|---|---|---|
| Static leak | Dynamic leak | Functional defect | |
| x | x | | Damage to piston rod in the form of points of impact |
| x | x | | Ridging on piston rod due to bending |
| x | x | | Welding contact due to earthing via piston rod |
| x | x | x | Welding contact due to earthing via cylinder barrel |
| x | x | | Paint on piston rod because not fully retracted during painting |
| x | x | | Adhesive tape residues on piston rod |
| x | x | | Piston rod starting to rust |
| x | x | | Corrosion due to extended piston rod in unfavourable conditions |
| x | x | x | Environmental hazards due to dust/sea air/stone fall/mud/impacts/vibration/chemicals |
| | | x | Piston rod bent due to high level of buckling |
| x | x | | Damage to chromium plating due to welding spatter |
| x | x | x | Axial cracking in cylinder barrel due to pressure peaks |
| x | x | x | Corrosion in cylinder barrel |
| x | x | x | Sealing element damaged by shavings/dirt/contamination of working fluid |
| x | x | x | Contamination in tank/pipe/oil connection |
| x | x | x | Sealing element damaged due to exposure to excess temperatures |
| x | x | x | Sealing element extruded due to pressure peaks |
| x | | x | Bleed screw not sealed correctly |
| | | x | Piston rod eye bracket widened/split due to overloading |
| | | x | Oil connection thread damaged during transport/forced rupture |
| | | x | Sealing surface on oil connection damaged |
| | | x | Press welded oil connectors broken off due to impact stress |
| x | | x | Incorrect installation torque used on oil connection |
| x | x | x | Piston seal damaged due to flow cavitation (air in hydraulic system) |
| x | x | | Rod U-ring damaged due to flow cavitation (air in hydraulic system) |
| x | x | | Piston rod/guide jam due to shear forces/torsion |
| x | x | x | Piston/cylinder barrel jam due to shear forces/torsion |
| | | x | Cylinder stiff due to overloading with shear forces/torsion |
| x | x | | External damage to wiper ring |
| | | x | Plug connection damaged/faulty electrical connection |
| | | x | Leaky valve due to contamination |