

Original operating instructions

TOX[®] Powerpackage line-X

Type X-S, X-K

craft

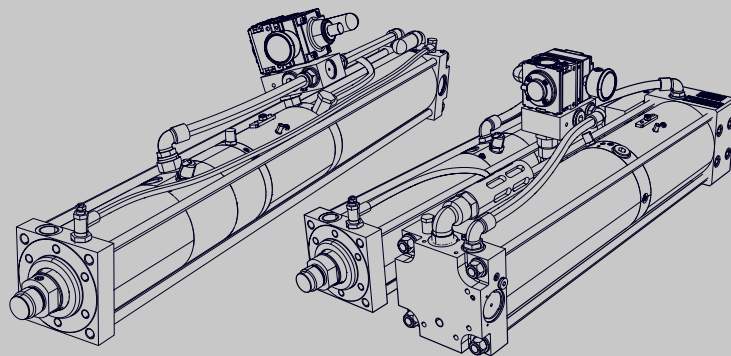


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1 Important information

1.1 Legal note

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Operating instructions, manuals, technical descriptions and software are originally compiled in German.

1.2 Exclusion of liability

TOX® PRESSOTECHNIK has checked the contents of this publication to ensure that it conforms to the technical properties and specifications of the products or plant and the description of the software. However, discrepancies may still be present, so we cannot guarantee complete accuracy. The supplier documentation included with the system documentation is an exception.

However, the information in this publication is checked regularly and any required corrections are included in subsequent editions. We are grateful for any corrections and suggestions for improvement. TOX® PRESSOTECHNIK reserves the right to revise the technical specifications of the products or plant and/or the software or documentation without prior notice.

1.3 Conformity

The product is compliant with EU guidelines.

See separate Declaration of conformity or installation declaration.

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1.4 Validity of the document

1.4.1 Content and target group

This manual contains information and instructions for the safe operation and safe maintenance or servicing of the product.

- All information in this manual is up to date at the time of print. TOX® PRESSOTECHNIK reserves the right to make technical changes that improve the system or increase the standard of safety.
- The information is intended for the operating company as well as operating and service personnel.

1.4.2 Other applicable documents

In addition to the available manual, further documents can be supplied. These documents must also be complied with. Other applicable documents can be, for example:

- additional operating manuals (e.g. of components or of a whole system)
- Supplier documentation
- Instructions, such as software manual, etc.
- Technical data sheets
- Safety data sheets
- Data sheets
- Schematics

1.5 Gender note

In order to enhance readability, references to persons that also relate to all sexes are normally only stated in the usual form in German or in the corresponding translated language in this manual, thus e.g. "operator" (singular) for male or female, or "operators" (plural) for male or female". This should in no way convey any gender discrimination or any violation of the principle of equality, however.

1.6 Displays in the document

1.6.1 Display of warnings

Warning signs indicate potential dangers and describe protective measures. Warning signs precede the instructions for which they are applicable.

Warning signs concerning personal injuries

DANGER

Identifies an immediate danger!

Death or severe injuries will occur if appropriate safety measures are not taken.

→ Measures for remedial action and protection.

WARNING

Identifies a potentially dangerous situation!

Death or serious injury may occur if appropriate safety measures are not taken.

→ Measures for remedial action and protection.

CAUTION

Identifies a potentially dangerous situation!

Injury may occur if appropriate safety measures are not taken.

→ Measures for remedial action and protection.

Warning signs indicating potential damage

NOTE

Identifies a potentially dangerous situation!

Property damage may occur if appropriate safety measures are not taken.

→ Measures for remedial action and protection.

1.6.2 Display of general notes

General notes show information on the product or the described action steps.



Identifies important information and tips for users.

1.6.3 Highlighting of texts and images

The highlighting of texts facilitates orientation in the document.

✓ Identifies prerequisites that must be followed.

1. Action step 1

2. Action step 2: identifies an action step in an operating sequence that must be followed to ensure trouble-free operation.

▷ Identifies the result of an action.

▶ Identifies the result of a complete action.

→ Identifies a single action step or several action steps that are not in an operating sequence.

The highlighting of operating elements and software objects in texts facilitates distinction and orientation.

- <In square brackets> identifies operating elements, such as buttons, levers and (valves) stopcocks.
- "with quotation marks" identifies software display panels, such as windows, messages, display panels and values.
- **In bold** identifies software buttons, such as buttons, sliders, checkboxes and menus.
- **In bold** identifies input fields for entering text and/or numerical values.

1.7 Contact and source of supply

Only use original spare parts or spare parts approved by TOX® PRESSOTECHNIK.

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For additional information and forms see

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2 Safety

2.1 Basic safety requirements

The product is state of the art. However, operation of the product may involve danger to life and limb for the user or third parties or damage to the plant and other property.

For this reason the following basic safety requirements will apply:

- Read the operating manual and observe all safety requirements and warnings.
- Operate the product only as specified and only if it is in perfect technical condition.
- Remedy any faults in the product or the plant immediately.

2.2 Organizational measures

2.2.1 Safety requirements for the operating company

The operating company is responsible for compliance with the following safety requirements:

- The operating manual must always be kept available at the operation site of the product. Ensure that the information is always complete and in legible form.
- In addition to the operating manual, the generally valid legal and other binding rules and regulations must be provided for the following content and all personnel must be trained accordingly:
 - Work safety
 - Accident prevention
 - Working with hazardous substances
 - First aid
 - Environmental protection
 - Traffic safety
 - Hygiene
- The requirements and contents of the operating manual must be supplemented by existing national regulations (e.g. for prevention of accidents and for environmental protection).
- Instructions for special operating features (e.g. work organization, work processes, appointed personnel) and supervisory and reporting obligations must be added to the operating manual.

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- Take action to ensure safe operation and make sure that the product is maintained in a functional condition.
- Only allow authorized persons access to the product.
- Ensure that all personnel work with awareness of safety and potential dangers with reference to the information in the operating manual.
- Provide personal protective equipment.
- Maintain all safety and information on dangers regarding the product complete and in legible condition and replace as required.
- Do not make any changes, carry out attachments or conversions to the product without the written approval of TOX® PRESSOTECHNIK. Action contrary to the above will not be covered by the warranty or the operating approval.
- Make sure that the annual safety inspections are carried out and documented by an expert.

2.2.2 Selection and qualifications of personnel

The following safety requirements are applicable for the selection and qualifications of personnel:

- Only appoint persons to work on the plant who have read and understood the operating manual, and in particular, the safety instructions before starting work. This is particularly important for persons who only work on the plant occasionally, e.g. for maintenance work.
- Only allow persons appointed and authorized for this work access to the plant.
- Only appoint reliable and trained or instructed personnel.
- Only appoint persons to work in the danger zone of the plant who can perceive and understand visual and acoustic indications of danger (e.g. visual and acoustic signals).
- Ensure that assembly and installation work and the initial commissioning are performed exclusively by qualified personnel who have been trained and authorized by TOX® PRESSOTECHNIK.
- Maintenance and repairs must be performed by qualified and trained personnel only.
- Ensure that personnel who are being trained, instructed or are in an apprenticeship can only work on the plant under the supervision of an experienced person.
- Have work on electrical equipment performed only by electricians or trained persons under the direction and supervision of an electrician in accordance with the electrotechnical regulations.

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2.3 Fundamental hazard potential

Fundamental hazard potentials exist. The specified examples draw attention to known hazardous situations, but are not complete and do not in any way provide safety and risk awareness action in all situations.

2.3.1 Electrical hazards

Attention should be paid to electrical hazards particularly inside the components in the area of all assemblies of the control system and motors of the installation.

The following basically applies:

- Have work on electrical equipment performed only by electricians or trained persons under the direction and supervision of an electrician in accordance with the electrotechnical regulations.
- Always keep the control box and/or terminal box closed.
- Before commencing work on electrical equipment, switch off the main switch of the system and secure it against being switched back on inadvertently.
- Pay attention to the dissipation of residual energy from the control system of the servomotors.
- Make sure that the components are disconnected from the power supply when carrying out the work.

2.3.2 Thermal hazards

During operation piece parts may become hot and cause burns when touched.

Hazardous positions are generally marked with a symbol.

See Safety symbols

- Wear individual protective equipment.
- Before starting work, make sure that surfaces have cooled down sufficiently.

2.3.3 Pneumatic hazards

Attention must be paid to pneumatic hazards particularly on the pneumatic supply lines and connection points.

The following basically applies:

- Allow work to be carried out on pneumatic equipment by authorized service personnel only.
- Wear individual protective equipment.

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- Do not exceed the permissible pressure.
- First switch on compressed air when all hose connections have been established and secured.
- Do not uncouple any hoses under pressure.
- If hoses slip off, switch off the compressed air supply immediately.

2.3.4 Contusions

Contusions and hand injuries can occur in the radius of action of the product.

The following applies generally:

- Make sure that that no persons are located in the danger area during operation.
- During necessary work in the danger area (e.g. maintenance, cleaning), secure the system against unexpected, accidental and unauthorized activation.
- Make sure that parts or tools cannot fall down or descend as a result of stored energy. Use appropriate fuses.

2.3.5 Hydraulic hazards

Attention must be paid to hydraulic hazards particularly on the supply lines, connection points and vent points.

The following applies generally:

- Allow work to be carried out on hydraulic equipment by authorized service personnel only.
- Wear individual protective equipment.
- Do not exceed the permissible pressure.
- Do not remove any hoses under pressure.
- Never vent hydraulic components under pressure.

2.3.6 Electromagnetic hazards

Electromagnetic hazards are to be taken into account in the area of electromagnetically vibrating or oscillating components.

Regular work on and with electromagnetically vibrating or oscillating components can cause disorders in the blood flow of the fingers as well as neurological and motoric dysfunctions.

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The following applies generally:

- Wear protective anti-vibration gloves when performing necessary work!
- Electromagnetic fields can have an indirect effect on heart pacemakers and other implants. Adhere to safety distances.

2.3.7 Laser

Depending on the model and features, lasers can be installed for the purpose of recognition. There is a danger of looking into the laser in some situations. If this is not avoided, eye injuries may result.

The following applies generally:

- Do not look into the direct or the reflected beam.
- If the laser beam hits the eye, deliberately close the eyes and move the head immediately out of the beam.
- When using the laser, no optical instruments are to be used for viewing the source of the beam, since this can lead to exceeding the exposure limit values.
- Manipulation (modification) of the laser equipment is inadmissible.

2.3.8 Hazardous substances

The following safety requirements apply when handling chemical substances:

- Observe the applicable safety regulations on handling chemical substances and the information on the manufacturer's safety data sheets of hazardous substances.
- Wear individual protective equipment.
- In the event of eye or skin contact, rinse the affected area, change contaminated clothing and visit a doctor if necessary. Provide appropriate equipment (eye wash bottle, washbasin) near the workplace.
- Groundwater hazardous substances must not get into the ground or sewage system. Collect groundwater hazardous substances and dispose of them properly.

2.3.9 Noise

Depending on the equipment, an increase in the noise level can arise in the sphere of the product.

- Keep the duration of the exposure at a minimum.
- Wear individual protective equipment.

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2.3.10 Lithium ion battery

Lithium ion (Li-Ion) batteries are a hazardous material.

The following safety requirements apply for handling:

- Check the battery before use for damage. Damaged Li-Ion batteries must no longer be used or charged.
- Do not drop batteries, throw them, subject them to shocks or other mechanical stress, which could lead to damaging the batteries.
- After a mechanical effect due to a crash, impact or contusion, the further use and charging of the battery is prohibited.
- Due to improper use, fluid (electrolyte) can escape from the battery. Avoid contact with liquids, and, in case of contact, thoroughly clean the affected point with water. If the liquid entered the eyes, contact a doctor immediately.
- If the operating period of a battery is found to lessen considerably, the use is to be stopped immediately and the battery is to be replaced. Otherwise there is the hazard of overheating and explosion.
- Ensure that the battery cannot be short-circuited.
- Do not subject the battery to rain nor dip it into conductive liquids (e.g. water, beverages, etc.).
- Do not burn batteries since the battery can explode at high temperatures in the fire.

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3 About this product

3.1 Intended use

The hydropneumatic drive performs the strokes that are generally defined as fast approach stroke, power stroke and return stroke. The drive is intended for installation in machines or robot tongs with the following technical applications:

- Installing, pressing
- Punching, pressing (of function elements)
- Riveting, crimping, flaring
- Punching, piercing
- Embossing, marking
- Tensioning, clamping, crimping
- Pressing, compressing
- Clinching, joining

This incomplete machine may not be commissioned until it has been ascertained that the incomplete machine in which the component is to be installed complies with the requirements of the Machinery Directive (2006/42/EC).

3.1.1 Safe and correct operation

Intended use includes the following conduct:

- Only operate with the components for which it is specified.
- Follow all instructions in this operating manual.
- Comply with the specified maintenance intervals and perform maintenance work correctly.
- Operate in compliance with the conditions of the technical data.
- Operation with fully assembled and functional safety devices.
- Activities may only be carried out by persons who are qualified or authorized for this purpose.

Any other use or application beyond this does not come under the scope of intended use.

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3.1.2 Safe and correct design and construction

The generated forces can be immense in case of different applications! This can lead to damage or breakage of material. This can cause dangerous situations during operation!

The following aspects are an intrinsic part of the intended design and construction:

- The design and construction must at all time guarantee that the maximum generated forces do not lead to the failure or to a breakage of system components.
- Especially during punching and hole applications must the dynamic forces be effectively limited.
- The dynamic forces must at no time exceed the maximum admissible (static) press forces in the direction of pressure and tension. These are specified for every drive of TOX® PRESSOTECHNIK.
- Dynamic forces must be limited with suitable precautionary measures to ensure that the admissible (static) press forces are not exceeded.
- Suitable precautionary measures can be as follows:
 - Dampings in the tool
 - Limit of the maximum accelerations,
 - Use of optional modules such as damping of cutting impact or press-in
 - etc.
- It must be ensured that there is no unauthorized, inadvertent, mistaken rise of the dynamic and static press forces and return stroke forces designed for the application during operation.

If the Powerpackage is to be installed in movable applications (movable carriages, robots, etc.), the maximum occurring acceleration and brake forces must not exceed the 5-fold of the dead weight of the Powerpackage. Higher brake forces can cause danger to the life and limb of the user and damage to the drive.

Non-observance of and non-adherence to the maximum admissible press forces and return stroke forces is not valid as intended use and is not permitted.

3.1.3 Foreseeable misuse

Use contrary to intended use includes the following foreseeable misuse:

- Operation under conditions that deviate from the technical data.
- Operation without fully assembled and functional connections.
- Operation without fully assembled and functional safety devices.
- Modifications to the product without prior approval by TOX® PRESSOTECHNIK and the approving authority.

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- Incorrect parameterization.
- Execution of activities by persons who are not qualified or authorized to do so.

The operating company is exclusively responsible for all personal injury and property damage resulting from non-intended use. Non-intended use will not be covered by the warranty or the operating approval.

3.2 Product Identification

3.2.1 Position and content of the type plate

Designation on the type plate	Meaning
Type	Product designation
No.	Serial number
ΔV [ml]	Lowering volume Indicates the amount of oil that must be discharged again after completely filling.
P_{max}	Maximum pressure

Type code structure

Type key	Description
X-S 008. 3030. 100. 12	
X-S 008. 3030. 100. 12	Identifies the series type such as X-S, S, K, etc.
X-S 008 . 3030. 100. 12	Indicates the press force in [tons].
X-S 008. 3030 . 100. 12	Indicates the version.
X-S 008. 3030. 100 . 12	Indicates the length of the total stroke.
X-S 008. 3030. 100. 12	Indicates the length of the power stroke.

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3.3 Function description of TOX® Powerpackage with pressure regulator pneumatic spring

The drive works with a pneumatically operated cylinder with pneumohydraulic power stroke. At the same time, a closed oil cylinder and valve system is driven with compressed air, which is controlled in the same way as a double-acting pneumatic cylinder.

Compressed air is converted to oil pressure in the intensifier part to generate the necessary pressure for the power stroke. In the working part, the oil pressure acts on the working piston.

The compressed air is also used for the fast approach of the working piston to the working position (fast approach stroke) and for the return to the home position (return stroke).

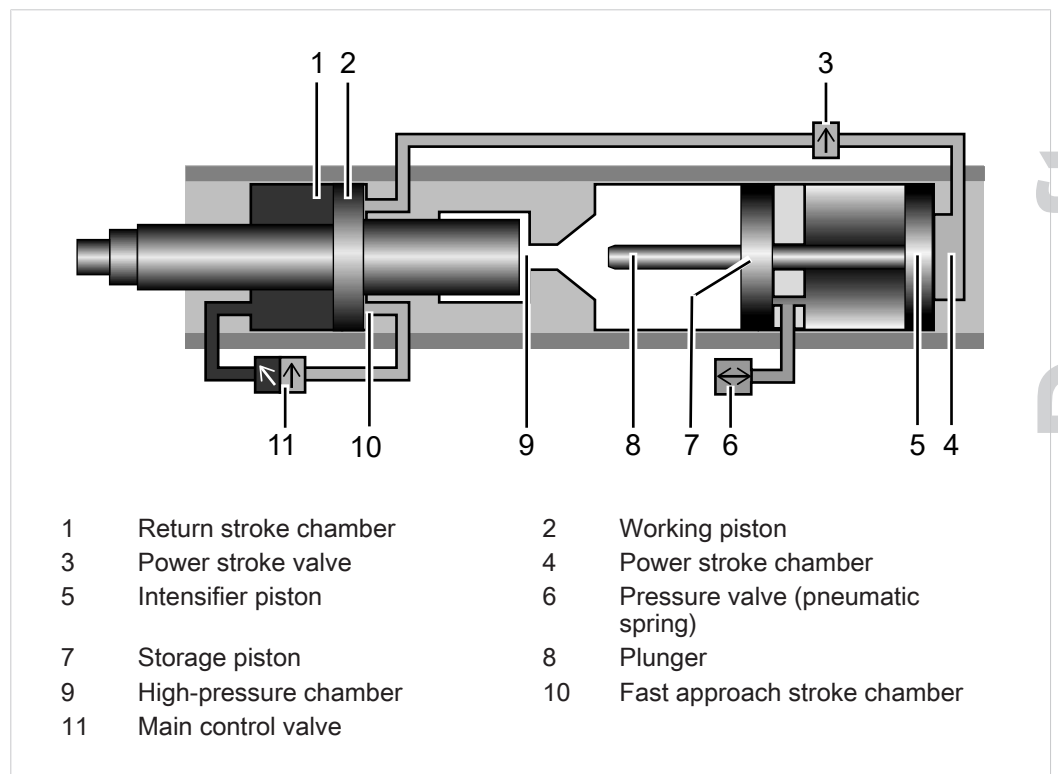


Fig. 1 Starting position

- In home position, the drive is controlled via the main control valve in the return stroke.
- The working piston is retracted.

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Pneumatically operated fast approach stroke

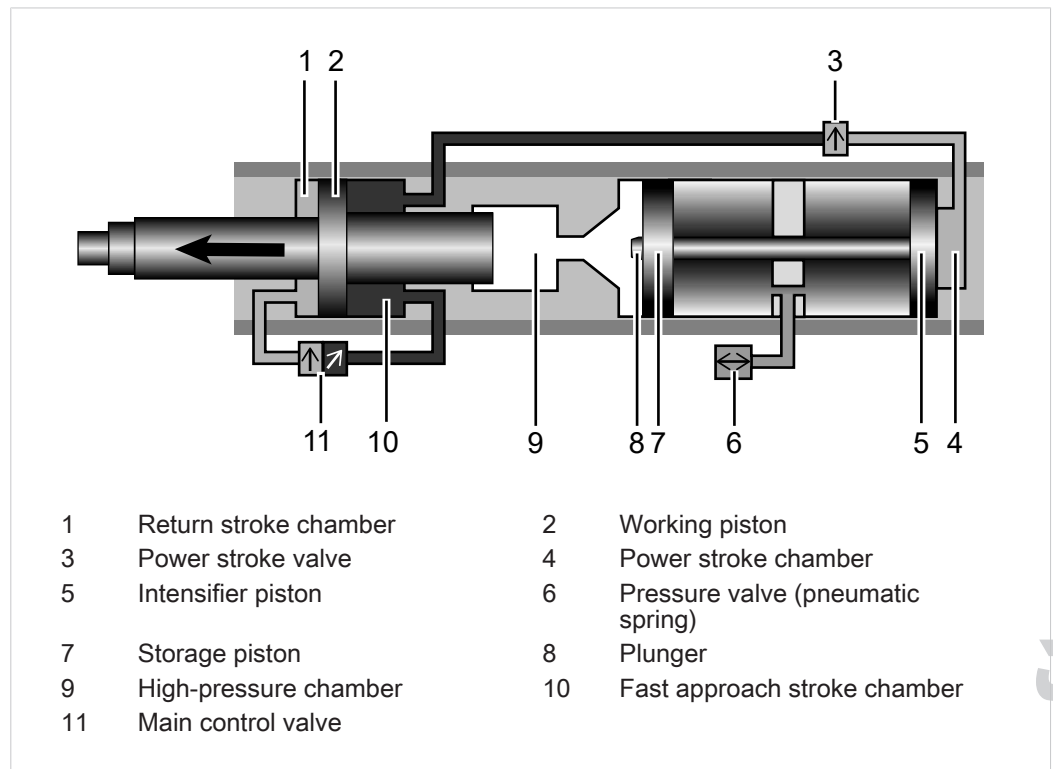


Fig. 2 Fast approach stroke

- After switching over the main control valve to forward stroke, compressed air enters the fast approach stroke chamber. The return stroke chamber is being vented.
- The power stroke valve is supplied with compressed air.
- The working piston extends with a fast approach stroke.
- The feed piston pushes hydraulic oil from the reservoir into the high pressure chamber activated by the pressure valve (pneumatic spring).
- As soon as the working piston meets any resistance, it stops.
- The power stroke valve switches over independently to power stroke after a delay, depending on the air volume flowing out of the control throttle 'X'.

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Pneumohydraulic power stroke

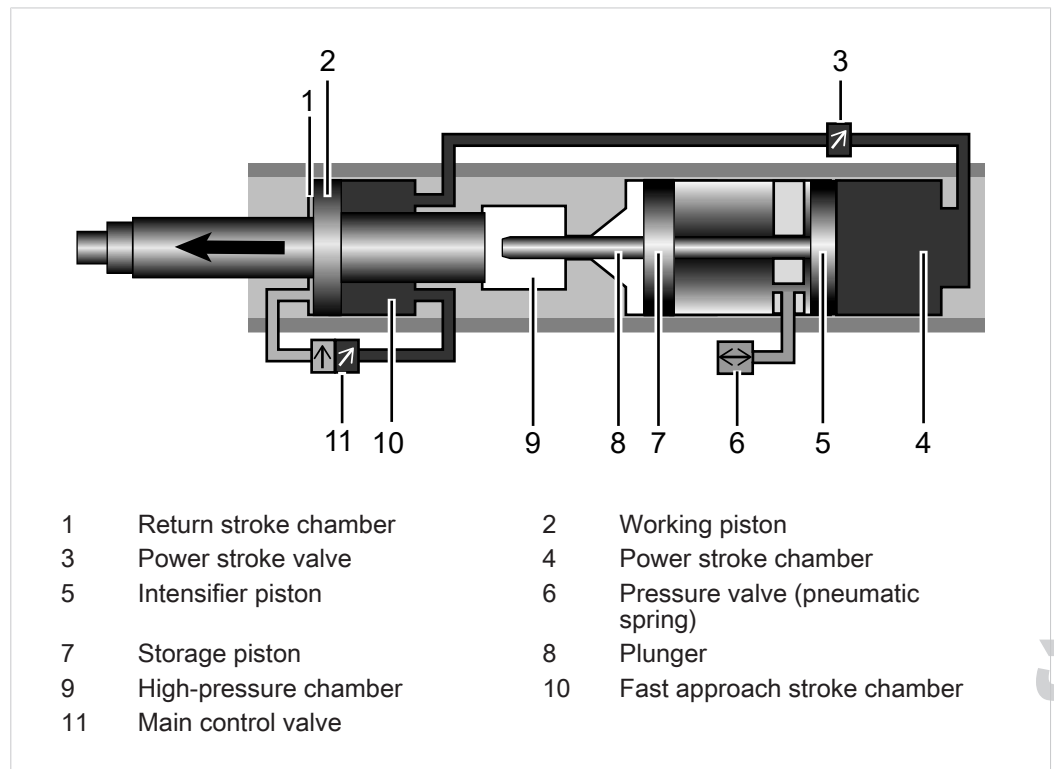


Fig. 3 Power stroke

- Compressed air from the forward stroke connection penetrates into the power stroke chamber of the intensifier piston via a connection line.
- The plunger passes through the high pressure seal and separates the oil chamber into a working area and an oil reservoir.
- A hydraulic pressure is generated in working area, which creates the power stroke via the working piston.

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Return stroke

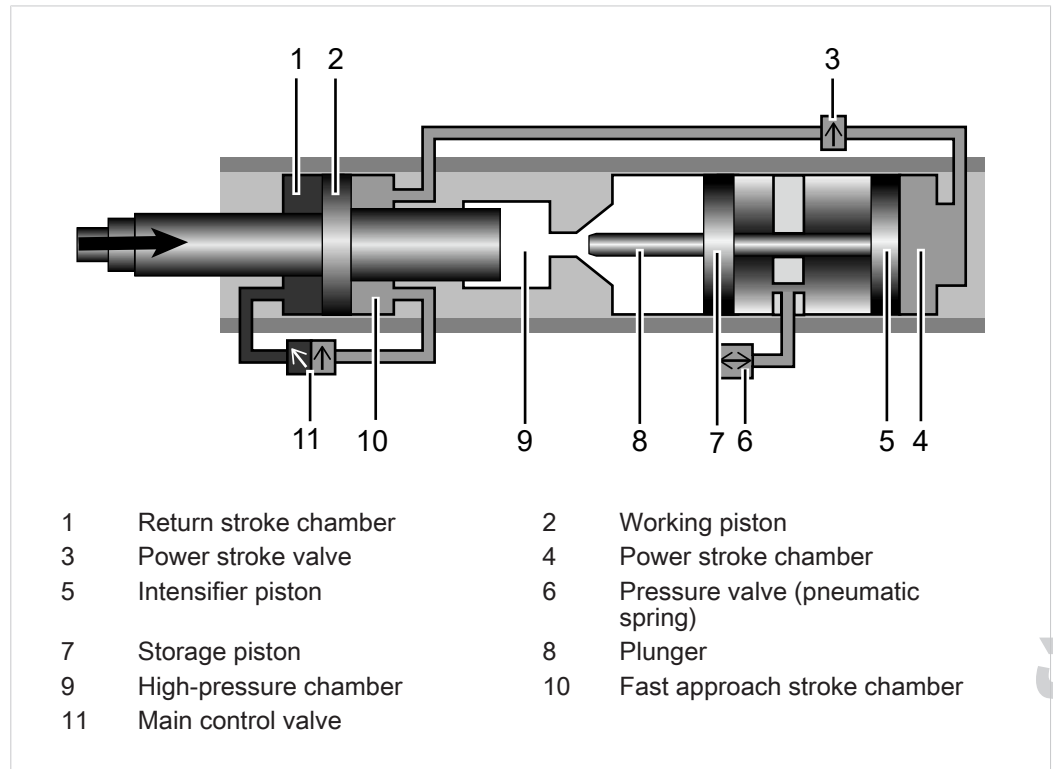


Fig. 4 Return stroke

- The main control valve is switched over to return stroke by a signal. The return stroke chamber is being filled with compressed air.
- As a result, the power stroke valve is vented and moved to the home position.
- The power stroke chamber of the intensifier piston is vented via the muffler and the return stroke is triggered.
- After the intensifier piston has released the high pressure seal, the working piston moves back to the home position.

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3.4 Product overview of TOX® Powerpackage line-X

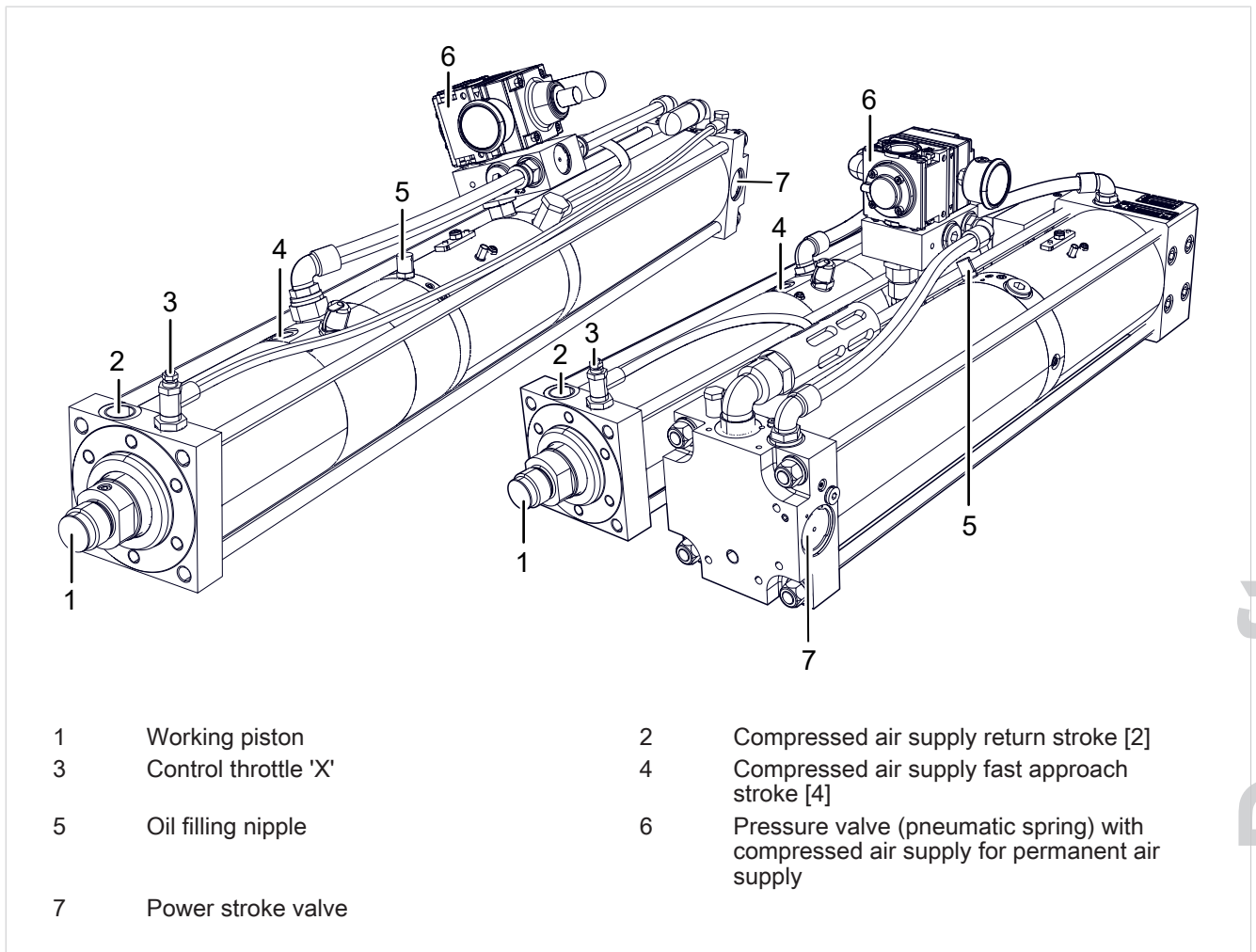


Fig. 5 Product overview of TOX® Powerpackage type X-S, X-K

3.4.1 Product attributes of Powerpackage line-X

Type X-S	Type X-K
<ul style="list-style-type: none"> Intensifier and working part are interconnected with a tension rod in a sandwich construction. 	<ul style="list-style-type: none"> Intensifier and working part are connected with an intermediate flange (compact construction).
<ul style="list-style-type: none"> Including power stroke valve and control throttle 'X'. 	
<ul style="list-style-type: none"> Including pressure valve (pneumatic spring) and fast stroke support. 	
<ul style="list-style-type: none"> Including fixed stop with elastomer cushioning in the lower final position. 	
<ul style="list-style-type: none"> Including power bypass ZLB with hydraulic end position cushioning ZHD in the upper final position. 	
<ul style="list-style-type: none"> Prepared for stroke monitoring ZHU (up to and including X-S 30/X-K 30). 	
<ul style="list-style-type: none"> Prepared for external linear position sensor ZHW (up to and including X-S 30/X-K 30). 	

3.5 Optional equipment

3.5.1 Product overview of TOX® Powerpackage with integrated damping function ZED

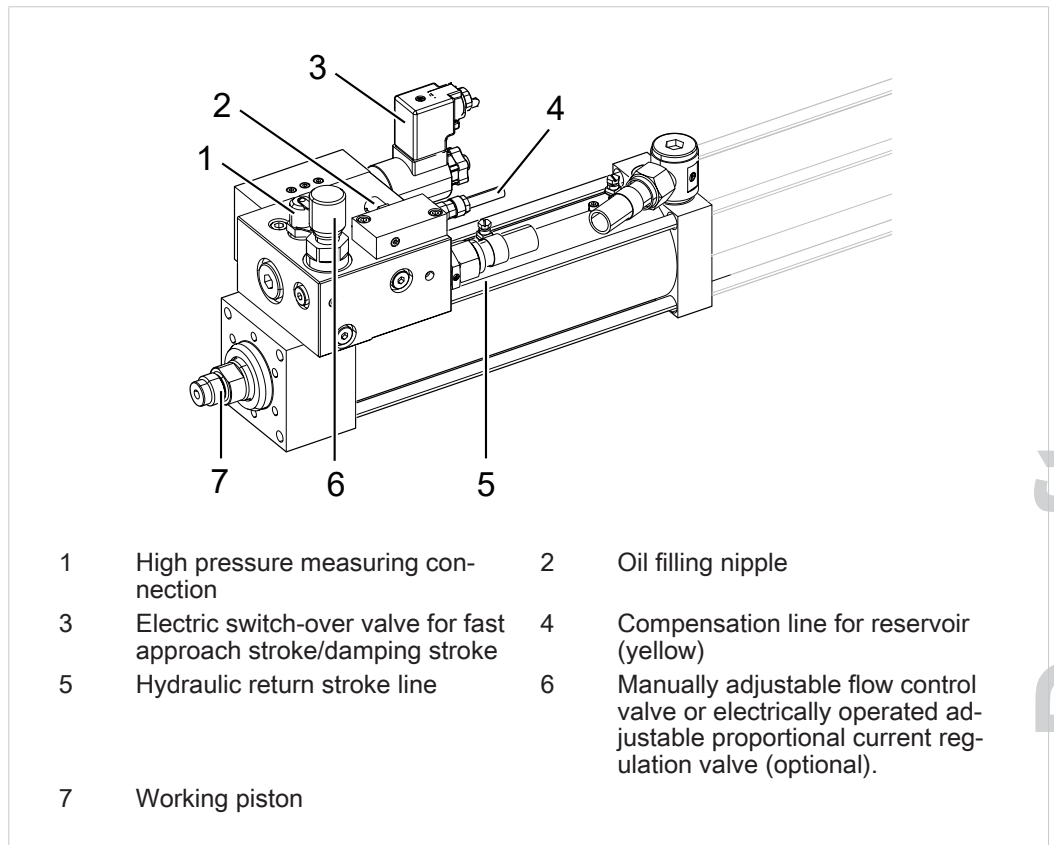


Fig. 6 Product overview of TOX® Powerpackage with integrated damping function

Product attributes of Powerpackage with integrated damping function ZED

<p>Type X-SD, X-KD</p> <p>Additional characteristics of type X-S, X-K</p> <ul style="list-style-type: none"> • With integrated damping function. Allows a selectable constant speed of the working piston during the approach stroke and power stroke, independent of the respective working forces. Manually adjustable flow control valve or optional electrically operated adjustable proportional current regulation valve. • The oil pressure cannot be used as signal for the return stroke. To switch over from power stroke to return stroke, a distance-dependent signal must be selected. • Including external power stroke connection (ZKHZ).
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Draft

3.5.2 Product overview of TOX® Powerpackage with cutting impact damping ZSD

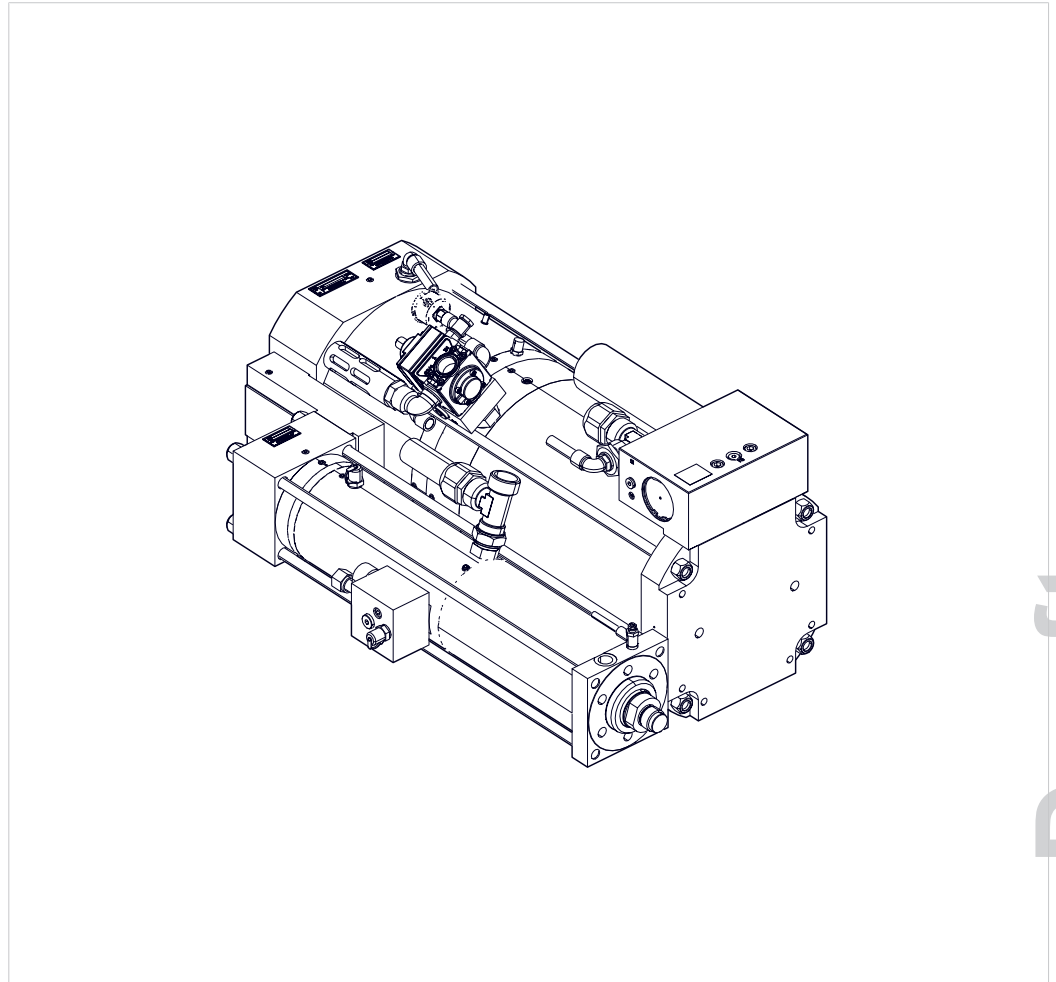


Fig. 7 Product overview of TOX® Powerpackage with cutting impact damping ZSD

Product attributes of Powerpackage with cutting impact damping ZSD

Type X-KSD
Additional characteristics of type X-K
<ul style="list-style-type: none"> Equipped with cutting impact damping. Makes adjustable damping possible during punching applications or damped operation of machines to the last 6-8 mm of the total stroke. The oil pressure cannot be used as signal for the return stroke. To switch over from power stroke to return stroke, a distance-dependent signal must be selected.

Draft

Type EKSD
<ul style="list-style-type: none"> Intensifier and working part are connected with an intermediate flange (compact construction).
<ul style="list-style-type: none"> Equipped with total stroke adjustment. The length of the total stroke can be adjusted independently of the length of the power stroke and the length of the cylinder.
<ul style="list-style-type: none"> Equipped with cutting impact damping. Makes adjustable damping possible during punching applications or damped operation of machines to the last 6-8 mm of the total stroke.
<ul style="list-style-type: none"> The oil pressure cannot be used as signal for the return stroke. To switch over from power stroke to return stroke, a distance-dependent signal must be selected.
<ul style="list-style-type: none"> Equipped with pressure control valve (pneumatic spring).

3.5.3 Product overview and product attributes of TOX® Powerpackage with integrated holding brake ZSL

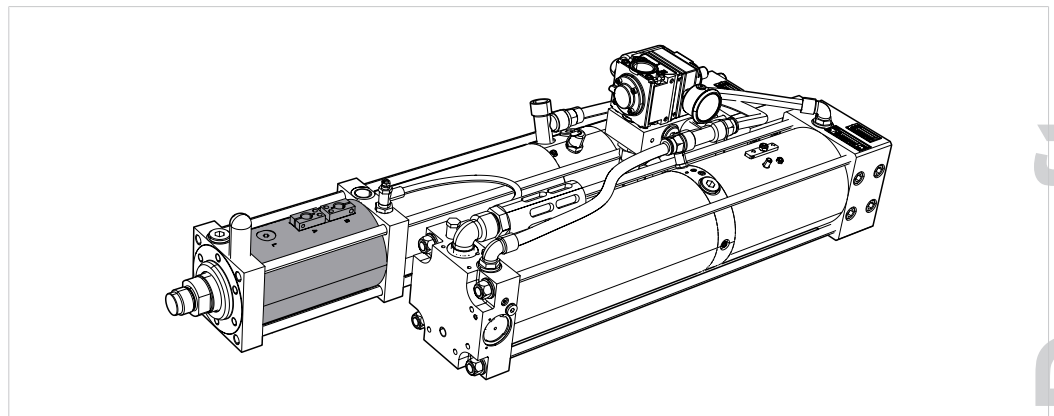


Fig. 8 Product overview of TOX® Powerpackage with integrated holding brake ZSL

Product attributes of TOX® Powerpackage with integrated holding brake ZSL

Integrated holding brake ZSL
Additional characteristics
<ul style="list-style-type: none"> Integrated holding brake (Safety Lock) (for almost all series) The holding brake is held open pneumatically and responds at a drop in pressure. The energy of the crashing or dropping load is used for generating the clamping force.

Draft

3.5.4 Additional optional equipment

Type	Product attributes
ZKW	Travel measuring system <ul style="list-style-type: none"> The travel sensor indicates the absolute actual position of the piston. For internal installation (only for series X-K 050 / 75 / 100 / 170).
ZHW	Travel measuring system <ul style="list-style-type: none"> The travel sensor indicates the absolute actual position of the piston. For external installation (for series line-Q and line-X to Q-S/Q-K 30, X-SX-K 30).
ZHU	Stroke monitoring <ul style="list-style-type: none"> Determines the position of the working piston during forward stroke and return stroke via the external sensor.
ZDK	Pressure regulation in power stroke line <ul style="list-style-type: none"> Make possible the individual adjustment of the press force with a manual pressure valve or electrical proportional valve.
ZKHZ	External power stroke connection <ul style="list-style-type: none"> Enables the connection of the power stroke valve with an electrically actuated 3/2-way valve.
ZWK	Tool coupling <ul style="list-style-type: none"> Connects the drive and tool flexibly to prevent transverse forces from affecting the drive.
ZDO	Electronic pressure switch <ul style="list-style-type: none"> Records the oil pressure in the high-pressure part as system pressure and visualizes it via a four-digit LED display. The set switching function allows 2 output signals to be created.
ZHO	Stroke frequency optimization <ul style="list-style-type: none"> Reduces the cycle time. Replaces the existing power stroke valve with one of the next size.
ZPS	Pressing force sensor <ul style="list-style-type: none"> Measures the press forces in the direction of the pressure.

For optional equipment, see data sheet and brochure TOX® Powerpackage.

<http://tox-pressotechnik.com/>

Draft

3.6 Product planning

3.6.1 Design data

Data sheet

For technical data and installation dimensions see data sheet.

(<http://www.tox-pressotechnik.de>)

3.6.2 Design principles

- When fastening, note the following:
 - Installation dimensions
 - Weight, including weight of the accessories
 - Press force
 - Loads caused by the working process (dynamics and vibrations)
- No transverse forces may act on the piston rod.
If necessary, use a linear guide for the working piston: either a ram plate and guiding columns or a guiding rail with guiding carriage.
- In the case of horizontal installation the connection side must face upwards.
- Elements requiring servicing maintenance, such as oil filling nipple, vent hole, high pressure measuring connection, control throttle, X' and oil level indicator should be accessible.
- Make sure that the ventilation of the hydraulic system is always possible even when installed.
- The space requirement for supply lines must be taken into consideration.
- The length of the hose lines, the connection of an oil pressure switch or oil pressure monitor can significantly reduce the power stroke.

Draft

3.6.3 Air consumption

- For the air consumption, the fast and return stroke are calculated with the available air pressure.
- The air requirement in the power stroke is calculated depending on the required press force.
For example, this depends on when the required oil pressure is reached.
- If the intensifier chamber is filled with complete air pressure, the air consumption can indeed be higher than the requirement that is actually needed and calculated.

In general, the specification for the air requirement includes all filling processes required for a stroke. The information only refers to the specific drive.

For hoses and valves - in particular for long hoses with large cross sections - which are filled and ventilated together with the drive, their consumption must also be considered when selecting a compressor.

The following applies here: Energy-saving are short lines from the valve to the drive.

When using pressure regulators (e.g. for the pneumatic spring), low internal air consumption cannot be avoided. This is usually in the range of a few liters per hour. Similarly, there might be air losses in the hose and valve connections. In order to avoid air losses, e.g. at night, the drive can be depressurized during this time.

WARNING

Risk of personal injury due to the lowering of the working piston

There is a risk of crushing when the working piston lowers.

The working piston of a Powerpackage / KT systems can only be held up with sufficient return stroke pressure and sufficient air supply during the installation in a press!

In the event of a compressed air failure, no return stroke will be initiated!

Depending on the size of the drive and the weight of the tool used, a slow lowering of the working piston is possible.

- Use a controlled check valve or holding brake (ZSL) or mechanical holding device, especially with large tool weights.
- If controllable valves are installed as pneumatic holding brake at the customer, the corresponding safety regulations are to be observed and adhered to.

Draft

3.6.4 Cycle times

The cycle time is calculated depending on the required press force. The following applies:

- The smaller the effective press force, the shorter the cycle time.
- An effective press force over 90 % should be avoided.
- The switching times of the valves and controls upstream of the drive must be taken into consideration for the specified cycle times.

Requirement for achieving the calculated times:

- **Air pressure**

The required air pressure is the result of the desired effective press force. To achieve a short cycle time, an air pressure as high as possible is recommended for fast and return stroke. If the maximum press force of the cylinder is to be reduced, this can be realized with a pressure control ZDK (manual or electric) in the power stroke line.

- **Cross-section of hose**

The line cross sections must at least match the connection sizes provided in order to achieve the calculated cycle time. This applies also to the regulation valves and maintenance units installed upstream of the drive. Reduced line cross sections can considerably reduce the cycle time. Reduced line cross sections can lead to oil leakages on the powerpackage, see [Avoidance of dynamic oil leakage, Page 33](#).

- **Tube lengths**

The length of the hoses should be kept to a minimum, since the air consumption as well as the cycle time are increased with the length.

- **Compressor performance**

The compressor performance should always be sized with sufficient safety.

- **Speed setting**

The speed can be regulated as required by installing throttle check valves in the fast approach stroke and return stroke lines (except for type RP, T). Furthermore, the speed of the power stroke can be adjusted by mounting a throttle in the power stroke line of the unit. The drive can thus also be used for special applications, such as pressing in bushes, projecting etc.

- **Optimization of stroke frequency ZHO**

The cycle time specifications correspond in general only to the entire drive under realistic conditions. If necessary, the cycle time can be further reduced using our optional accessory module ZHO.

3.6.5 Performance optimization

The ratio of the speed between the return stroke and the fast approach stroke must be set in order to ensure optimum performance.

- An optimum speed ratio between fast approach stroke and return stroke.
- A balanced power stroke speed.
- Adequately sized connection sizes (cross-section of hose, switching valves, maintenance unit) that prevent a reduction of the power stroke speed.

For technical data and installation dimensions see data sheet.

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3.6.6 Avoidance of dynamic oil leakage

The dynamic oil leakage is based on the physical effect of drag flow: the higher the speed, the thicker the oil film dragged along. In the case of an unfavorable speed ratio between the fast approach stroke and return stroke, an oil film could get into the pneumatic chambers of the TOX® Powerpackage.

The following applies:

- The ratio of the speed between the return stroke and the fast approach stroke must be set.
 - For setting the speed ratios, also the exhaust air dampers must be installed on the fast approach stroke connections and the return stroke connections.
- A balanced power stroke speed.
 - For the attuned power stroke speed an exhaust air damper must also be installed in the power stroke venting.
- For the throttled power stroke speed, the speed ratios between power stroke speed and venting of the power stroke must be set.
See [Installing the speed reduction for power stroke venting, Page 80](#).
- The power cross sections to the TOX® Powerpackage (hose cross sections, switching valves, maintenance unit) must at least meet the specifications in the type sheet.

For technical data and installation dimensions see data sheet.

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Setting speed ratio of return stroke to fast approach stroke

The speed of the working piston in the fast approach stroke and return stroke can be set with external exhaust air dampers on the forward stroke and return stroke. The exhaust air dampers may have to be retrofitted.

Type
line-X
Necessary speed ratio
<ul style="list-style-type: none"> Return stroke equally fast as fast approach stroke or Return stroke faster than the fast approach stroke

Tab. 1 Necessary speed ratio


 A visual check of the speeds is generally sufficient.

1. Set speed ratio according to the specifications.
2. Perform test and check the speed visually.

Set the speed ratio between power stroke and power stroke venting (optional)

At throttled power stroke speed
Necessary speed ratio between power stroke and power stroke venting
<ul style="list-style-type: none"> Power stroke speed equal to the return stroke speed of the intensifier piston or Power stroke speed faster than the return stroke speed of the intensifier piston

Tab. 2 Necessary speed ratio

 A visual check of the speeds is generally sufficient.

1. Set speed ratio according to the specifications.
2. Perform test and check the speed visually.

Draft

3.6.7 Stroke limitation of the power stroke

For applications that require a fixed end stop, the total stroke of the drive can be limited.

For punch applications a limiting the travel of the power stroke must take place. The travel of the power stroke must be limited to a maximum of 80%.

The travel of the power stroke can be limited by:

- Stroke limitation in the tool.
- Stroke limitation by a set total stroke (fast approach stroke and power stroke).
- Stroke limitation by setting the total stroke length and cutting impact damping (ZSD).

Stroke limitation of the power stroke in the tool

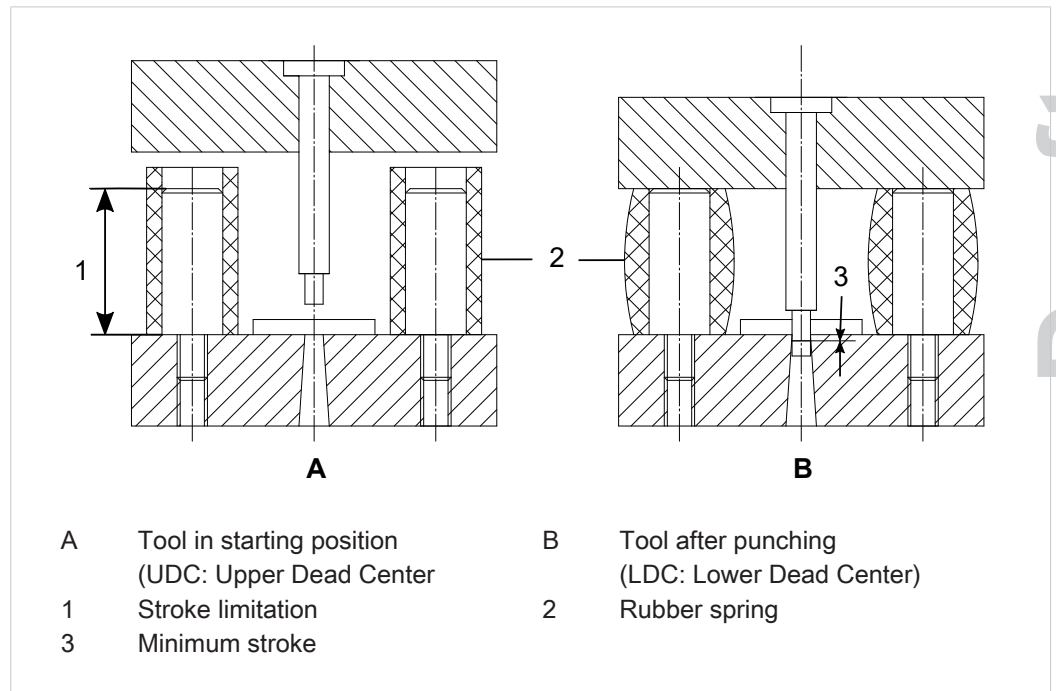


Fig. 9 Stroke limitation in the tool

After the punching process the tool limits the power stroke (LDC).

Stroke limitation due to use of the internal fixed stop

Aside from the stroke limitation in the tool, also the internal fixed stop in the drive at the end of the total stroke (fast approach stroke+power stroke) can be used.

If required, the total stroke can be reduced to the necessary total stroke when placing the order.

Draft

3.6.8 Power limit of the power stroke

It is possible to monitor the press force of the power stroke by connecting an oil pressure switch or an oil pressure monitor. Upon reaching the desired press force, the return stroke must be induced.

The press force can be reduced permanently by installing a pressure control in the power stroke line.



An oil pressure of at least 30 bar is necessary for pressure control in the power stroke line (ZDK).

3.6.9 Speed reduction of the power stroke

The speed of the power stroke can be reduced if a control throttle is installed in the supply line for the power stroke.

To prevent a dynamic oil leakage, an additional exhaust throttle must be installed in this case so that the speed ratio can be adjusted.

See [Installing the speed reduction for power stroke venting, Page 80](#).

3.6.10 Switchover of power stroke to return stroke for Powerpackage with hydraulic damping (ZED, ZSD)

For drives with hydraulic damping (ZED, ZSD) there is an increase in oil pressure in the power stroke. The oil pressure can therefore not be used as signal for the return stroke.

To switch over from power stroke to return stroke, a distance-dependent signal must be selected.

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3.6.11 Horizontal installation Type K and Z

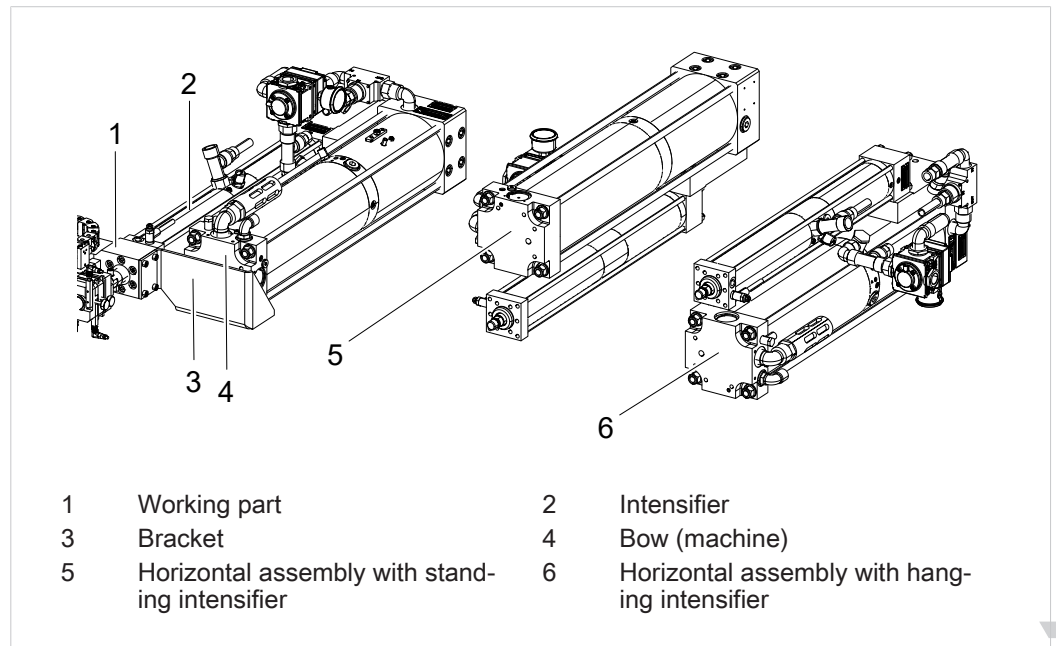


Fig. 10 Horizontal installation

For horizontal installation type K, Z the following applies:

- When the diameter difference between the working part and the intensifier part is large, the weight of the intensifier needs to be supported.
- The intensifier may only rest on the support device and must not be screwed onto the working part.



A horizontal assembly with a standing intensifier facing up or with a hanging intensifier facing down is preferable to a lateral assembly.

Draft

3.6.12 Holding brake (Assembly ZSL)

The following applies for the installation and use of the holding brake (ZSL):

- The holding brake serves exclusively for the mechanical safety of a tool up to the maximum admissible load (see type plate).

- The holding brake is intended for operation in dry, clean production halls (normal factory environment).

In case of strong generation of dirt around the holding brake, e.g. grinding dust, swarf, cooling agent or other liquid media, special protective measures are required.

- During normal operation the holding brake is to be so activated that it opens.

In all other operating conditions, power failure, emergency-stop, etc., the holding fixture activates and holds the piston rod or brakes the load.

At a defect of the supply line to the holding fixture the load is secured.

- If the pressure is not sufficiently constant (e.g. "pressure hole" at the start of the lowering movements) a check valve must be installed in the compressed air supply of the valve.
- If impact noises occur during the opening of the holding brake due to the relatively high pressure, they can be suppressed with a throttle in the pressure line (connection 'L').
- The pressure room of the clamping head and its pressure feed line must always be vented.

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Electrical activation

The following applies:

- Two signals can be taken by means of proximity switches.
- A safe state exists when signal 'A' (load secured) is active. This signal must be processed and displayed by the machine control.
- The function must be cyclically monitored, which happens suitably by the cyclical adjustment with signal 'B' (clamping released).
- Downward travel is only possible if signal 'B' is active after pressure is applied to the holding fixture (clamping released). The control must be programmed in such a way that when this signal is missing, upward travel takes place automatically until signal 'B' (clamping released) appears.

3.7 Activation and pressure control

3.7.1 Design principles of activation

A distance-dependent external power stroke switch is recommendable:

- For a piston rod working upwards.
- In the case of a heavy tool weight.
- In the case of fast approach stroke travel that is interrupted on account of the application (e.g. for fixing in place a spring-loaded holding-down clamp).
- If the control throttle 'X' cannot be adjusted for reasons of installation.

An external power stroke release with an electrical release signal is recommendable:

- If the power stroke release can accidentally be activated with the control throttle 'X' due to interference contours in the working area.

When depressurizing a pressure valve (pneumatic spring), the following applies:

- When the forward stroke connection and back stroke connection are switched, the compressed air supply of the pneumatic spring must also be turned off.

Measuring connection and control connection

The oil pressure proportional to the press force is present on the measuring connection and control connection.

This can be displayed, for example, by connecting a pressure gauge or used via transmission to a pressure switch for generating a switching pulse.

Draft

3.7.2 Activation according to dynamic pressure method

If the working piston meets a counterforce during the fast approach stroke, it stops and the dynamic pressure acting on the piston surface falls. The power stroke valve switches and the intensifier piston is impinged with compressed air. The changeover time is controlled and adjusted with the control throttle X.

The drive is actuated like a double-acting pneumatic cylinder, via an electrical, pneumatic or mechanical 4/2 or 5/2 directional control valve or via a 4/3 or 5/3 directional control valve.

The drive must be switched to initial position before changing over to the fast approach stroke.

Powerpackage with pressure valve (pneumatic spring) and fast approach stroke support

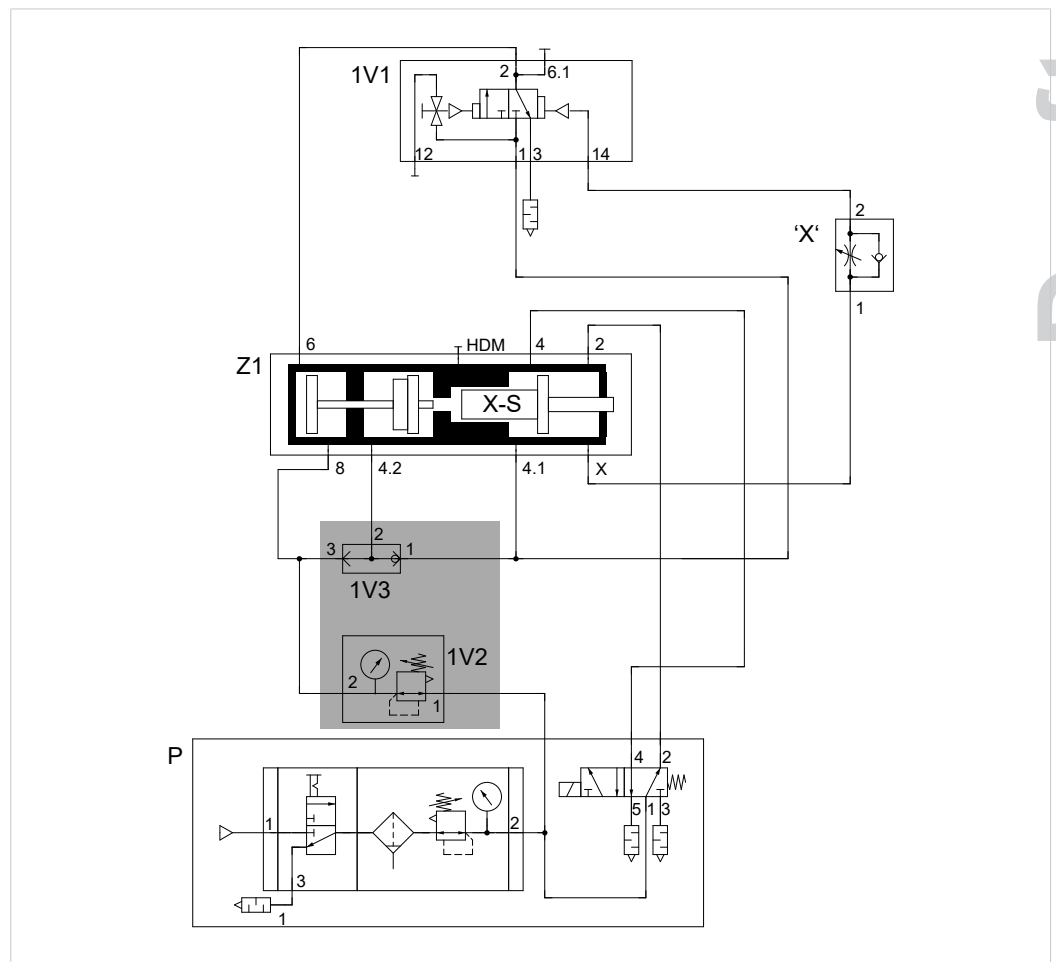


Fig. 11 Activation according to dynamic pressure method with pneumatic spring and fast stroke support

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Assembly	
1V1	Power stroke valve
	2 Power stroke output
	6.1 Power stroke signal
	14 Control connection
	3 Muffler output
	1 Power stroke input
	12 Control connection
1V2	Pressure valve (pneumatic spring)
1V3	Fast stroke support
1V4	Pneumatic spring switch-off (type X-K 75/X-K 100 only)
'X'	Control throttle 'X'
Z1	Drive (example type X-S)
	8 Plunger return stroke input
	4.2 Reservoir input
	4.1 Fast approach stroke output
	X Control throttle 'X' output
	2 Return stroke input
	4 Fast approach stroke input
	HPM High pressure measuring connection
	6 Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)

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Powerpackage with pneumatic spring cut-out in power stroke line

For the pneumatic spring switch-off, a valve is mounted between connection [8] of drive connection [3] of the fast stroke support and connection [2] of the fast stroke support. The valve is connected to connection [6.1] of the power stroke valve.

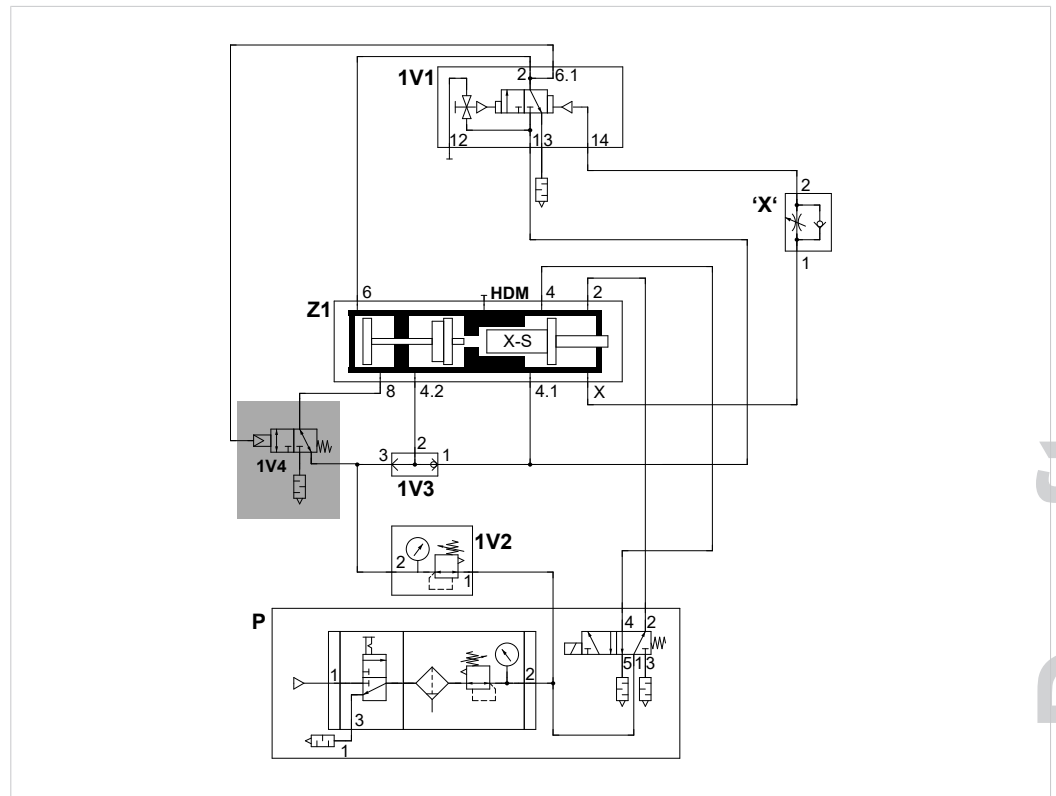


Fig. 12 Activation according to dynamic pressure method with pneumatic spring and fast stroke support and pneumatic spring cut-out in the power stroke line

	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
1V2	Pressure valve (pneumatic spring)	
1V3	Fast stroke support	
1V4	Pneumatic spring switch-off (type X-K 75/X-K 100 only)	
'X'	Control throttle 'X'	
Z1	Drive (example type X-S)	

Draft

Assembly	
8	Plunger return stroke input
4.2	Reservoir input
4.1	Fast approach stroke output
X	Control throttle 'X' output
2	Return stroke input
4	Fast approach stroke input
HPM	High pressure measuring connection
6	Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)



Pneumatic spring switch-off (with standard only for type X-K 75/ X-K 100)

3.7.3 Pressure control in the power stroke line (assembly ZDK) (optional)

A pressure valve in the power stroke line enables individual adaptation of the press force. No additional rapid vent valve is required. The required size depends on the size of the power stroke valve.

For installing the pressure regulation, see the operating manual, chapter Installation.

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Powerpackage with pressure valve (pneumatic spring)

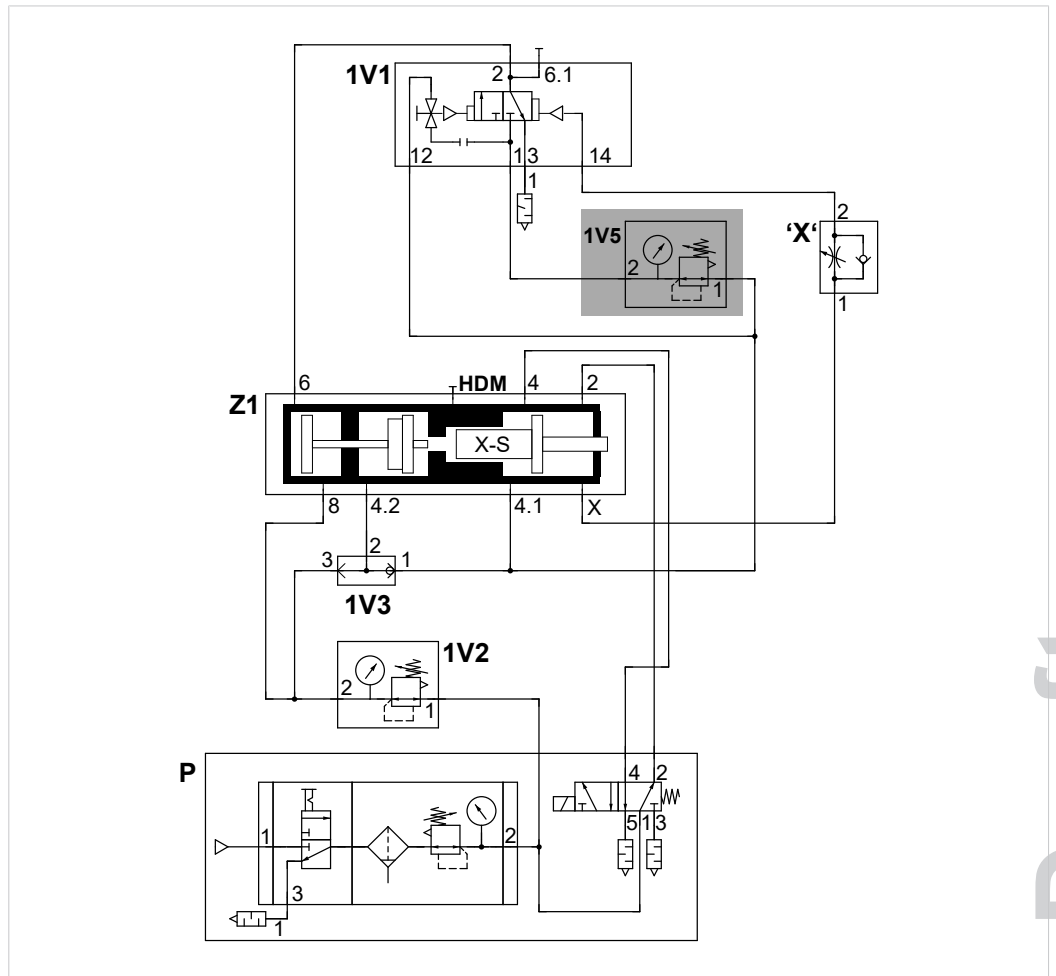


Fig. 13 Pressure control in the power stroke line (assembly ZDK)

	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
	12	Control connection
1V2	Pressure valve (pneumatic spring)	
1V3	Fast stroke support	
1V5	Pressure regulator ZDK .2	
	1	Fast approach stroke input
	2	Power stroke output
'X'	Control throttle 'X'	
Z1	Drive (example type X-S)	

Assembly		
	8	Plunger return stroke input
	4.2	Reservoir input
	4.1	Fast approach stroke output
	2.1	Return stroke output
	2	Return stroke input
	4	Fast approach stroke input
	HPM	High pressure measuring connection
	6	Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)	

3.7.4 Pressure control in the power stroke line with proportional pressure control valve (optional)

The electrical proportional valve in the power stroke line enables individual adaptation of the press force. No additional rapid vent valve is required. The required size depends on the size of the power stroke valve.

For installing the pressure regulation, see the operating manual, chapter Installation.

Powerpackage with pressure valve (pneumatic spring)

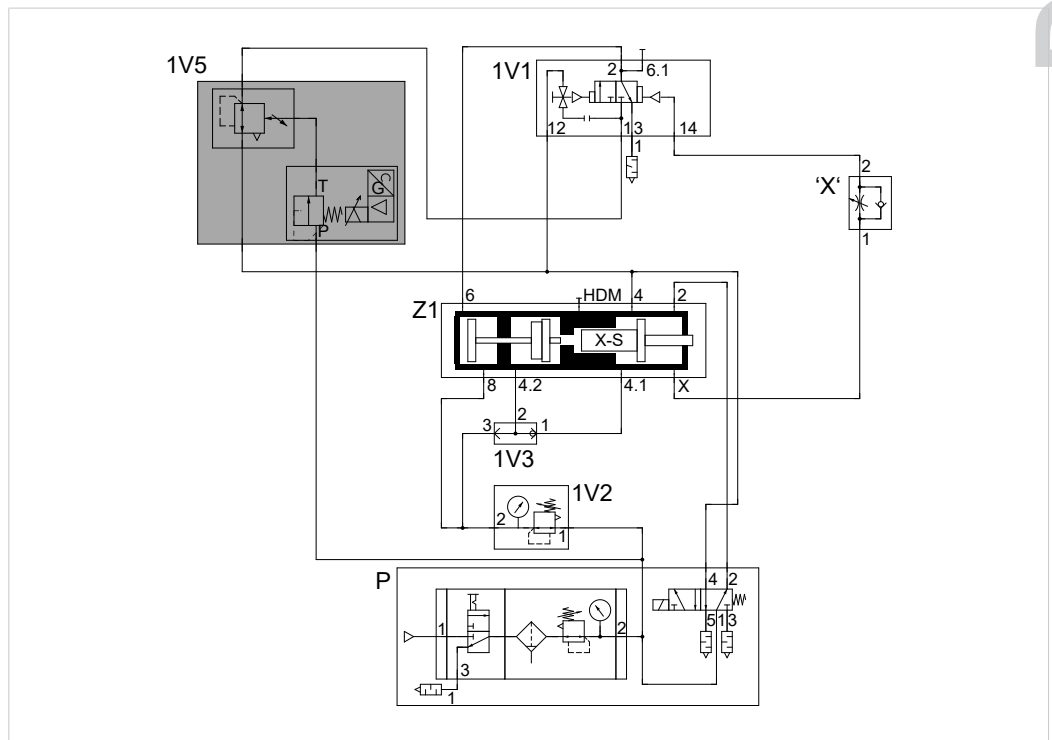


Fig. 14 Pressure control in the power stroke line with proportional pressure control valve

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	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
	12	Control connection
1V2	Pressure valve (pneumatic spring)	
1V3	Fast stroke support	
1V5	Electrical proportional valve	
	1	Fast approach stroke input
	2	Power stroke output
'X'	Control throttle 'X'	
Z1	Drive (example type X-S)	
	8	Plunger return stroke input
	4.2	Reservoir input
	4.1	Fast approach stroke output
	2.1	Return stroke output
	2	Return stroke input
	4	Fast approach stroke input
	HPM	High pressure measuring connection
	6	Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)	

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3.7.5 External power stroke switch (assembly ZKHZ) (optional)

In the case of the external power stroke switch, the power stroke is initiated after reaching a particular distance or after a certain period of time.

With the external power stroke switch option, the power stroke valve can be switched using an electrically actuated 3/2-way valve.

An external power stroke switch can also be fitted retrospectively. The control system can be combined with a pressure regulator in the power stroke line.

The following is required:

- Permanent compressed air supply of the electrical 3/2-way valve with 3 to 6 bar (connection G 1/8").
- Electric switching signal (24 V) for switching the power stroke, e.g. a proximity switch ZHS 001 in combination with the stroke monitoring device ZHU, or output signal of a travel transducer ZKW/ZHW.
- Setting the position sensor of the stroke monitoring to the fast approach stroke end position to prevent an overload.

Powerpackage with pressure valve (pneumatic spring)

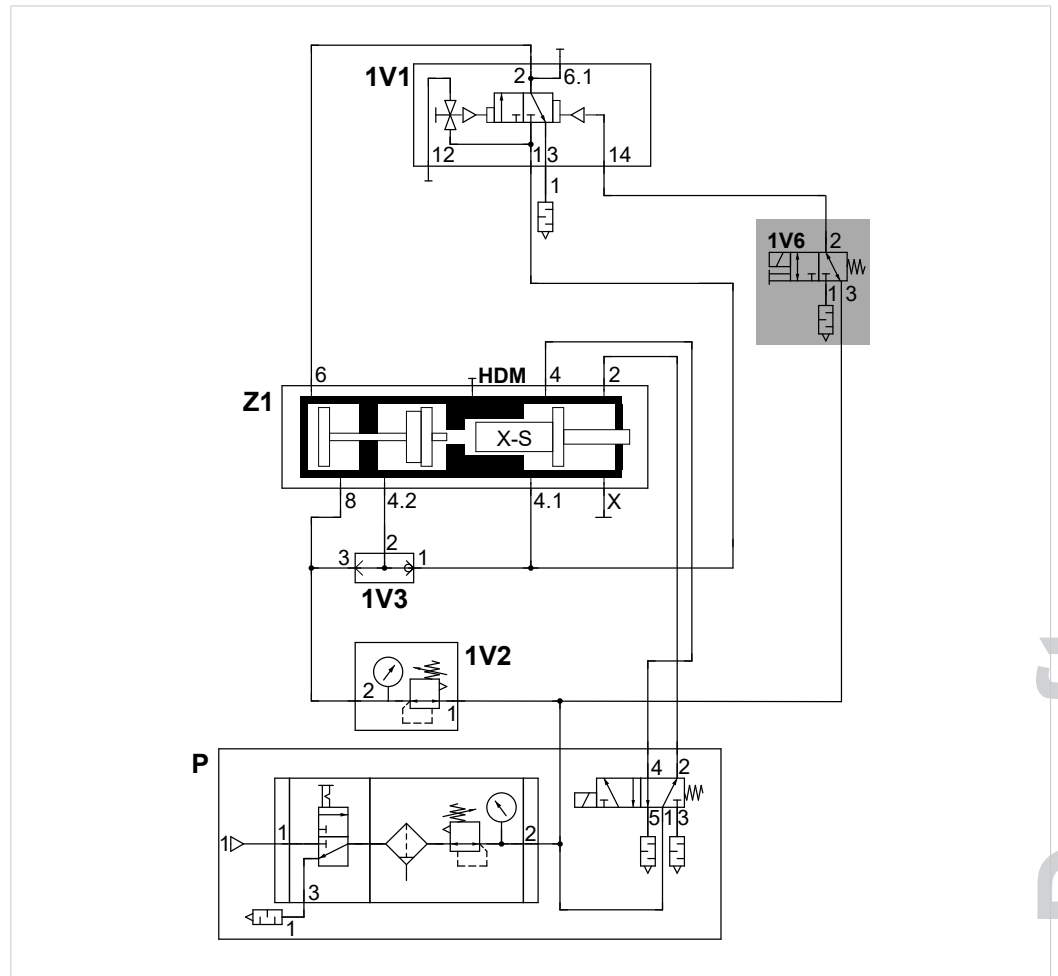


Fig. 15 External power stroke switch (subassembly ZKHZ)

	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
12	Control connection	
1V2	Pressure valve (pneumatic spring)	
1V3	Fast stroke support	
1V6	Power stroke switch valve	
	1	Muffler output
	2	Output
3	Input	
Z1	Drive (example type X-S)	

Draft

		Assembly
	8	Plunger return stroke input
	4.2	Reservoir input
	4.1	Fast approach stroke output
	2.1	Return stroke output
	2	Return stroke input
	4	Fast approach stroke input
	HPM	High pressure measuring connection
	6	Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)	

3.7.6 External power stroke deactivation (assembly ZKHD) (optional)

The power stroke can be deactivated with an electrical signal if necessary.

An external power stroke deactivation can also be fitted retrospectively. The control system can be combined with a pressure regulator in the power stroke line.

The following is required:

- Permanent compressed air supply of the electrical 3/2-way valve with 3 to 6 bar (connection G 1/8").

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Powerpackage with pressure valve (pneumatic spring)

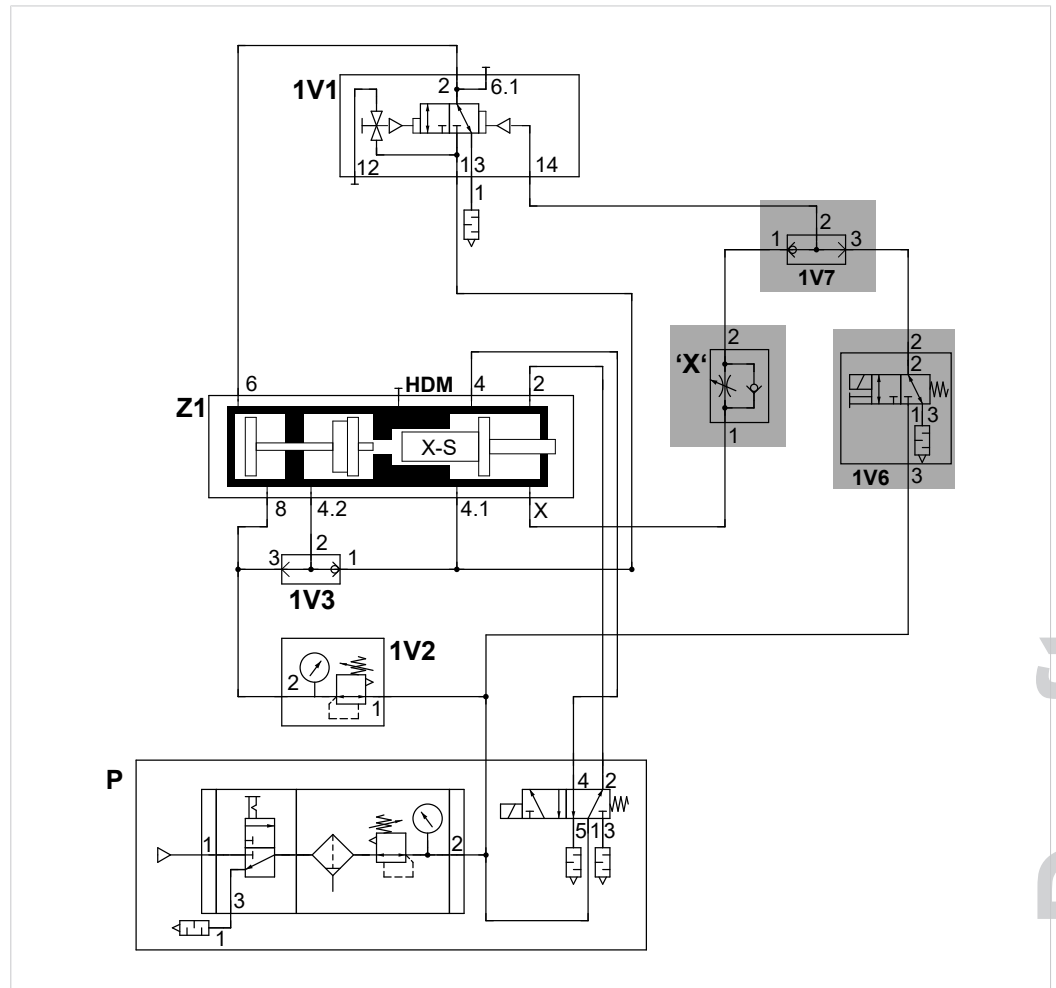


Fig. 16 External power stroke deactivation (assembly ZKHD)

	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
	12	Control connection
1V2	Pressure valve (pneumatic spring)	
1V3	Fast stroke support	
1V6	Electrical switching valve	
	3	Input (release)
	2	Output
	1	Input (deactivation)
1V7	OR valve	
	3	Switching valve input
	1	Control throttle 'X' input
	2	Output

Draft

	Assembly	
'X'	Control throttle 'X'	
Z1	Drive (example type X-S)	
	8	Plunger return stroke input
	4.2	Reservoir input
	4.1	Fast approach stroke output
	2.1	Return stroke output
	2	Return stroke input
	4	Fast approach stroke input
	HPM	High pressure measuring connection
	6	Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)	

3.7.7 External power stroke release (assembly ZKHF) (optional)

The power stroke can be released with an electrical signal if necessary.

An external power stroke deactivation can also be fitted retrospectively. The control system can be combined with a pressure regulator in the power stroke line.

The following is required:

- Permanent compressed air supply of the electrical 3/2-way valve with 3 to 6 bar (connection G 1/8").

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Powerpackage with pressure valve (pneumatic spring)

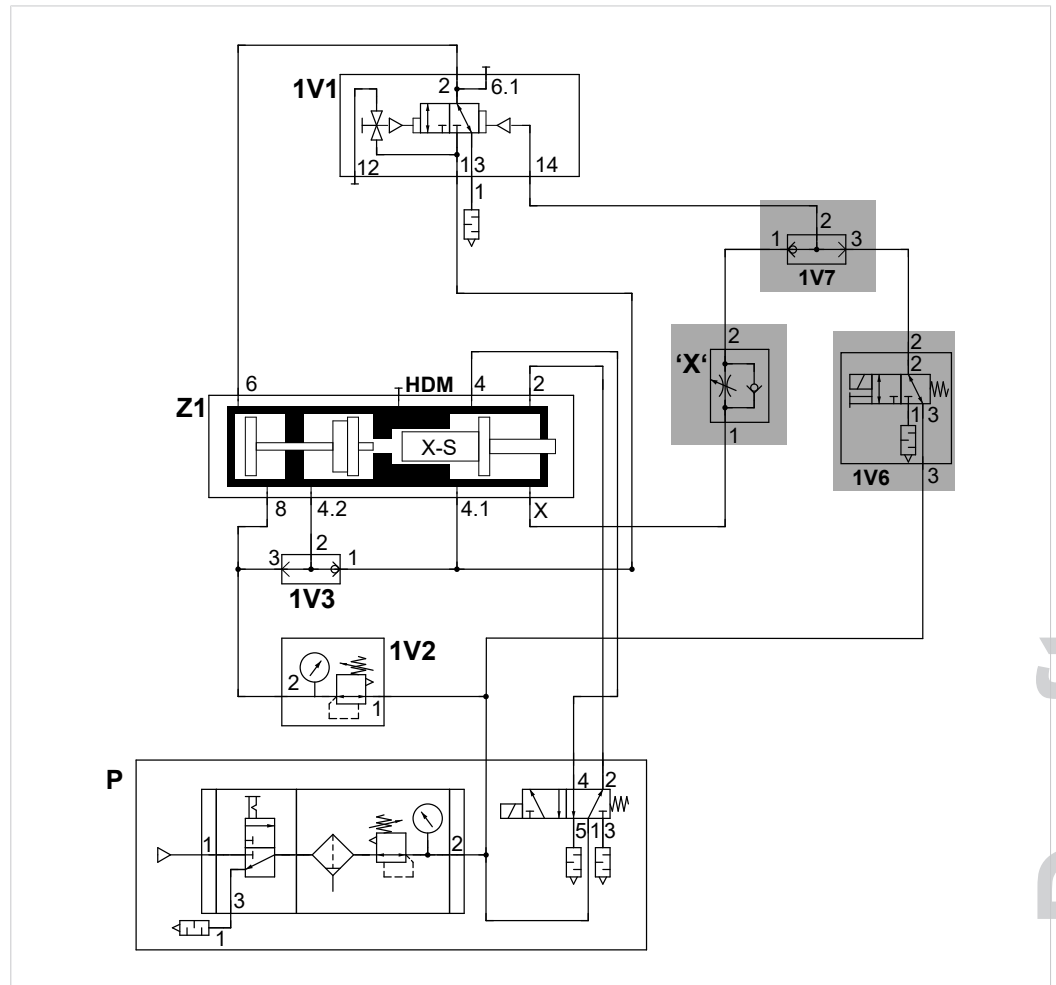


Fig. 17 External power stroke release (assembly ZKHF)

	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
	12	Control connection
1V2	Pressure valve (pneumatic spring)	
1V3	Fast stroke support	
1V6	Electrical switching valve	
	3	Input (release)
	2	Output
	1	Input (deactivation)
1V7	OR valve	
	3	Switching valve input
	1	Control throttle 'X' input
	2	Output

Draft

	Assembly	
'X'	Control throttle 'X'	
Z1	Drive (example type X-S)	
	8	Plunger return stroke input
	4.2	Reservoir input
	4.1	Fast approach stroke output
	2.1	Return stroke output
	2	Return stroke input
	4	Fast approach stroke input
	HPM	High pressure measuring connection
	6	Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)	

3.7.8 External power stroke supply (optional)

In the case of the external power supply, the power stroke valve is supplied with compressed air separately and independently from the fast approach stroke. The power stroke can be released by a dynamic pressure switch, an external power stroke switch (assembly ZKHZ), or by an external power stroke release (ZKHF).

If a power stroke deactivation (assembly ZKHD) is installed, the power stroke can be deactivated with an electrical signal if necessary.

The control system can be combined with a dynamic pressure switch, an external power stroke switch, an external power stroke release or a power stroke deactivation.

The following is required:

- External pressure supply at connection [1] of the power stroke valve.

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Powerpackage with pressure valve (pneumatic spring)

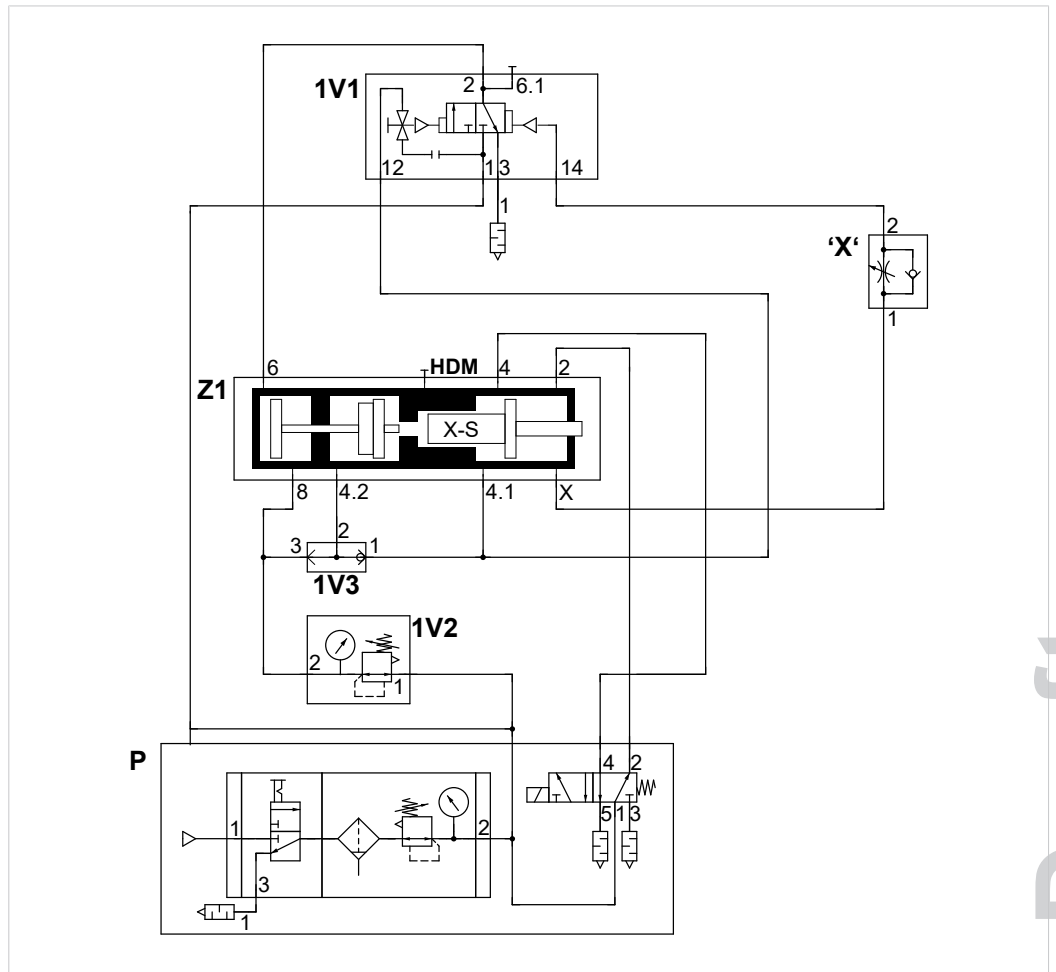


Fig. 18 External power stroke supply (optional)

	Assembly	
1V1	Power stroke valve	
	2	Power stroke output
	6.1	Power stroke signal
	14	Control connection
	3	Muffler output
	1	Power stroke input
1V2	Pressure valve (pneumatic spring)	
	12	Control connection
'X'	Control throttle 'X'	
Z1	Drive (example type X-S)	

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Assembly	
	8 Plunger return stroke input
	4.2 Reservoir input
	4.1 Fast approach stroke output
	2.1 Return stroke output
	2 Return stroke input
	4 Fast approach stroke input
	HPM High pressure measuring connection
	6 Power stroke input
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)

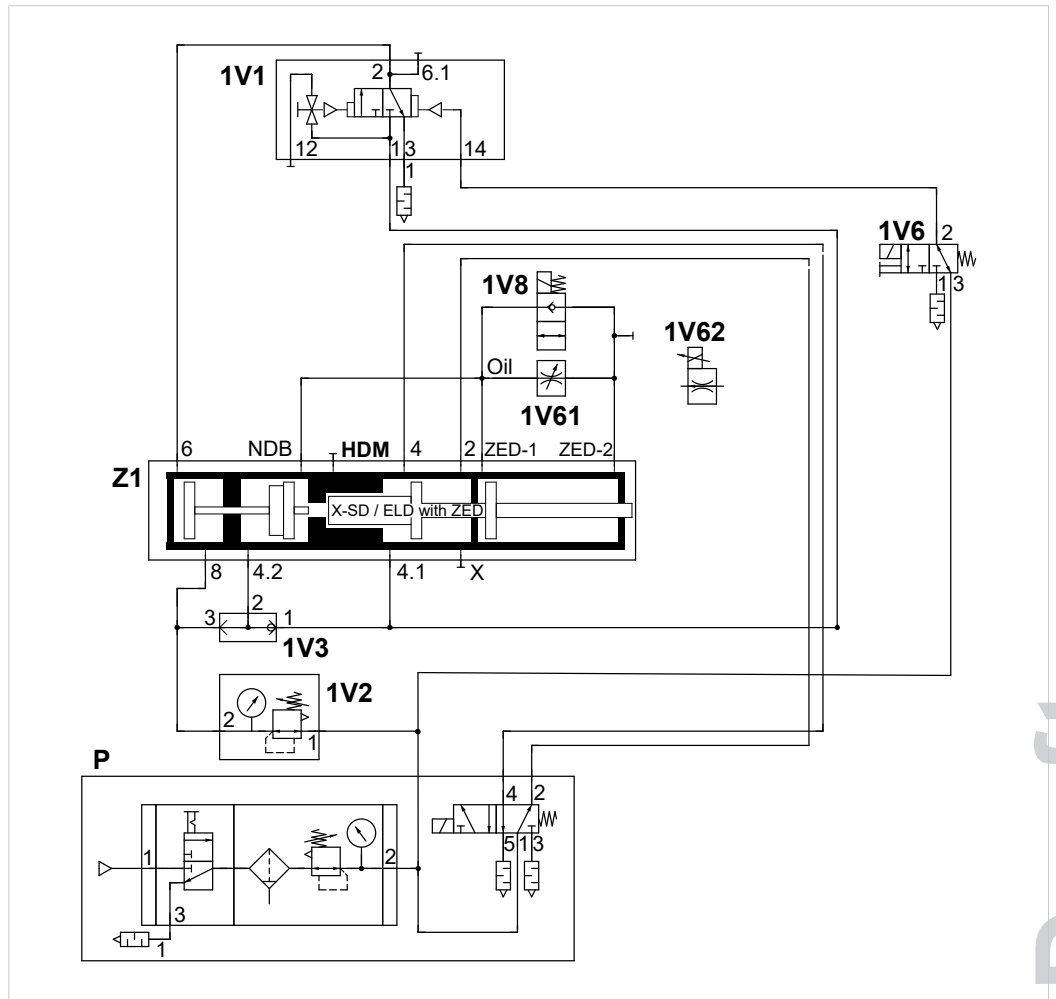
3.7.9 Adjustable damping (assembly ZED) (optional)

The integrated damping option allows an adjustable constant speed of the working piston during the approach stroke and power stroke, independent of the working forces.

Thus, the following can be compensated:

- When joining: stick-slip effect.
- When stamping: sudden acceleration of the working piston when the opposing force, the stamping impact, is removed.

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Draft

Fig. 19 Adjustable damping ZED (optional)

	Assembly
1V1	Power stroke valve
1V2	Pressure valve (pneumatic spring)
1V3	Fast stroke support
1V6	External power stroke connection
1V61	Manual flow control valve
1V62	Electric proportional flow control valve (optional)
1V8	Damping On / Off
Z1	Drive
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)

3.7.10 Integrated cutting impact damping (module ZSD) (option)

The cutting impact damping dampens the working piston when the counterforce is removed, e.g. for punching applications. As pure mechanical damping, it can also be used with limitations as stroke damping.

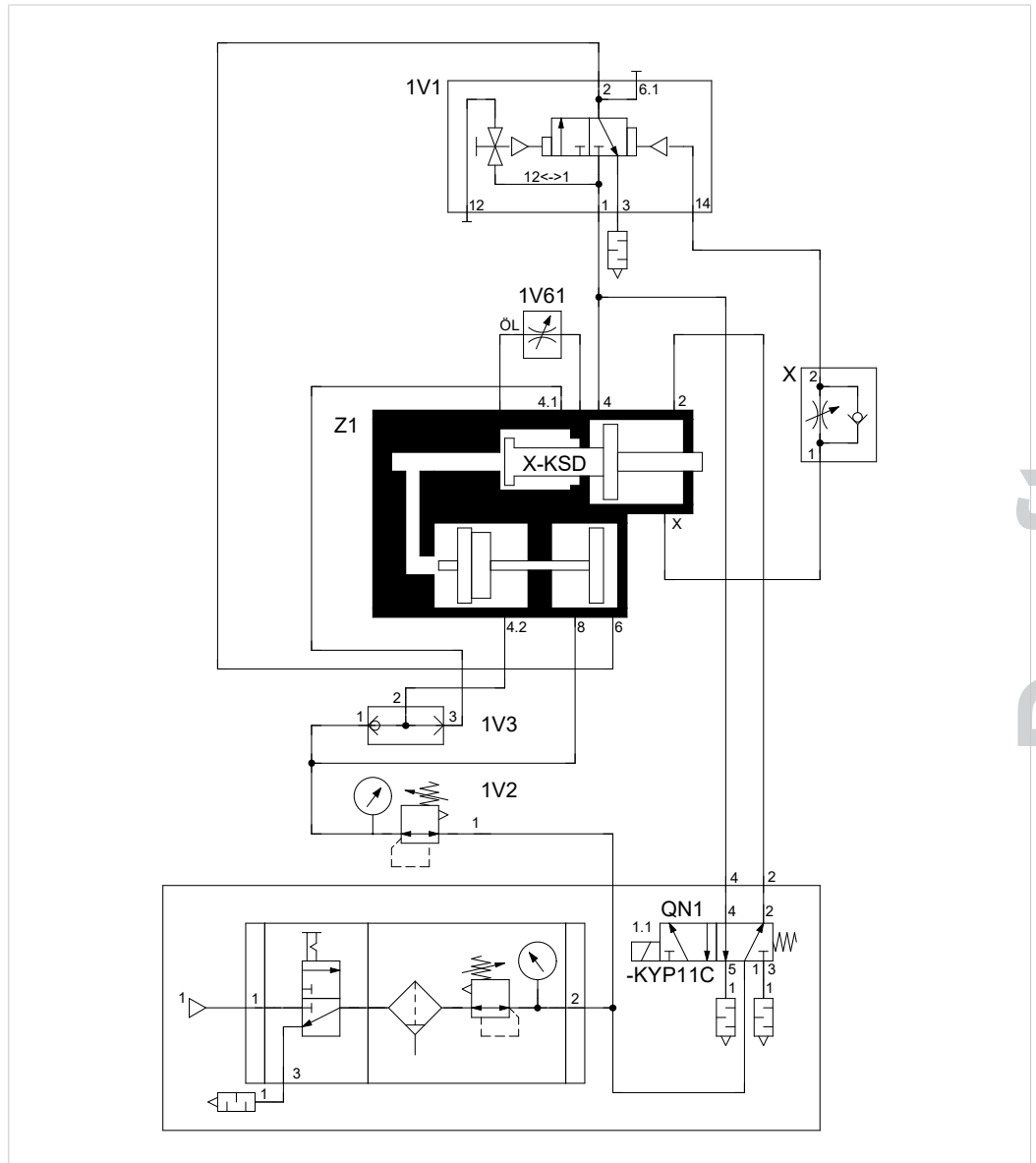


Fig. 20 Integrated cutting impact damping ZSD (option)

	Assembly
1V1	Power stroke valve
1V2	Pressure valve (pneumatic spring)
1V3	Fast stroke support
1V61	Manual throttle valve

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	Assembly
Z1	Drive
P	To be carried out by the customer: Compressed air supply and maintenance unit (not included in delivery)

Draft

4 Technical data

4.1 Type sheet and data sheet

For technical data and installation dimensions see data sheet.
www.tox.com

4.2 General environmental conditions

- The TOX® Powerpackage is protected against the penetration of liquids and contamination from the environment by means of seals, strippers and mufflers. However, the penetration of foreign substances during the use of dusty or strongly contaminated environment cannot be completely excluded.
The damages resulting from contamination during operation are not covered by warranty regulations.
- The penetration of water or other corrosive liquids must be prevented.
- No guarantee for use in environments with strongly corrosive environmental conditions such as increased salt content (maritime climate), cleaning with corrosive cleaning agents, or the use of high-pressure cleaners.
If the drives are used in a corrosive environment, TOX® PRESSOTECHNIK can supply drives in corrosion-protected design.
- The specified maximum admissible environmental temperature must not be exceeded to prevent damages to the sealing system and inadmissible expansion in the hydraulic system.
See [Ambient temperature, Page 58](#).
- The specified particle size and moisture for compressed air is to be adhered to.
See [Compressed air quality and pneumatic connection, Page 59](#).

4.3 Ambient temperature

Approved ambient temperature: 10 °C to 60 °C.

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4.4 Compressed air quality and pneumatic connection

The following is required:

- Filtered and dried compressed air

Lightly oiled compressed air is permitted.

Compressed air quality (according to DIN ISO 8573-1):

Solids		Water dew point		Maximum Oil content	
Class	[μm]	Class	[$^{\circ}\text{C}$]	Class	[mg/m^3]
5	40	4	3	3	1

4.4.1 Pneumatic connection, air pressure, oil pressure

See data sheet.

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Separate compressed air supply for the permanent air supply of pressure valve (pneumatic spring):

- Default setting: P_{EL} 0.8 bar
- Minimum supply pressure of pressure valve: $P_{min} = 2.5$ bar.

4.5 Tightening torques

4.5.1 Tightening torques for flange mounting the drive

Prescribed tightening torques for fastening screws of property class ISO 4762-12.9:

Thread size	Torque
M 6	17 Nm
M 8	40 Nm
M 10	80 Nm
M 12	135 Nm
M 16	340 Nm
M 20	660 Nm
M 24	1,130 Nm
M 30	2,250 Nm

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4.5.2 Tightening torques on the piston rod

Tool coupling ZWK	Piston rod thread	Tightening torque
ZWK 001	M12 x 1.5	10 Nm
ZWK 002	M16 x 1.5	15 Nm
ZWK 004	M22 x 2.0	40 Nm
ZWK 008	M30 x 2.0	180 Nm
ZWK 015	M30 x 2.0	210 Nm
ZWK 030	M39 x 2.0	230 Nm
ZWK 050	M42 x 2.0	290 Nm
ZWK 075	M64 x 2.0	500 Nm
ZWK 200	M80 x 2.0	500 Nm

4.5.3 Tightening torques of pneumatic screw fittings on the Powerpackage

The specified tightening torques only apply to pneumatic screw fittings on the Powerpackage.

Connecting thread	Tightening torque
1/8"	10 Nm
1/4"	15 Nm
3/8"	25 Nm
1/2"	30 Nm

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4.6 Press force table

Press force table see separate document.

4.7 Specification for hydraulic oil

The following oils are approved for standard application:

- Hydraulic oil HLP32 (according to DIN 51524-2), filtered < 5µm, load rating > 30 N/mm²
- Food grade oil Klüber Summit HySyn FG 32

The following hydraulic oils are approved with limitations for standard application:

- Hydraulic oil UCON™ LB-165
- Synthetic oil ISOTEX 46
- Synthetic oil Envolubric PC 46 NWL

- The use of hydraulic oils that have not been approved as standard can lead to an increase of maintenance intervals due to an increased intake of air.
- The use of hydraulic oils that have not been approved as standard can reduce the lubrication capacity lower than for HLP32 hydraulic oils. This can lead to a shorter lifetime of seals.
- Some sealing materials in case of hydraulic oils not approved as standard tend towards increased swelling and therefore to a reduced lifetime of the seals.

NOTE

Loss of warranty in case of the use of non-approved hydraulic oils!

Due to the negative effects on maintenance intervals, swelling behavior and lifetime of the seals in case of the use of hydraulic oils that have not been approved as standard, the granted warranty becomes extinct.

- Use hydraulic oils that have been approved by TOX® PRESSOTECHNIK as standard.
 - Use other hydraulic oils only after the express approval of TOX® PRESSOTECHNIK.
 - Do not mix different hydraulic oils. Negative effects such as flocculation cannot be excluded.
-

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5 Transport and storage

5.1 Safety during transport

WARNING

Hazard from suspended loads!

Severe crushing, impacts and serious accidents as a result of improper transportation and falling load!

- Only use lifting gear that is appropriate and in perfect technical condition, as well as load attachment devices with an adequate safe working load.
- Never stand or work under suspended loads.
- Make sure that that no person is in the danger area.
- When transporting and setting down, make sure that no parts of the body become jammed.
- Wear suitable personal protective equipment (e.g. safety boots).

CAUTION

Injury from toppling and falling products!

- Secure product from toppling, falling and accidentally moving.

- The transportation may only be carried out by authorized personnel.
- The product may only be transported with empty liquid containers.
- The product may only be transported with the transport pallet or transport device provided.
- The product may only be lifted with suitable lifting devices at suitable lifting points.
See Safety symbols.
- Note the weight of the product.
See technical data sheet.
- Note the center of gravity of the product.
See general arrangement drawing.

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5.2 Lifting device

Depending on the size of the drive, the flange cover at the rear is provided with threaded bore holes for ring bolts for hoisting.

WARNING

Risk of impact and crushing due to products swivelling out!

Severe impacts, crushing, and serious accidents as a result of the product rotating and swiveling out.

- Pay attention to the center of gravity and pivot point.
- Establish a V-shaped suspension connection in the center of gravity between the ring bolts.
- If there are no threaded holes, suspend the ring bolt between the working part and intensifier.
- Lift up the product carefully.

5.3 Temporary storages

- Use original packaging.
- Make sure that all connections and threads are covered to prevent dust ingress and shocks.
- Store the product only in closed, dry, dust-free and dirt-free rooms at room temperature.

5.4 Dispatch for repair

To dispatch the product for repair to TOX® PRESSOTECHNIK, please proceed as follows:

- Fill in the "Accompanying repair form". This we supply in the service sector on our website or upon request via e-mail.
- Send us the completed form via e-mail.
- Then you will receive the shipping documents from us via e-mail.
- Send us the product with the shipping documents and a copy of the "Accompanying repair form".

For contact data see [Contact and source of supply, Page 11](#) or www.tox.com.

6 Installation

6.1 Safety during installation

The installation may only be carried out by trained and authorized personnel.

DANGER

Electrical hazards in case of contact with live parts!

Electric shock, burns or death in case of contact with live parts!

- Have all work on the electrical equipment performed by an electrician.
- Disconnect power supply.
- Wait for residual energy to dissipate safely (at least 3 minutes).

WARNING

Ejecting parts and compressed air from compressed air conducting lines!

Serious injuries to eyes and body cavities!

- Always connect and disconnect lines without pressure.
- Pay attention to maximum permitted pressures.
- Wear individual protective equipment.

CAUTION

Tripping points from laid supply lines!

Injuries from tripping and falling!

- Avoid tripping points when setting up.
- Mark unavoidable tripping points with warning sign.

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6.2 Installing drive

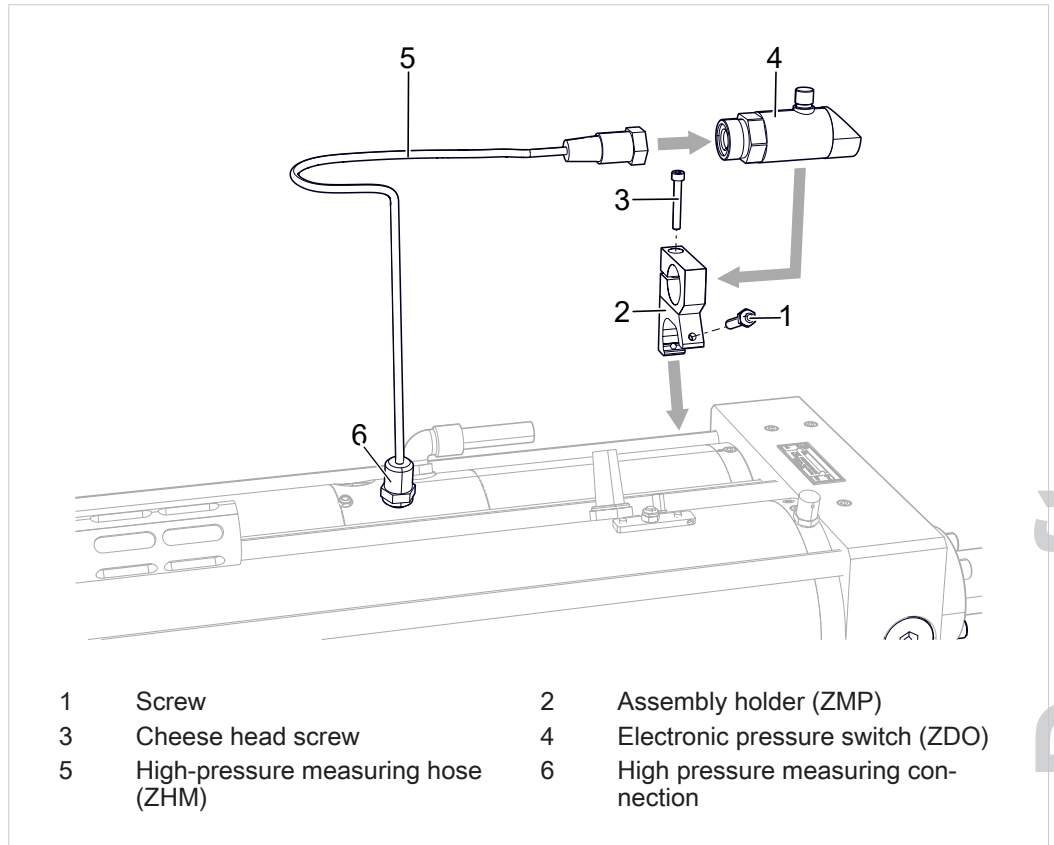
Material required:

- Screws of the strength class : 12.9 (in accordance with ISO 4762)
 - Torque wrench
1. **WARNING!** Risk of crushing! Attach lifting device (ring bolts) and use appropriate lifting gear.
Place and align drive on the fastening element provided.
 2. Tighten screws, observe torques while doing so.
See [Tightening torques, Page 59](#).

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6.3 Installing optional accessories

6.3.1 Installing electronic pressure switch (ZDO)



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Material required:

- Electronic pressure switch (ZDO)
- Assembly holder (ZMP)
- High-pressure measuring hose (ZHM)

NOTE

Air trapped in the connecting line!

Air could get into the high pressure chamber, impair the working process and distort the measuring result.

➔ Fill connecting line with oil and vent.

- ✓ Make sure that the system is depressurized and disconnected from the power supply.
 - ✓ Observe the tightening torques.
See [Tightening torques, Page 59](#).
1. Install assembly holder of pressure switch on the drive. Make sure that display and operating elements are easily accessible.
 2. Fasten the pressure switch in the assembly holder.
 3. Install high pressure hose on the pressure switch and on the high pressure measuring connection.
 4. Connect cable of the pressure switch on the control system according to circuit diagram.
See pressure switch ZDO operating manual.

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6.3.2 Installing and setting position sensors of stroke monitoring for forward and return stroke (ZHU)

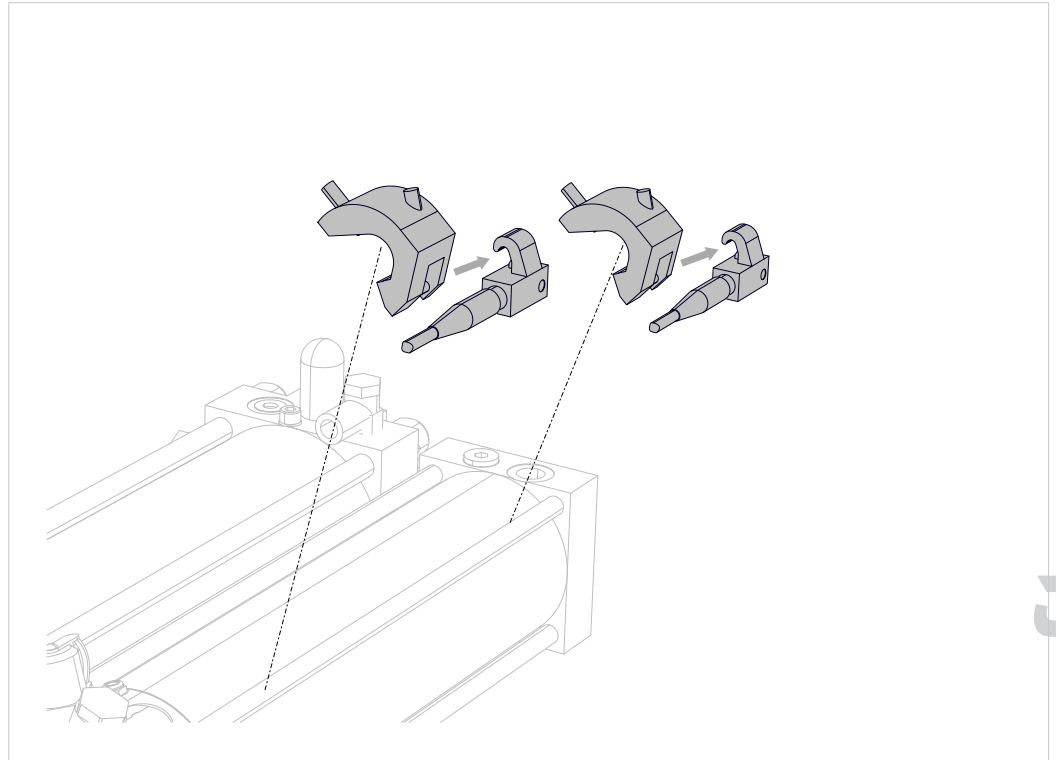


Fig. 21 Installing position sensors for stroke monitoring for forward and return stroke

Material required:

- Magnet-sensitive proximity switch with LED (ZHS 001.001)
- Holding angle for proximity switch
- Cable box

1. Installing holding angle.
2. Installing proximity switch.
3. Connect the proximity switch to the control.
See circuit diagram.

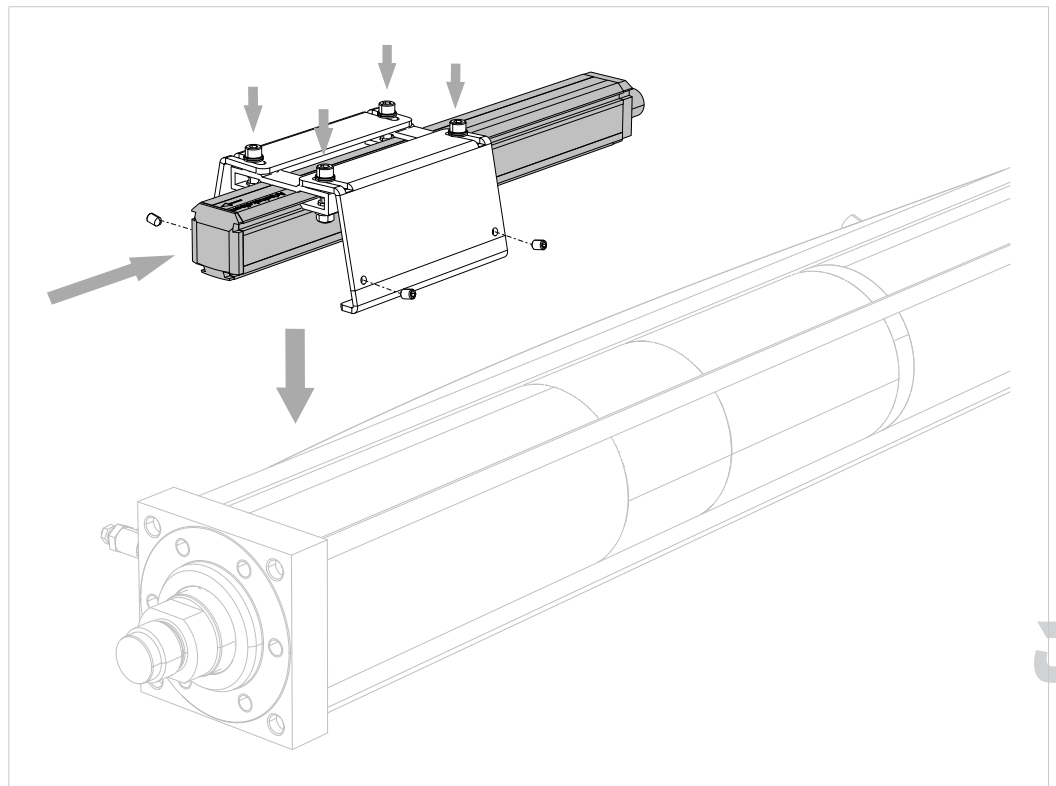
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Setting the position sensors

- ✓ Proximity switches are connected.
 - ✓ Working piston in home position.
1. Push the proximity switch from the edge of the cylinder to the first switch-on point.
 - ▷ The LED lights up.
 2. Mark the edge of the proximity switch on the cylinder.
 3. Push the proximity switch further to the switch-off point.
 - ▷ The LED switches off.
 4. Push the proximity switch back to the 2nd switch-on point.
 - ▷ The LED lights up.
 5. Mark the edge of the proximity switch on the cylinder.
 6. Position and fix the proximity switch between the two markings.

Draft

6.3.3 Installing the external linear position sensor (ZHW)



Material required:

- i** Prerequisite for the installation of the external linear position sensor:
- TOX® Powerpackage type line-Q, line-X or RZS
 - 20 mm stroke reduction either positioned inside in the Powerpackage or
 - positioned outside the tool
- Linear position sensor (ZHW)
 - Holding angle for linear position sensor

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- ✓ The operating manual of the linear position sensor is available.

NOTE**Risk of damage to the device due to incorrect installation and connection!**

- ➔ The specifications of the operating manual of the manufacturer are to be adhered to.

1. Installing holding angle.
2. Insert the linear position sensor into the holding angle. Ensure that the position sensing system with contact bears against the front flange.
3. Adjust position sensing system. Ensure that for ZHW 002/004/008/015 there is a distance between the front flange and front edge of the travel sensor of 2 +/-0.05 mm, and for ZHW 030 a distance between the front flange and front edge of the travel sensor 14 +/-0.05 mm.
4. Ensure the parallel alignment of the position sensing system to the longitudinal axis.
5. Fix the position sensing system with set screws to the tension rods to prevent it from shifting. Tightening torque: 2 Nm.
6. Secure the set screws with the hexagon nuts and with safeguarding lacquer.
7. Connect the position sensing system to the control.
See circuit diagram and operating instructions of the position sensing system.

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6.3.4 Installing pressure control in the power stroke line (ZDK)

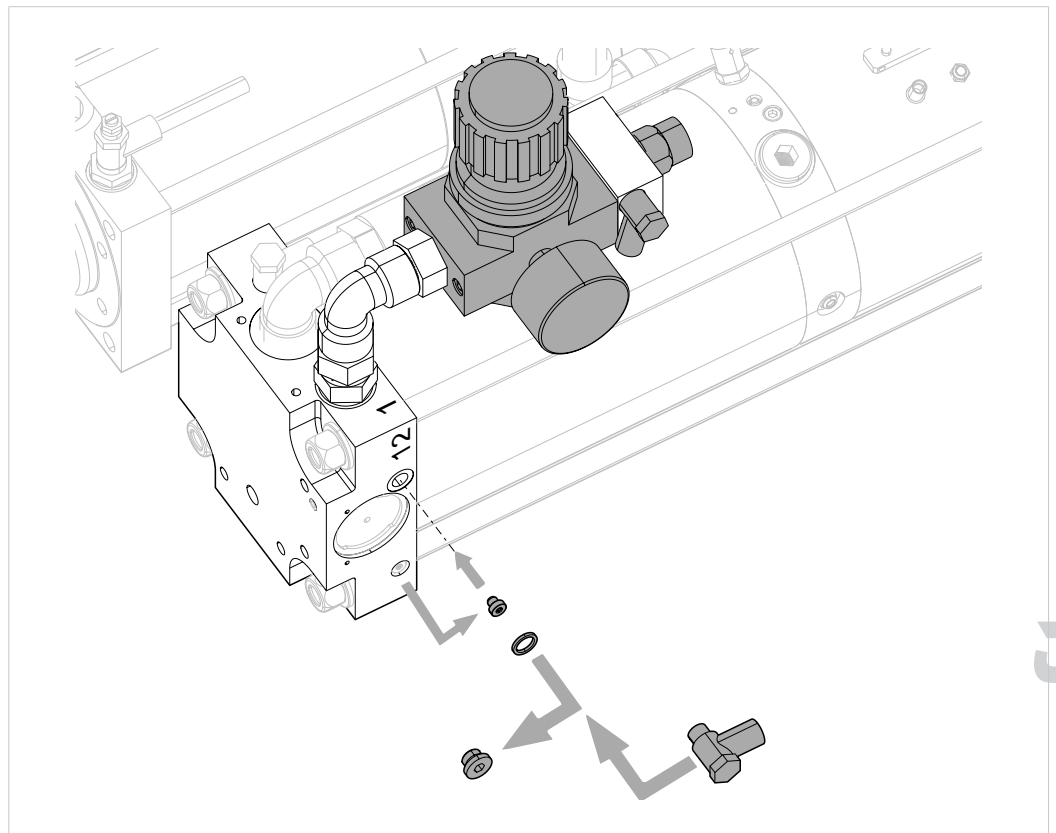


Fig. 22 Installing pressure control in the power stroke line (assembly ZDK)

Material required:

- Manual pressure regulator (ZDK)
- Screw plug with collar, size M 5 (laterally on power stroke valve next to connection [12])

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- ✓ For connections see [Pressure control in the power stroke line \(assembly ZDK\) \(optional\), Page 43](#).
- 1. Remove the screw plug on the control connection [12].
 - ▷ The lower positioned M 5 threaded hole is set free.
- 2. Remove the M5 screw plug from the par position.
- 3. Screw the M 5 screw plug fully into the lower positioned M 5 threaded hole of the control connection [12].
 - ▷ The M 5 threaded hole in power stroke valve is closed.
- 4. Connect control connection [12] on the power stroke valve to output of fast approach stroke [4.1] or connection [4.4] on the pressure regulator. In addition, install hose line and seal.
- 5. Install pressure regulator on power stroke input [1].
- 6. When installing a proportional pressure regulator, connect it to the control. See data sheet, or circuit diagram.

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6.3.5 Installing proportional pressure control valve in the power stroke line

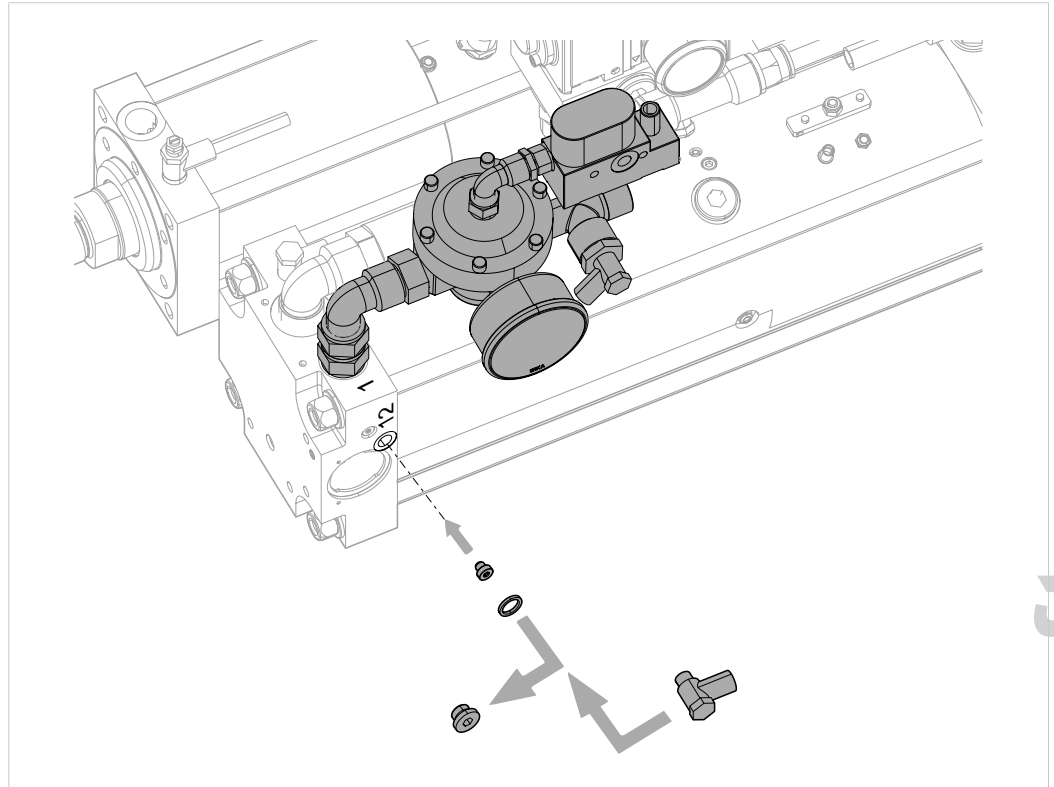


Fig. 23 Installing proportional pressure control valve in the power stroke line

Material required:

- Proportional pressure control valve
 - Screw plug with collar, size M 5 (laterally on power stroke valve next to connection [12])
- ✓ For connections see [Pressure control in the power stroke line \(assembly ZDK\) \(optional\), Page 43.](#)

1. Remove the screw plug from the control connection [12] and screw the M 5 screw plug with collar fully in.
 - ▷ Bore hole in power stroke valve is closed.
2. Connect the control connection [12] on the power stroke valve with output of fast approach stroke [4.1] or connection [4.4] on the proportional pressure control valve. In addition, install hose line and seal.
3. Install pressure regulator on power stroke input [1].
4. When installing a proportional pressure control valve, connect it to the control.

See data sheet, or circuit diagram.

6.3.6 Installing external power stroke connection (ZKHZ)

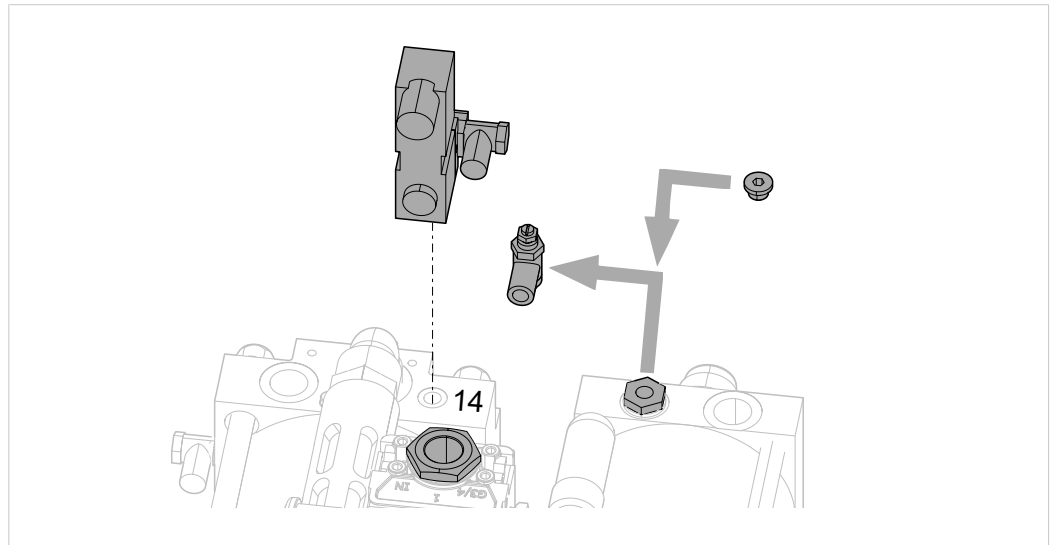


Fig. 24 Installing external power stroke connection (ZKHZ)

Material required:

- Electrical switching valve power stroke switch (ZKHZ)
- Screw plug

✓ For connections see [External power stroke switch \(assembly ZKHZ\) \(optional\), Page 46](#).

1. Disassemble control throttle 'X'.
2. Connect the control throttle 'X' connection to screw plug.
3. Install power stroke switch to connection of the power stroke valve [14].
4. Connect the power stroke switch to permanent compressed air supply.
5. Connect the power stroke connection to the control.
See circuit diagram.

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6.3.7 Installing external power stroke release (ZKHF) and power stroke deactivation (ZKHD)

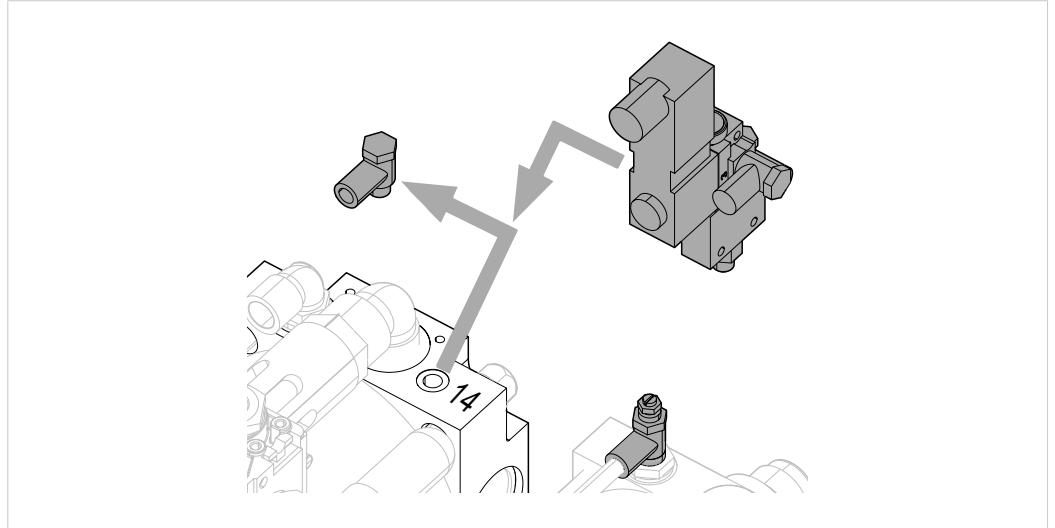


Fig. 25 Installing external power stroke release (ZKHF) and power stroke deactivation (ZKHD)

Material required:

- Electrical switching valve power stroke release (ZKHF) and power stroke deactivation (ZKHD) with pneumatic OR valve

Installing the external power stroke release (ZKHF)

✓ For connections see [External power stroke deactivation \(assembly ZKHD\) \(optional\), Page 48.](#)

1. Install switching valve power stroke release and power stroke deactivation with OR valve on control connection [14].
2. Connect line of the control throttle 'X' to the OR valve.
3. Connect pneumatic input [3] of the switching valve to compressed air supply.

Installing the external power stroke deactivation (ZKHD)

✓ For connections see [External power stroke deactivation \(assembly ZKHD\) \(optional\), Page 48.](#)

1. Install switching valve power stroke release and power stroke deactivation with OR valve on control connection [14].
2. Connect line of the control throttle 'X' to the OR valve.
3. Connect pneumatic input [1] of the switching valve to compressed air supply.

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6.3.8 Preparing external power stroke supply

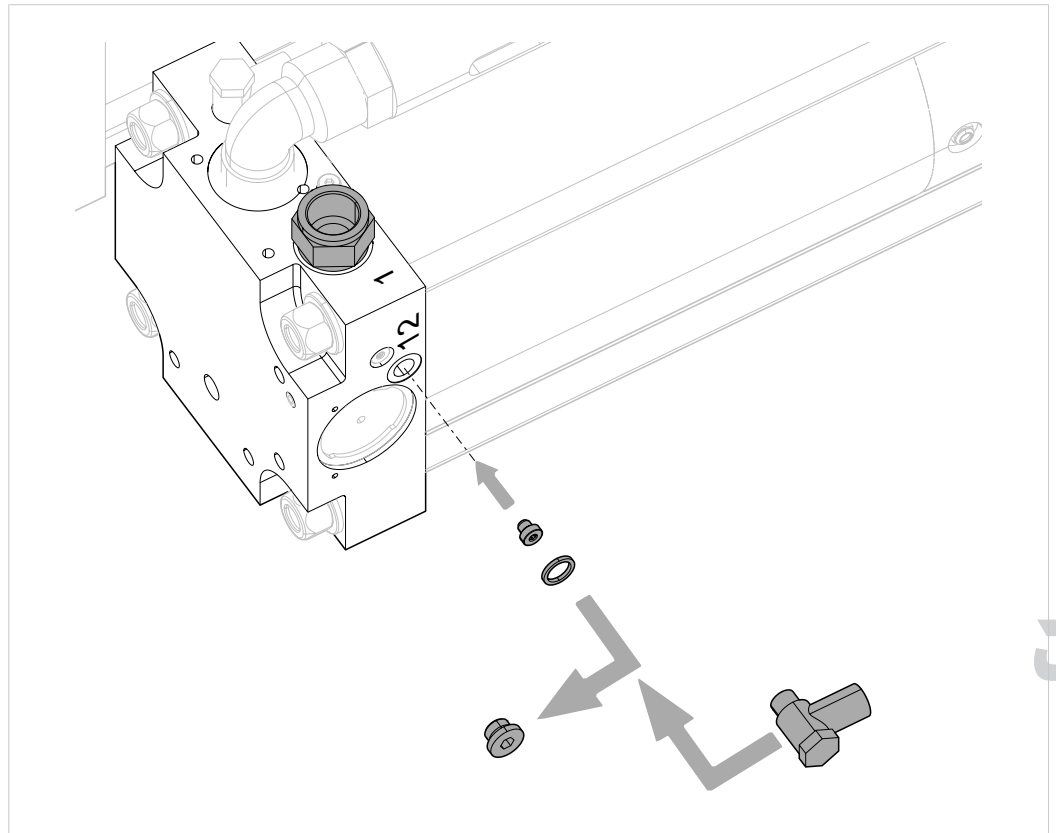


Fig. 26 Preparing external power stroke supply

Material required:

- Screw plug M 5 with collar (laterally on power stroke valve next to connection [12])

✓ For connections see [External power stroke supply \(optional\)](#), Page 52.

1. Remove the screw plug from the control connection [12] and screw the M 5 screw plug with collar fully in.
 - ▷ Bore hole in power stroke valve is closed.
2. Connect control connection [12] on the power stroke valve to output of fast approach stroke [4.1]. In addition, install hose line and seal.
3. Install external power stroke supply on power stroke input [1].

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6.3.9 Installing the stroke frequency optimization (ZHO)

Installing the stroke frequency optimization (ZHO) for drive with integrated power stroke valve

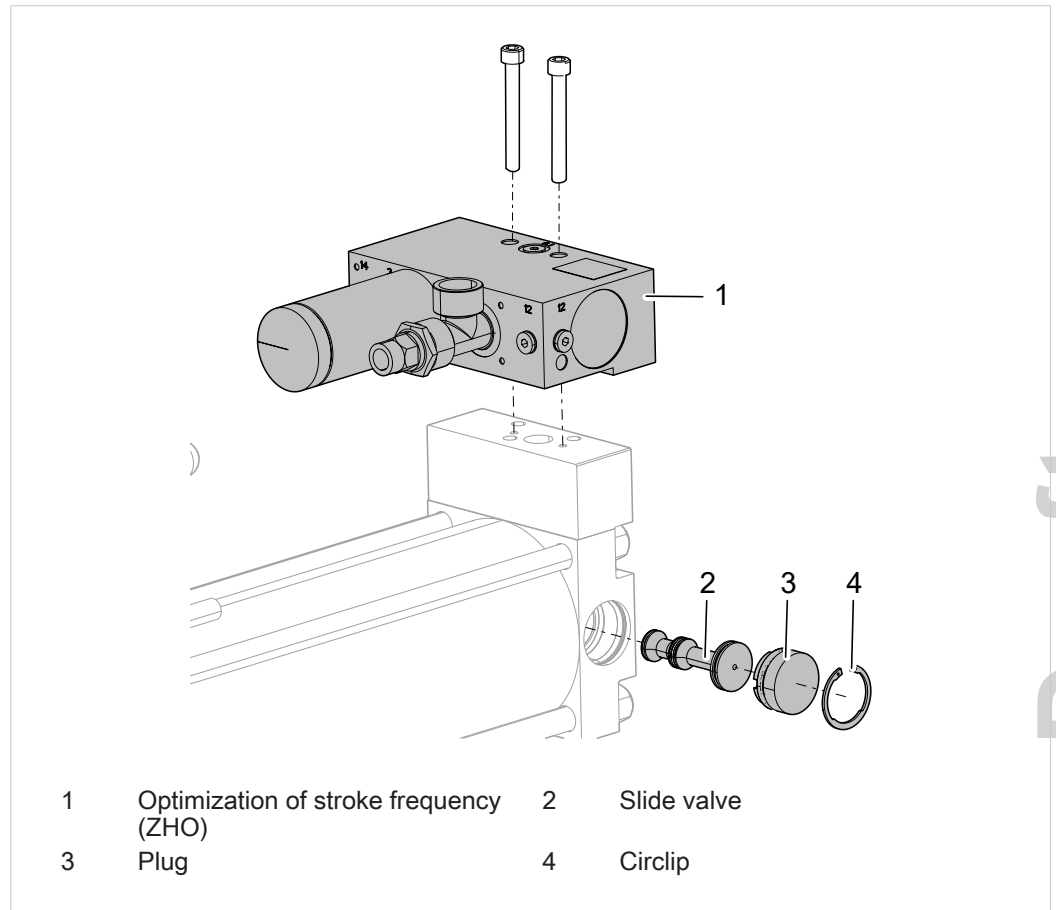


Fig. 27 Installing the stroke frequency optimization ZHO

Material required:

- Stroke frequency optimization (ZHO) for drive with integrated power stroke valve
- Pneumatic supply line including all series-connected valves in the size fitting to the connections.

1. Remove circlip and plug.
2. Remove the valve slide.
3. Install the plug and circlip.
4. Installing the stroke frequency optimization (ZHO).

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Installing the stroke frequency optimization (ZHO) for drive with external power stroke valve

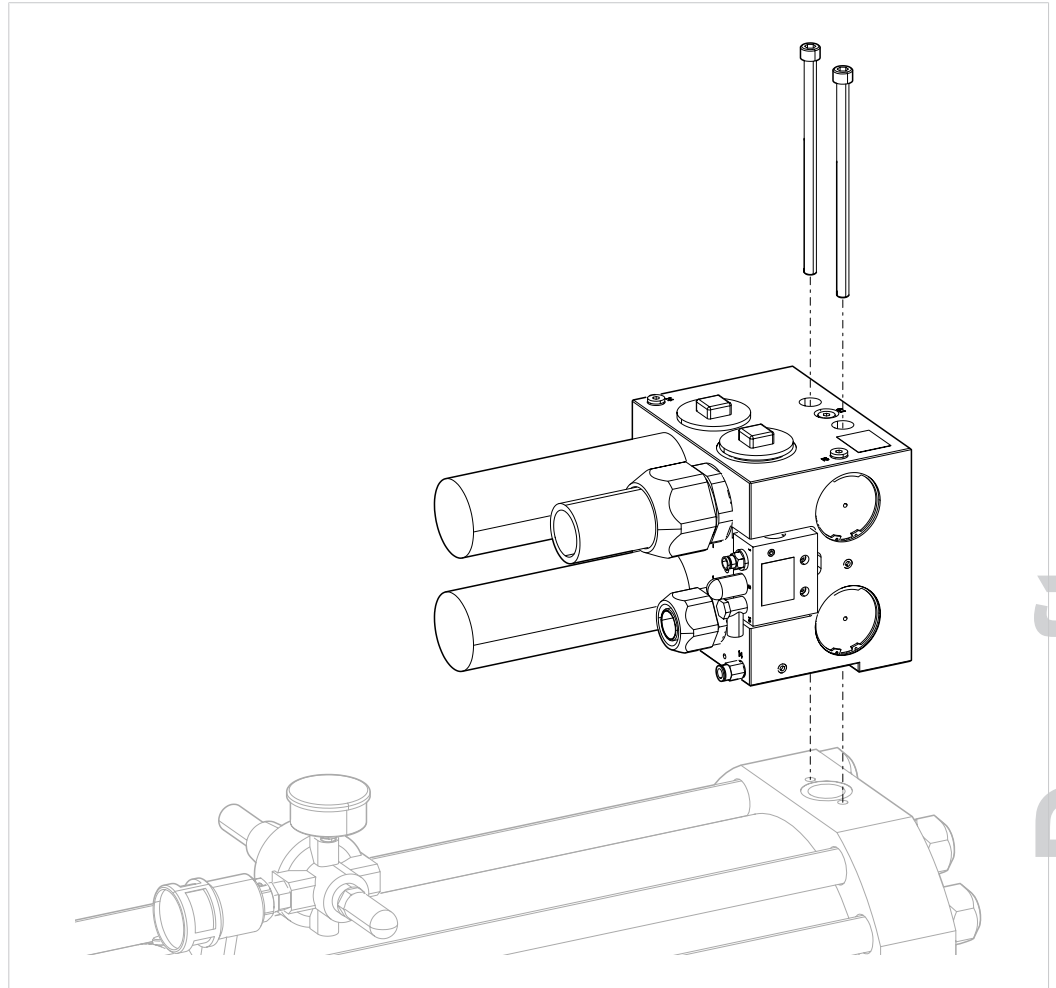


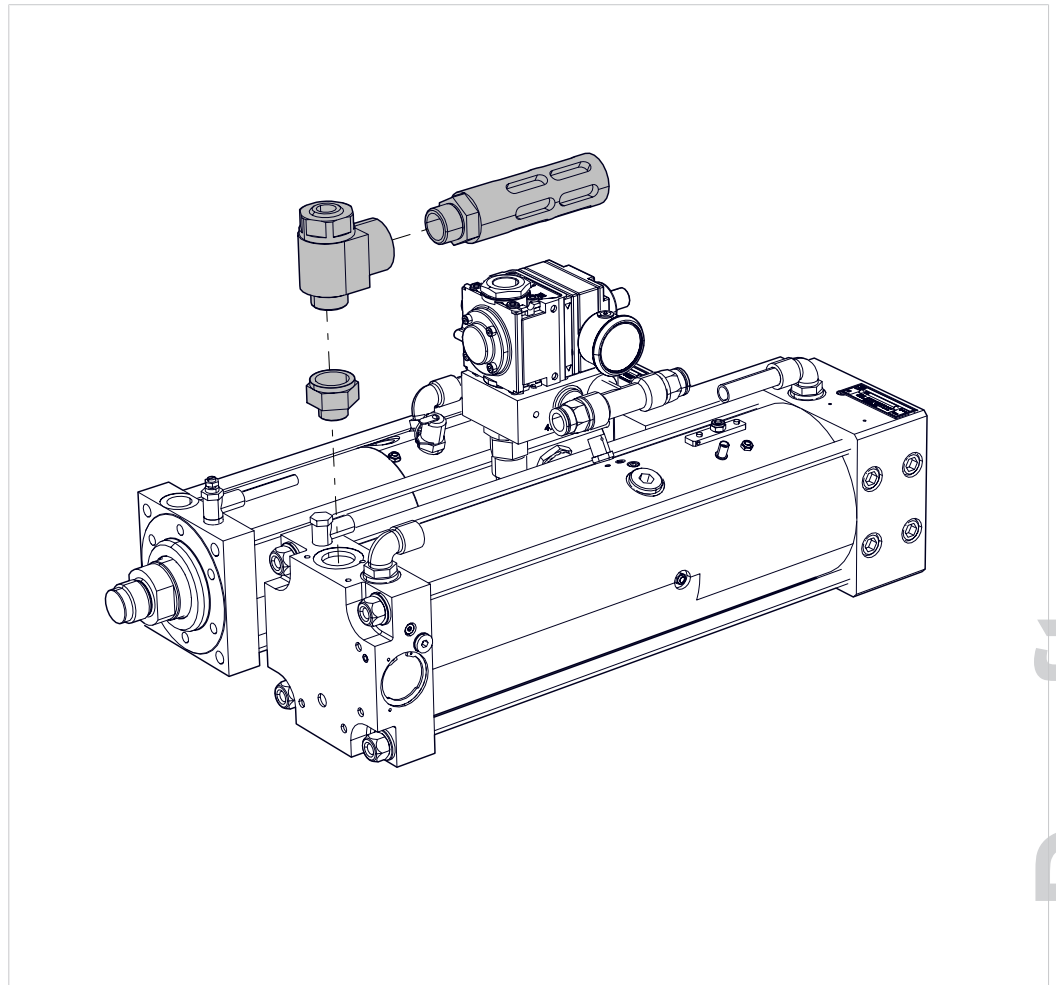
Fig. 28 Installing the stroke frequency optimization ZHO

Material required:

- Installing the stroke frequency optimization (ZHO) for drive with external power stroke valve
- Pneumatic supply line including all series-connected valves in the size fitting to the connections.

1. Dismantle the existing external power stroke valve.
2. Install the stroke frequency optimization (ZHO).

6.3.10 Installing the speed reduction for power stroke venting



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Fig. 29 Installing the speed reduction for power stroke venting

Material required:

- Adjustable exhaust air damper (ZD)

1. Install the exhaust throttle between the power stroke valve output [3] and the muffler.
2. Connect the compressed air supply connections.
3. Set the exhaust air damper.
See [Set the speed ratio between power stroke and power stroke venting \(optional\)](#), Page 34.

6.3.11 Installing tool coupling (ZWK)

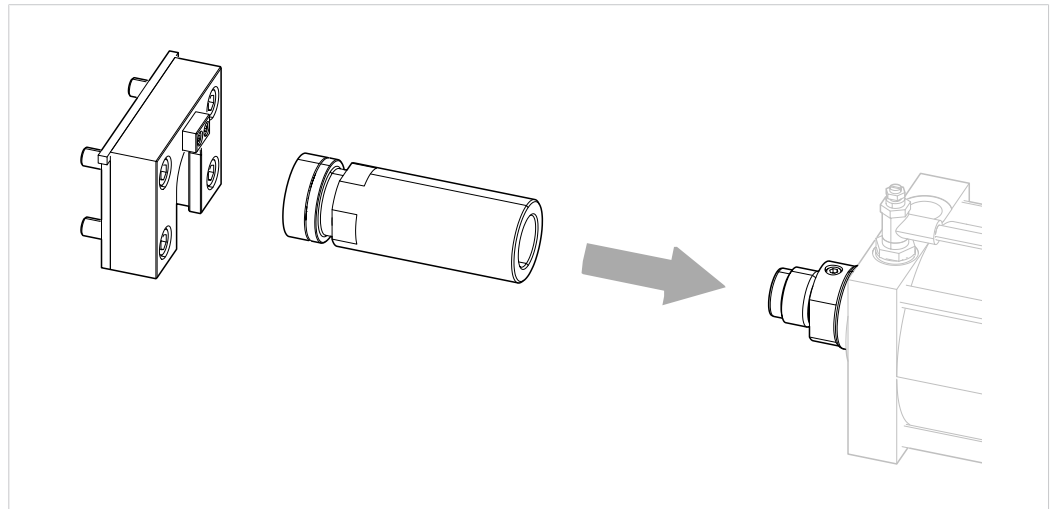


Fig. 30 Installing tool coupling (ZWK)

The thread at the end of the piston rod is intended for the installation of a tool holding fixture or a tool.

Material required:

- Tool holding fixture (ZWK) or tool
- Low-strength screw locking compound (e.g. Loctite 222)
- Lubricating grease (Klübersynth UH1 14-151 or a technically comparable one)

✓ Technical data, dimensions are observed.
See data sheet, or type sheet at www.tox.com.

1. Install the tool holding fixture on the thread of the working piston. Observe tightening torques.
See [Tightening torques on the piston rod, Page 60](#).
2. Secure the tool holding fixture screw locking compound.
3. Wet the contact surface between the holding tray and tool holding fixture with lubricating grease.
4. Install the holding tray on the ram or on the tool plate.

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7 Commissioning

7.1 Safety during the commissioning

The commissioning may only be carried out by trained and authorized personnel.

The following applies:

- Make sure that that no persons are located within the danger area of the machine.
- Observe technical data and limit values.
See Technical data.

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7.2 Requirements for the commissioning

This incomplete machine may not be commissioned until it has been ascertained that the incomplete machine in which the component is to be installed complies with the requirements of the Machinery Directive (2006/42/EC).

The requirements are:

- All components are properly installed.
- The safety devices of the entire system are properly assembled and functional.
- Any transport locks are removed.
- Supply connections, communication and control connections, material or media hoses are installed properly. The permissible values are complied with.
- The necessary software for controlling the component is installed.
- TOX® PRESSOTECHNIK has released the system and associated components for commissioning.

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- i** For the use of pneumatic systems, very small air leakages are possible on the pneumatic screw fittings / seals and basically do not represent a defect. For this there are no measurable limit values and specifications, the awareness takes place acoustically by the operator.

Pneumatic screw fittings can come loose under certain circumstances due to vibrations during transport, differences in temperature or manipulation during installation.

→ Check the firm seating of the pneumatic screw fittings.

→ For pneumatic screw fittings on the TOX® Powerpackage, see:
[Tightening torques of pneumatic screw fittings on the Powerpackage, Page 60.](#)

7.3 Setting control throttle 'X'

The control throttle 'X' is used to set the timing of the switchover from fast approach stroke to power stroke, and must be readjusted for each application (e.g. tool weight drawing/pressing). The effect of the control throttle 'X' is influenced by the system pressure and by setting an optional fast approach stroke throttle.

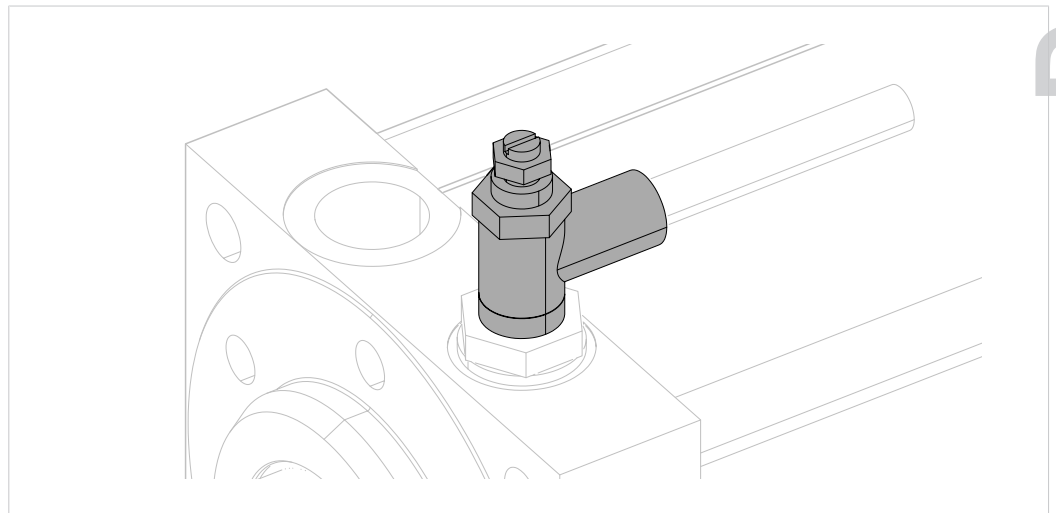


Fig. 31 Setting control throttle 'X'

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- ✓ Working piston is retracted.
 - ✓ Compressed air supply is switched on.
1. Close control throttle 'X' when piston is retracted and impinged by turning clockwise.
 2. Extend working piston rod.
 3. Open control throttle 'X' slowly by turning counterclockwise until the power stroke is noticeably activated on meeting a counterforce. Opening the control throttle 'X' further causes the power stroke to be activated earlier.


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7.4 Setting speed ratio of return stroke to fast approach stroke

The speed of the working piston in the fast approach stroke and return stroke can be set with external exhaust air dampers on the forward stroke and return stroke. The exhaust air dampers may have to be retrofitted.

Type
line-X
Necessary speed ratio
<ul style="list-style-type: none"> Return stroke equally fast as fast approach stroke or Return stroke faster than the fast approach stroke

Tab. 3 Necessary speed ratio


 A visual check of the speeds is generally sufficient.

1. Set speed ratio according to the specifications.
2. Perform test and check the speed visually.

7.5 Set the speed ratio between power stroke and power stroke venting (optional)

At throttled power stroke speed
Necessary speed ratio between power stroke and power stroke venting
<ul style="list-style-type: none"> Power stroke speed equal to the return stroke speed of the intensifier piston or Power stroke speed faster than the return stroke speed of the intensifier piston

Tab. 4 Necessary speed ratio

 A visual check of the speeds is generally sufficient.

1. Set speed ratio according to the specifications.
2. Perform test and check the speed visually.

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7.6 Setting the (ZED) damping (optional)

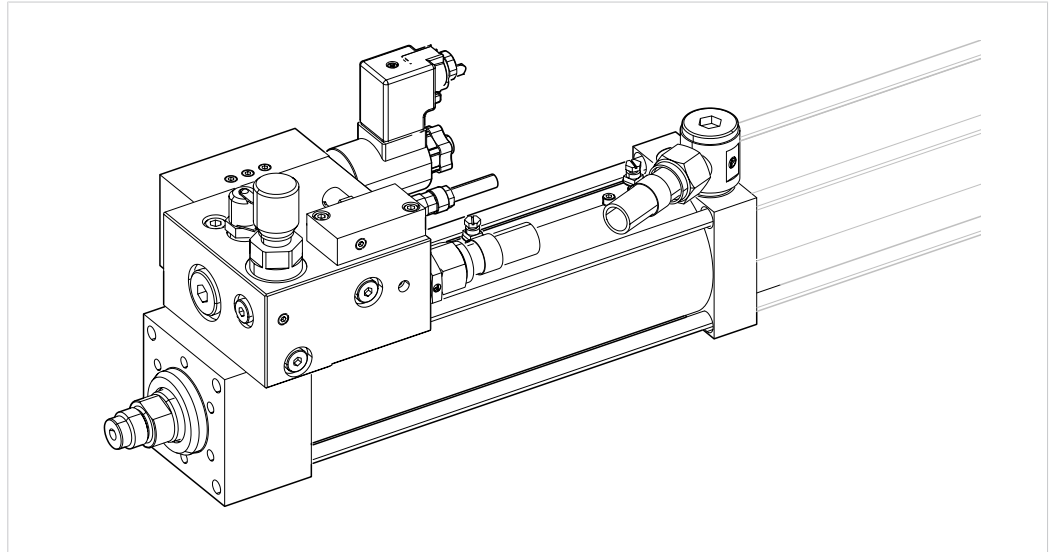


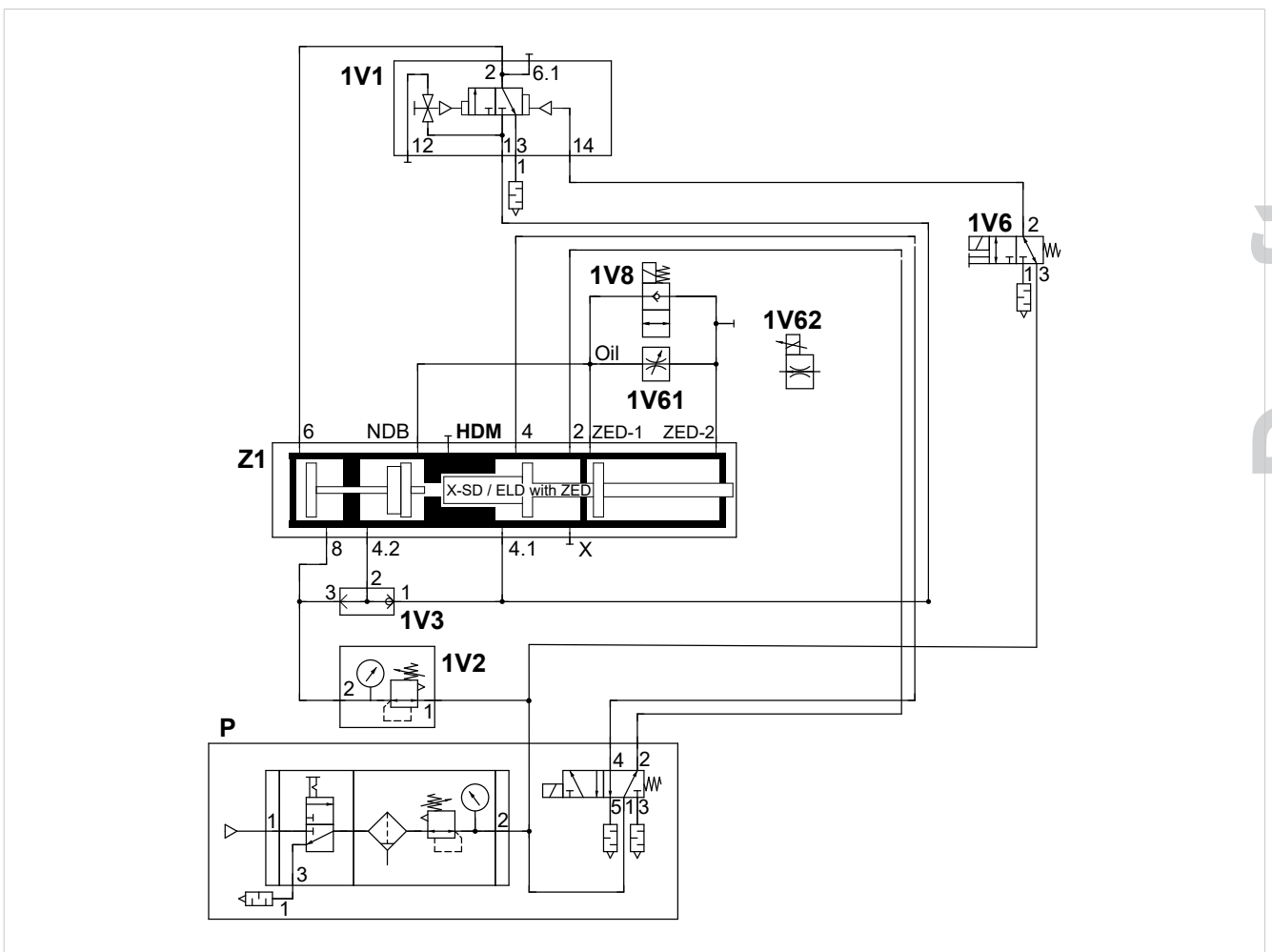
Fig. 32 Setting (ZED) damping (optional)

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i The integrated damping function allows a selectable, adjustable constant speed of the working piston during the fast approach stroke and power stroke, independent of the respective working forces. This makes it possible to almost fully compensate the acceleration of the working piston when the counterforce is removed (during punching) or also a stick-slip-effect (during pressing in).

At the same setting of the flow control valve the speeds of the working piston during the fast approach stroke and power stroke are almost constant. This allows a very soft placement on the piece part.

Function sequence and switching states



The damping is set on the flow control valve (1V61 or 1V62). The electrically switchable solenoid valve (1V8) makes individual activation and deactivation of damping possible. With the standard stroke monitoring on the working piston the time can be specified at which damping is to be activated.

- Fast approach stroke
 - For a fast approach stroke the solenoid valve (1V8) must be switched electrically, so the oil can flow unrestricted.

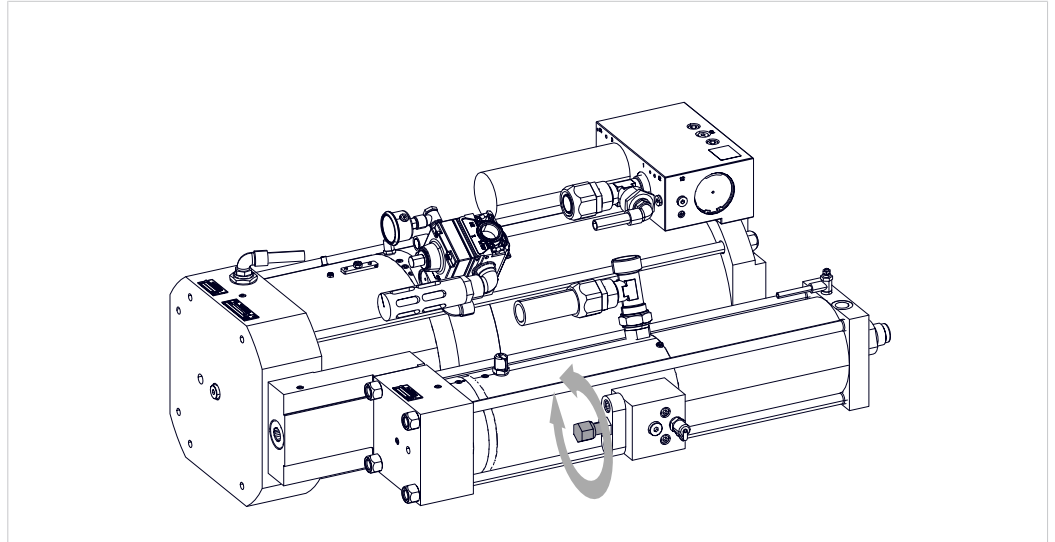
Draft

- Activation of damping during the fast approach stroke for a soft placement on the piece part (Soft Touch)
Activation of damping during the fast approach stroke.
 - Damping can be activated already via an external distance signal.
 - For a smooth contact with the piece part, the response time of the solenoid valve (1V8) listed in the data sheet and the response distance traveled by the working piston during this time must be taken into consideration.
 - Solenoid valve (1V8) switched off (0-active), the oil flows through the flow control valve (1V61 or 1V62) and the damping effect begins.
 - Activation of damping during the power stroke
 - The power stroke must, for example, be activated via an external distance signal electrically on valve (1V6).
 - Solenoid valve (1V8) switched off (0-active), so the oil flows through the flow control valve (1V61 or 1V62) and the damping effect begins.
 - Return stroke
 - For a fast return stroke a check valve is integrated in the solenoid valve (1V8) so the oil can flow unrestricted independent of the switching state.
 - Emergency off
 - When an emergency stop is triggered the solenoid valve (1V8) is switched off. During the subsequent back stroke into the home position the oil is conveyed back via the installed check valve.
- Set damping with the manual flow control valve. For this, turn the set screw open or closed.
- OR -
Set damping with the electrical proportional flow control valve.

Draft

7.7 Setting cutting impact damping (X-KSD) (optional)

Setting the damping effect



⚠ WARNING

Bursting, flying parts and ejecting oil due to excessive oil pressure!

Severest injuries to eyes, body cavities and all over the body!

- The oil pressure at the cutting impact damping (X-KSD) must not exceed 450 bar at closed damping. Maximum admissible is 450 bar.
- Wear individual protective equipment.

1. Loosen the counter nut on the outer thread of the control pin.
2. Set the damping effect with the control pin.
Turn to the right: Increase the damping effect.
Turn to the left: Reduce the damping effect.
3. Take note that a quarter turn can result in a perceptible change of the damping. Set the damping stepwise.
 - ▷ The damping effect is set.
4. Fasten the counter nut.

Draft

7.8 Setting the proximity sensors of the holding brake (ZSL) (optional)

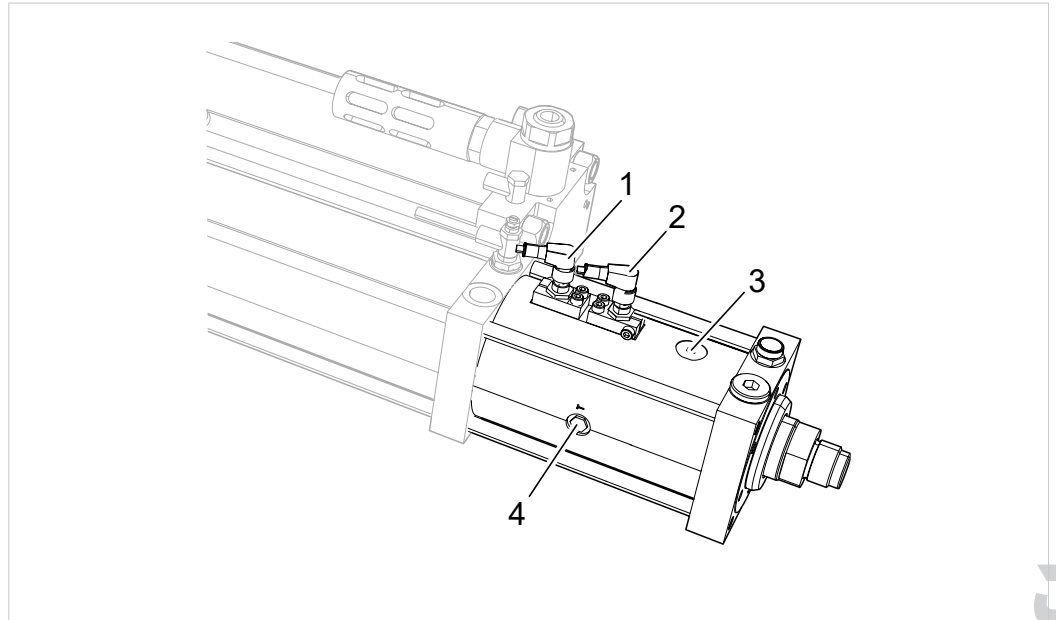


Fig. 33 Setting the proximity sensors of the holding brake

- | | | | |
|---|--|---|---|
| 1 | Holding fixture for sensor "Lock loosened" [B] | 2 | Holding fixture for sensor "Load secured" [A] |
| 3 | "Loosen" pressure connection [L] | 4 | "Pressure compensation" connection [T] |

Control plan ZSL

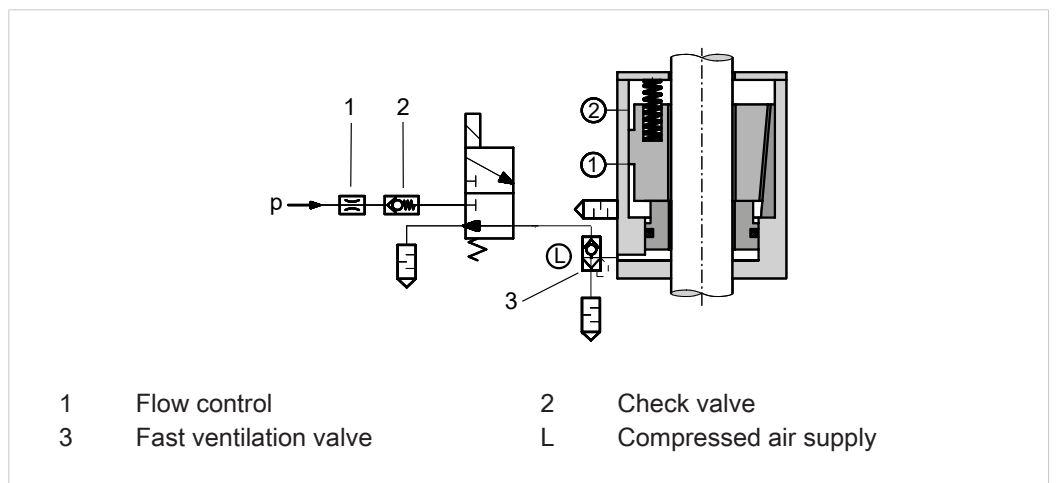


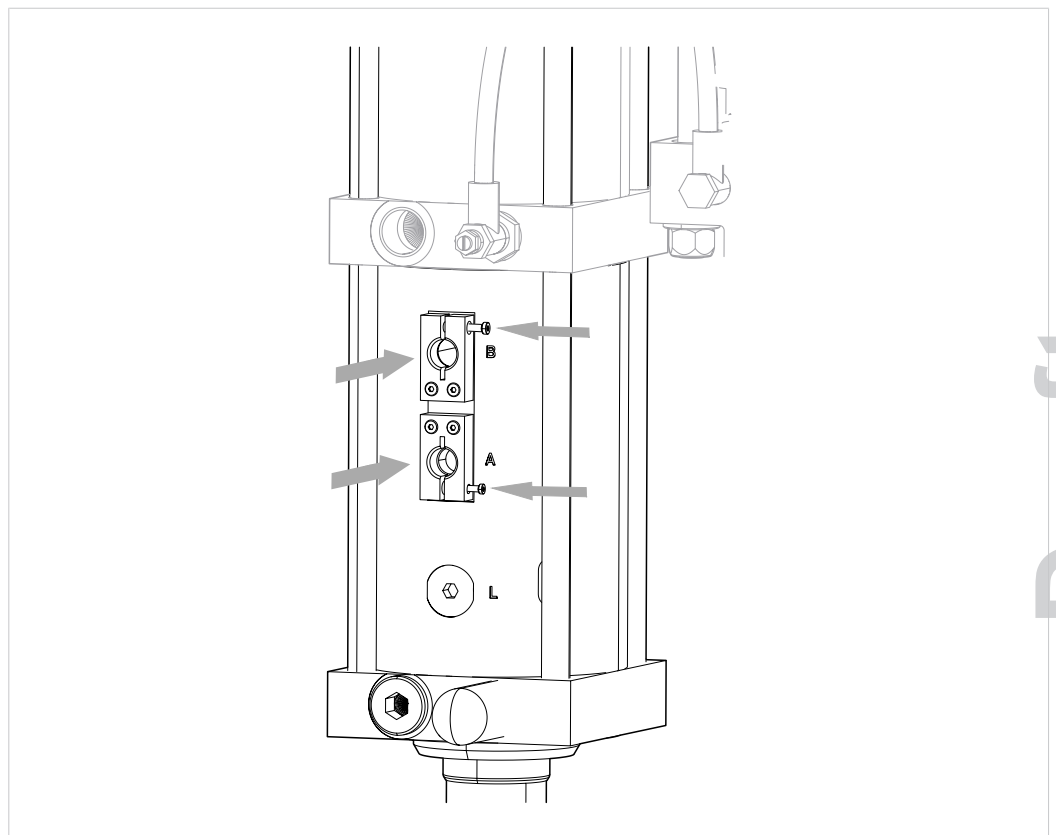
Fig. 34 Control plan ZSL

Draft

Material required:

- 2 Proximity switch, inductive:
 External thread: M 12 x 1 / Ø 12 mm
 Closing function
 Nominal distance: 2 mm, can be installed flush

i The connections are marked permanently. The position of the connections can vary depending on the model.



Draft

NOTE**Destruction of sensors!**


Sensors that are screwed too deep into the holding fixture for sensor "Lock loosened" [B], are destroyed when the locking head is activated!

- Ensure that the sensors are seated correctly.
- Observe the operating instructions of the holding brake.

1. Supply the holding brake with compressed air.
2. Secure the adjustment sleeve on the holding fixture for sensor "Load secured" [A] and ensure that it cannot turn.
3. Screw the sensor "Load secured" [A] in only until it lights up. Ensure that it is not screwed in deeper.
4. Turn off the holding brake with compressed air.
5. Secure the adjustment sleeve on the sensor "Lock loosened" [B] and ensure that it cannot turn.
6. Screw the sensor "Lock loosened" [B] in only until it lights up. Ensure that it is not screwed in deeper.
7. Check whether the turned-off compressed air "Load secured" [A] is lit.
 - ▷ Sensor "Load secured" [A] is lit: **WARNING!** Damage to sensor! Sensor is screwed in too deep.
Readjust sensor "Lock loosened" [B].
8. Pull sensors back 0.5 mm to 1 mm.
9. Fix the sensors with the counter nut.

Draft

7.9 Check the holding force of the holding brake

-  In the installed state the holding force of the holding brake must have a safety reserve of at least the 1.5-fold of the existing load.

WARNING

Risk of injury due to a non-functioning holding brake!

- Check the holding brake at regular intervals!
- Observe the operating instructions of the holding brake.

- ✓ The holding brake is closed, the piston rod is secured.

WARNING

Risk of crushing due to dropping piston rod!

- Ensure that contact with moving machine parts is not possible during the safety test.

If necessary, program an automatic test operation.

If necessary, provide a two-hand operation.

- Check the holding force of the holding brake.
See the operating instructions of the holding brake.
- ▶ The piston rod slides through: The holding brake brake is NOK.
- ▶ The piston rod does not slide through: The holding brake brake is OK.

Draft

8 Operation

8.1 Safety in operation

 WARNING**Dangerous machine movements!**

Serious contusions and injuries!

- Make sure that that no persons are located in the danger area during operation.

 CAUTION**Noise during operation!**

Hearing impairment!

- Wear individual protective equipment.

 CAUTION**Hazard from flying parts!**

Injuries to eyes and body cavities!

- Wear individual protective equipment.

Draft

8.2 Requirements for operation

- The safety devices of the entire machine are properly assembled and functional.
- All components are properly maintained, clean and without damage.
- Supply connections, communication and control connections, material or media hoses are installed properly. The permissible values are complied with.
- The main switch of the machine is switched on.
- Compressed air supply is open.
- The fault message on the machine are acknowledged.
- There are no persons are located in the danger area.
- A visual inspection is carried out, especially:
 - Position of the oil level indicator when the working piston is retracted (oil level indicator flush with the surface of the cylinder).
 - No objects in the working area.

8.3 Operating drive

The operation depends on:

- Intended purpose
- Control system
- Operating elements
- Safety equipment
- Tooling and accessories

Draft

9 Troubleshooting

9.1 Safety during troubleshooting

Troubleshooting may only be carried out by trained and authorized personnel.

- Make sure that that no persons are located within the danger area of the machine.

Draft

9.2 Searching for causes of fault on the Powerpackage

Fault	Possible cause	Measure
Piston rod does not extend.	Tool jams. Guiding columns are jammed.	Mechanically decouple the Powerpackage and check ease of movement by extending and retracting.
	Air pressure too low (only for assembly direction from the bottom to the top).	Check air pressure and increase if necessary.
	Main control valve does not switch.	Check main control valve. Contact authorized service personnel.
	Unlockable check valves (optional equipment) do not open.	Check non-return valves. Contact authorized service personnel.
	Faulty pneumatic hose.	Check the compressed air supply. Contact authorized service personnel.
No execution of power stroke. Press force not reached.	Insufficient air pressure.	Increase air pressure.
	Compressed air setting on pressure regulator in the power stroke line (optional) is too low.	Increase air pressure in power stroke line.
	Pneumatic spring pressure setting is too high or the pneumatic spring is faulty.	Check compressed air supply of the pneumatic spring. Contact authorized service personnel.
	Oil level is too low.	Checking oil level, Page 105.
	Air is trapped in the hydraulic oil system.	Refilling oil and venting drive, Page 106.
	Power stroke valve is faulty.	Contact authorized service personnel.
	Control throttle 'X' incorrectly set, overloaded.	Setting control throttle 'X', Page 84.
	No air pressure in home position.	Impinge the return stroke with air pressure before initiating the fast approach stroke.
Power stroke not triggered with very short fast approach stroke (only for type Q-S, X-S, S, EL with hydraulic end position cushioning ZHD)	The fast approach distance traveled is too short. Required: min. 8 mm.	Set sufficient travel for fast approach stroke before the power stroke is switched on.
Piston rod does not retract.	Tool jams. Guiding columns are jammed.	Mechanically decouple the Powerpackage and check ease of movement by extending and retracting.
	Insufficient air pressure.	Check air pressure and increase if necessary.
	Main control valve does not switch.	Check main control valve. Contact authorized service personnel.
	Unlockable check valves (optional equipment) do not open.	Check non-return valves. Contact authorized service personnel.
	Pneumatic hose is faulty.	Check the compressed air supply. Contact authorized service personnel.
	Tool is too heavy for return stroke force.	Increase return stroke pressure. Use additional return stroke cylinders.
	Changeover signal for return stroke is not present.	Check electrical switching signal (e.g. for ZHU, ZHW, ZDO). Contact authorized service personnel.
	Power stroke valve is faulty.	Contact authorized service personnel.
	Pneumatic spring pressure regulator or pressure gauge pneumatic spring is faulty.	Check the compressed air pressure on the pressure gauge. Contact authorized service personnel.

Fault	Possible cause	Measure
Frequent refilling of hydraulic oil is necessary.	Speed ratio of fast approach stroke to return stroke is set incorrectly.	Setting speed ratio of return stroke to fast approach stroke, Page 86. Contact authorized service personnel.
	Speed ratio of power stroke and power stroke venting is set incorrectly.	Set the speed ratio between power stroke and power stroke venting (optional), Page 86. Contact authorized service personnel.
	Pneumatic supply insufficient. Cross-section of hose, size of connectors, switching valves, maintenance unit are too small.	Observe predefined connections sizes and cross-sections. See Datasheet.
	Powerpackage is not fully vented.	Refilling oil and venting drive, Page 106.
	Oil level after oil filling is not lowered.	Lowering of oil level, Page 115.
	The HP measuring connection, vent screw or oil filling nipple is leaky or faulty.	Contact authorized service personnel.
	Seals are damaged.	Contact authorized service personnel.

Draft

Maintenance table of Powerpackage

The specified intervals are only approximate values. Depending on the area of application, the actual values may differ from the guide values.

Maintenance cycle	Additional information	
according to counter (flexible)	10.5	Refilling oil and venting drive
	10.6.1	Refilling oil and venting drive with integrated damping function ZED
Weekly	10.4	Checking oil level
Half-yearly	10.8	Check the holding force of the holding brake

Draft

10 Maintenance

10.1 General information

Maintenance may only be carried out by trained and authorized personnel.

The following applies:

- Observe maintenance intervals if present and stipulated.
- Maintenance intervals may vary from the stipulated maintenance intervals.
The maintenance intervals may have to be verified with the manufacturer if necessary.
- Perform only maintenance work that is described in this manual.
- Inform operating personnel before starting repair work.
- Appoint a supervisor.

Draft

10.2 Safety during maintenance

DANGER

Electrical hazards in case of contact with live parts!

Electric shock, burns or death in case of contact with live parts!

- Have all work on the electrical equipment performed by an electrician.
- Disconnect power supply.
- Wait for residual energy to dissipate safely (at least 3 minutes).

WARNING

Hot surfaces on the drive and on the control box!

Injuries from burns!

- Allow hot surfaces and motors to cool down before touching them.

WARNING

Ejecting parts and compressed air from compressed air conducting lines!

Serious injuries to eyes and body cavities!

- Always connect and disconnect lines without pressure.
- Pay attention to maximum permitted pressures.
- Wear individual protective equipment.

WARNING

Dangerous machine movements!

Serious contusions and injuries!

- Make sure that that no persons are located in the danger area during operation.

NOTE**Incorrect cleaning agents or cleaning procedures, lack of corrosion protection!**

Damage to machine components!

- Clean plastic parts such as panes (safety guard door, housing, etc.) and control elements with cotton cloths (smooth woven structure) and suitable cleaning agents (e.g. clear water and neutral rinsing liquid).
Do not use scouring (abrasive) cleaning agents.
 - Only touch bare spots with gloves.
 - For metallic surfaces use cleaning set, such as industrial cleaner (e.g. Loctite 7063, or Würth Montagekraftreiniger 0890 107), vacuum cleaner, dry cloth and brush.
 - After cleaning, protect bare outer surfaces from corrosion. Coat surfaces with a cloth slightly moistened with anticorrosive fluid.
 - Keep inside surfaces, especially element-carrying parts, dry and free of grease.
-

Draft

10.3 Requirements for maintenance

10.3.1 Set system to maintenance position

Unless specified otherwise, before all maintenance work:

1. Retract the working piston.
 - ▷ The machine is in initial position (working piston retracted).
2. Install a restraint device if necessary.
3. Make sure that fast approach stroke and power stroke cannot be activated in maintenance position.
4. Make sure that return stroke is impinged with compressed air.
5. Make sure that the pressure valve (pneumatic spring) is impinged.
6. Make sure that unauthorized, accidental or unexpected starting up of the machine and initiation or dangerous movements due to latent energies are prevented.

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10.4 Checking oil level

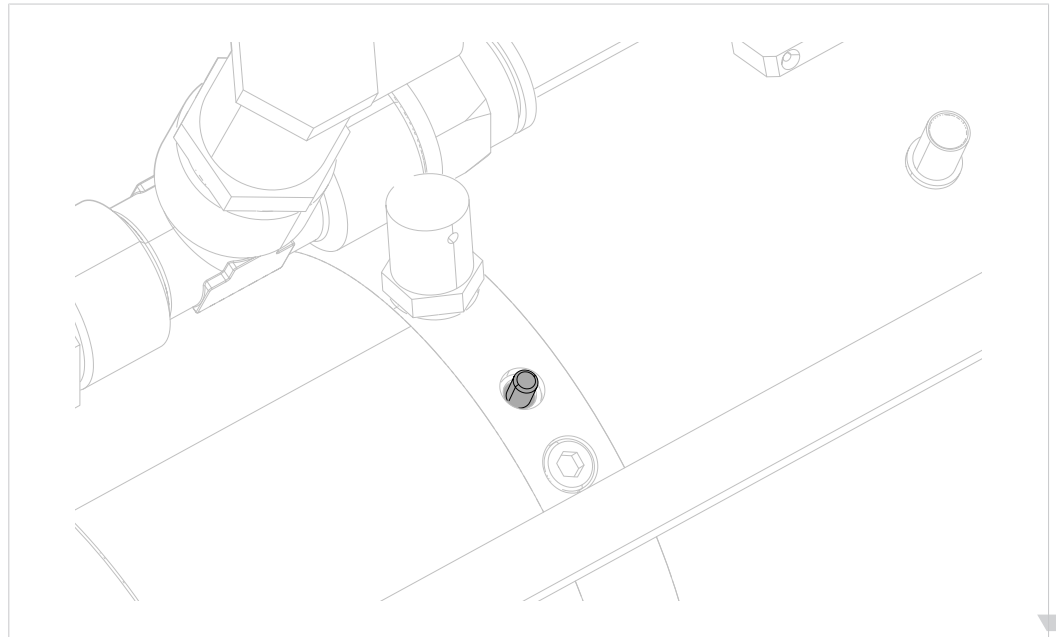


Fig. 35 Checking oil level

- ✓ System is in maintenance position.
See [Set system to maintenance position, Page 104](#).
- Check needle of the oil level indicator.
- ▶ The needle of the oil level indicator is flush with the surface of the cylinder:
Oil level is ok.
- OR -
- ▶ The needle of the oil level indicator comes out: Oil must be refilled.
See [Refilling oil and venting drive, Page 106](#).

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10.5 Refilling oil and venting drive

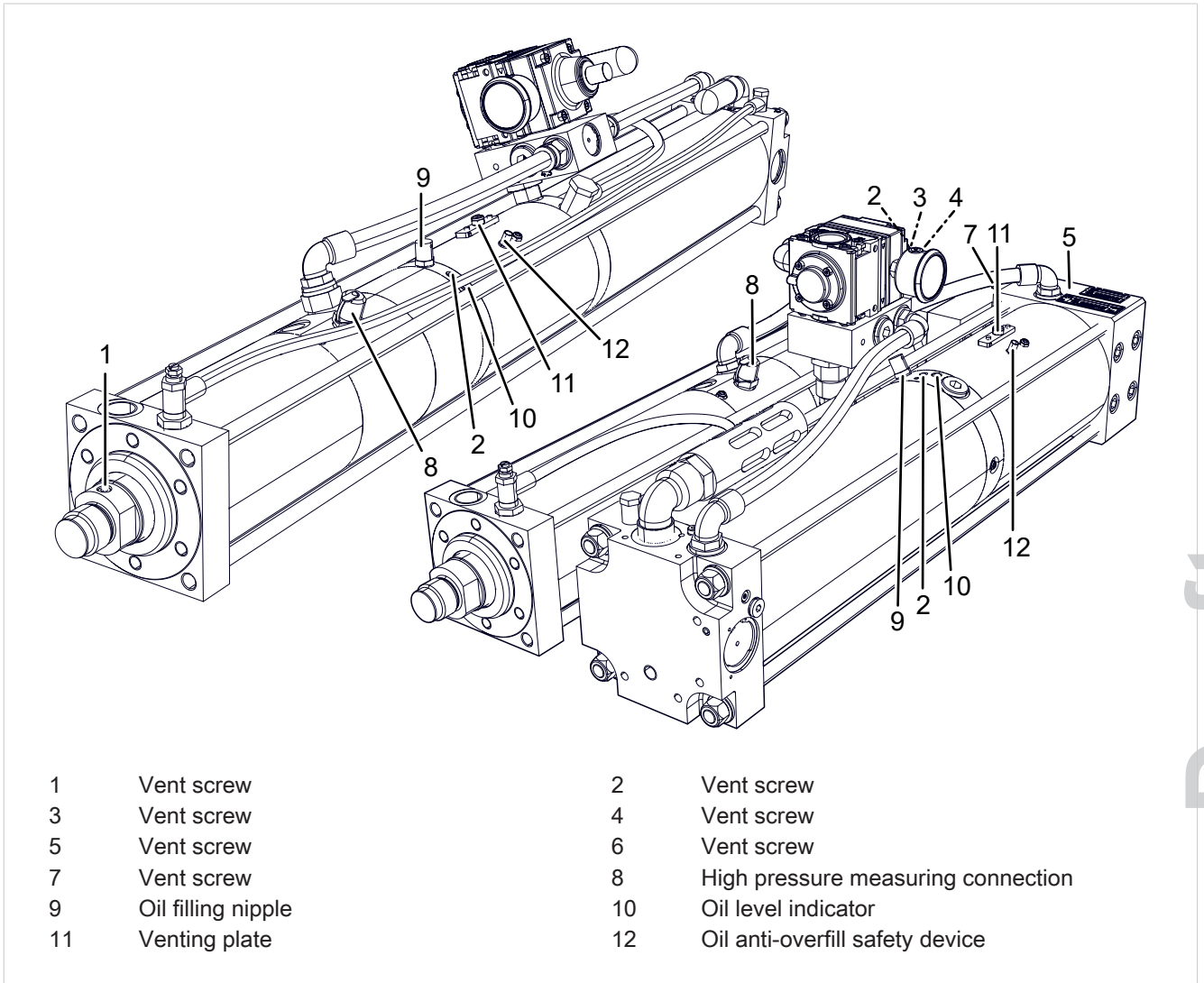



Fig. 36 Refilling oil and venting drive

Material required:

- Oil, filtered < 5 µm, load rating > 30 N/mm² (in accordance with DIN 51524-2 HLP32)
If different special oils are used, see sticker.
- Oil pump ZP 20

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 The top vent screws or the top HD measuring connections must be selected for the venting.

Venting points according to installation position

Installation position	Type X-S	Type X-K
Vertical, working piston downward	Vent screw 2	Vent screws 2, 4, 6, 5, 7
Vertical, working piston upward	Vent screw 1 HP measuring connection 8	Vent screws 3, 5 HP measuring connection 8
Horizontal, operating side facing upward	Vent screw 2 HP measuring connection 8	Vent screws 2, 3, 5, 6, 7 HP measuring connection 8

Tab. 5 Venting points according to installation position

 **WARNING**

Contusions caused by uncontrolled extending working piston!

Serious contusions and injuries on hand and fingers.

- Make sure that the return stroke is impinged with compressed air.
- Make sure that fast approach stroke and power stroke cannot be activated.
- Install a restraint device if necessary.
- Turn off compressed air supply of the pressure valve.

 **CAUTION**

Environmental pollution caused by environmentally harmful liquids!

- Absorb spilled liquids and remove without residue.
- Dispose of liquid according to the statutory regulations.

NOTE

Damage caused by trapped air!

- Vent drive after filling with oil.
- Use highest vent screw or high pressure measuring connection for venting.

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- ✓ System is in maintenance position.
See [Set system to maintenance position, Page 104](#).
- 1. Remove venting plate with locking wire on the intensifier (X-ES).
- 2. Unscrew knurled cap of the oil filling nipple.
- 3. Vent filling hose of the oil pump.
- 4. Install filling hose of the oil pump on oil filling nipple.
- 5. Continue to fill until oil escapes from the vent hole free of bubbles.
- 6. **CAUTION!** Risk of slipping from leaking oil! Absorb oil immediately and without residue!
- 7. Wait 10 min. Afterwards, repeat filling procedure until oil escapes from the vent hole free of bubbles.
- 8. Deactivate power stroke. For this, turn the control throttle X fully closed.
- 9. Move the working piston several times forward and backwards without power stroke.
- 10. Continue to refill until oil escapes from the open vent hole free of bubbles.
- 11. **CAUTION!** Splashing oil! Open vent screw slowly!
Unscrew the corresponding vent screw (see table "Venting point according to installation position") a maximum of 2 turns until the oil comes out under the vent screw without bubbles.
Then immediately close the vent screw.
- OR -
Unscrew the corresponding high pressure measuring connection cover (see table "Venting point according to installation position") and push in with a blunt object (e.g. a pin) until the oil comes out without bubbles.
- 12. Move the working piston several times forward and backwards with power stroke. For this, open control throttle X until the power stroke is audibly activated.
- 13. **CAUTION!** Splashing oil! Open vent screw slowly!
Unscrew the corresponding vent screw (see table "Venting point according to installation position") a maximum of 2 turns until the oil comes out under the vent screw without bubbles.
Then immediately close the vent screw.
- OR -
Unscrew corresponding high pressure measuring connection cover (see table "Venting point according to installation position") and push in with a blunt object (e.g. a pin) until the oil comes out without bubbles.
- 14. Tighten the vent screws. For tightening torque see Tightening torques.
- 15. If necessary, unscrew the sealing cap on high pressure measuring connection.
- 16. Unscrew filling hose of the oil pump.
- 17. Screw in knurled cap of the oil filling nipple.
- 18. Install venting plate.

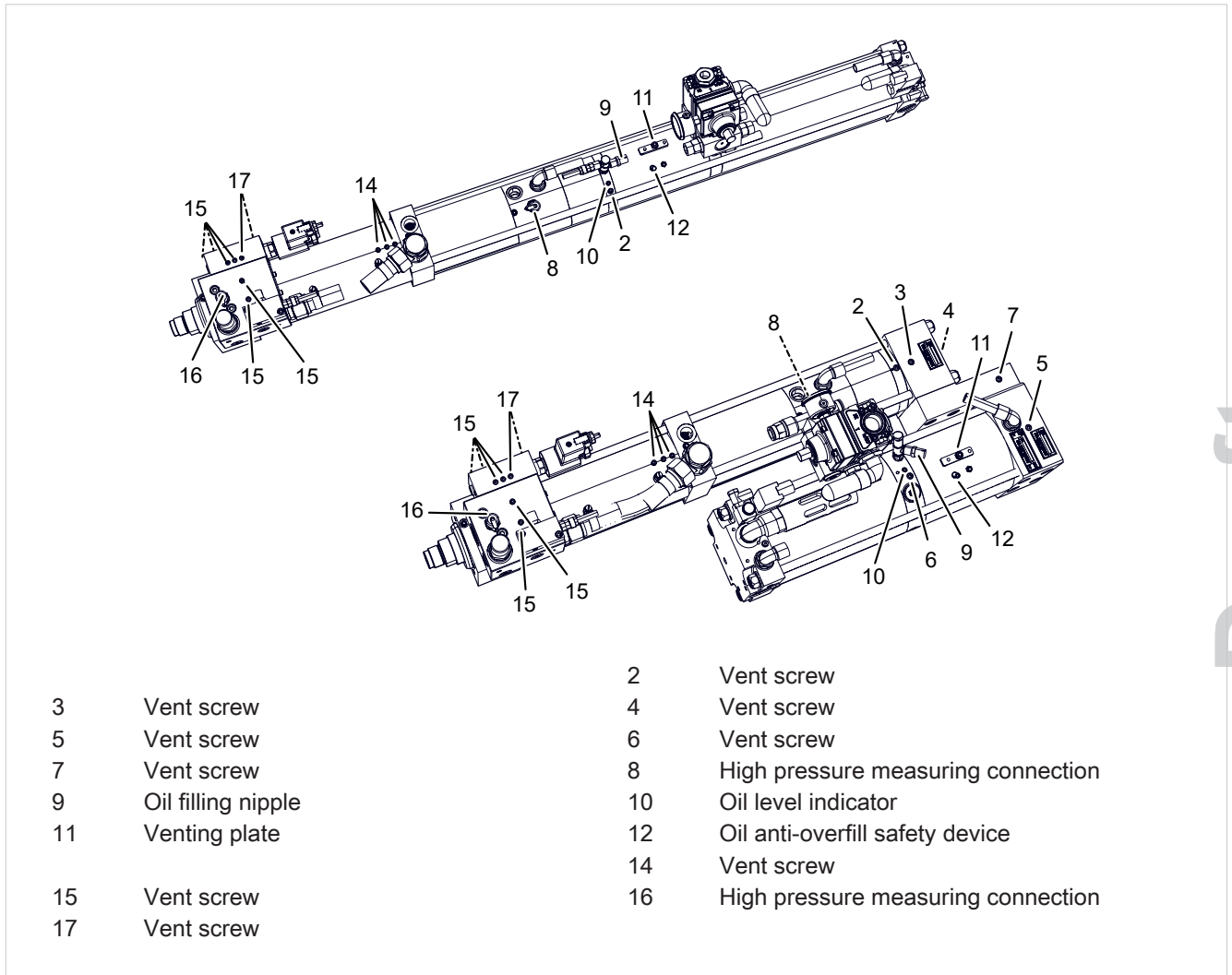
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19. Fasten locking wire.
20. **NOTE!** Device damage due to overfilling!
Lower oil level.
See [Lowering of oil level, Page 115](#).

Draft

10.6 Refilling oil and venting the drive of Powerpackage with optional equipment

10.6.1 Refilling oil and venting drive with integrated damping function ZED



Material required:

- Oil, filtered < 5 µm, load rating > 30 N/mm² (in accordance with DIN 51524-2 HLP32)
If different special oils are used, see sticker.
- Oil pump ZP 20



The top vent screws or the top HP measuring connection must be selected for the venting.

Venting points according to installation position

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Installation position	Type X-SD, ELD	Type X-KD, EKD
Vertical, working piston downward	<ul style="list-style-type: none"> Vent screw 2 Venting plate 11 Vent screws ZED 14, 15 HP measuring connection ZED 16 After solenoid valve is switched on: Vent screws 17 	<ul style="list-style-type: none"> Vent screw 2, 3, 4, 5, 6, 7 Venting plate 11 Vent screws ZED 14, 15 HP measuring connection ZED 16 After solenoid valve is switched on: Vent screws 17
Vertical, working piston upward	<ul style="list-style-type: none"> Venting plate 2 HP measuring connection 8 Vent screws ZED 14, 15 HP measuring connection ZED 16 After solenoid valve is switched on: Vent screws 17 	<ul style="list-style-type: none"> Vent screws 2, 3, 6 HP measuring connection 8 Vent screws ZED 14, 15 HP measuring connection ZED 16 After solenoid valve is switched on: Vent screws 17
Horizontal, operating side facing upward	<ul style="list-style-type: none"> Venting plate 2 HP measuring connection 8 Venting plate 11 Vent screws ZED 14, 15 HP measuring connection ZED 16 After solenoid valve is switched on: Vent screws 17 	<ul style="list-style-type: none"> Vent screws 2, 3, 4, 5, 6, 7 HP measuring connection 8 Venting plate 11 Vent screws ZED 14, 15 HP measuring connection ZED 16 After solenoid valve is switched on: Vent screws 17

Tab. 6 Venting point according to installation position

⚠ WARNING

Contusions caused by uncontrolled extending working piston!

Serious contusions and injuries on hand and fingers.

- ➔ Make sure that the return stroke is impinged with compressed air.
- ➔ Make sure that fast approach stroke and power stroke cannot be activated.
- ➔ Install a restraint device if necessary.
- ➔ Turn off compressed air supply of the pressure valve.

⚠ CAUTION

Environmental pollution caused by environmentally harmful liquids!

- ➔ Absorb spilled liquids and remove without residue.
- ➔ Dispose of liquid according to the statutory regulations.

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NOTE

Damage caused by trapped air!

- Vent drive after filling with oil.
 - Use highest vent screw or high pressure measuring connection for venting.
-

Draft

- ✓ System is in maintenance position.
See [Set system to maintenance position, Page 104](#).
- 1. Remove venting plate with locking wire on the intensifier (X-ES).
- 2. Unscrew knurled cap of the oil filling nipple.
- 3. Vent filling hose of the oil pump.
- 4. Install filling hose of the oil pump on oil filling nipple.
- 5. Continue to fill until oil escapes from the vent hole free of bubbles.
- 6. **CAUTION!** Risk of slipping from leaking oil! Absorb oil immediately and without residue!
- 7. Wait 10 min. Afterwards, repeat filling procedure until oil escapes from the vent hole free of bubbles.
- 8. Deactivate power stroke. For this, turn the control throttle X fully closed.
- 9. Move the working piston several times forward and backwards without power stroke.
- 10. Continue to refill until oil escapes from the open vent hole free of bubbles.
- 11. **CAUTION!** Splashing oil! Open vent screw slowly!
Unscrew the corresponding vent screw (see table "Venting point according to installation position") a maximum of 2 turns until the oil comes out under the vent screw without bubbles.
Then immediately close the vent screw.
- OR -
Unscrew the corresponding high pressure measuring connection cover (see table "Venting point according to installation position") and push in with a blunt object (e.g. a pin) until the oil comes out without bubbles.
- 12. Move the working piston several times forward and backwards with power stroke. For this, open control throttle X until the power stroke is audibly activated.
- 13. **CAUTION!** Splashing oil! Open vent screw slowly!
Unscrew the corresponding vent screw (see table "Venting point according to installation position") a maximum of 2 turns until the oil comes out under the vent screw without bubbles.
Then immediately close the vent screw.
- OR -
Unscrew corresponding high pressure measuring connection cover (see table "Venting point according to installation position") and push in with a blunt object (e.g. a pin) until the oil comes out without bubbles.
- 14. Tighten the vent screws. For tightening torque see Tightening torques.
- 15. If necessary, unscrew the sealing cap on high pressure measuring connection.
- 16. Unscrew filling hose of the oil pump.
- 17. Screw in knurled cap of the oil filling nipple.
- 18. Install venting plate.

Draft

19. Fasten locking wire.
20. **NOTE!** Device damage due to overfilling!
Lower oil level.
See [Lowering of oil level, Page 115](#).

Draft

10.7 Lowering of oil level

CAUTION

Environmental pollution caused by environmentally harmful liquids!

- Absorb spilled liquids and remove without residue.
- Dispose of liquid according to the statutory regulations.

NOTE

Damage to seal due to high oil level!

After refilling and venting, lower the oil level by a defined value (lowering volume " ΔV ").

For lowering volume " ΔV " see type plate.

Material required:

- Oil pump ZP 20
-
- ✓ System is in maintenance position.
See [Set system to maintenance position, Page 104.](#)
 - ✓ Drive is filled and vented.
See [Refilling oil and venting drive, Page 106.](#)
-
1. Remove venting plate with locking wire.
 2. Unscrew knurled cap of the oil filling nipple.
 3. Screw filling hose of the oil pump onto oil filling nipple.
 4. **CAUTION!** Risk of slipping from leaking oil! Absorb oil immediately and without residue!
Remove oil quantity exactly according to lowering volume " ΔV ".
 5. Unscrew filling hose of the oil pump.
 6. Install venting plate.
 7. Screw on knurled cap of the oil filling nipple.
 8. Fasten locking wire.
 9. Push in oil level indicator needle.

10.8 Check the holding force of the holding brake

See [Check the holding force of the holding brake, Page 94.](#)

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11 Repairs

11.1 Safety during repairs

Repairs may only be carried out by trained and authorized personnel.

11.2 Changing seals

Seals may only be replaced by trained and authorized service personnel.

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12 Disassembly and Disposal

12.1 Safety during disassembly and disposal

The dismantling and disposal may only be carried out by trained and authorized personnel.

DANGER

Electrical hazards in case of contact with live parts!

Electric shock, burns or death in case of contact with live parts!

- Have all work on the electrical equipment performed by an electrician.
- Disconnect power supply.
- Wait for residual energy to dissipate safely (at least 3 minutes).

WARNING

Ejecting parts and compressed air from compressed air conducting lines!

Serious injuries to eyes and body cavities!

- Always connect and disconnect lines without pressure.
- Pay attention to maximum permitted pressures.
- Wear individual protective equipment.

CAUTION

Sharp edges caused by material splintering!

Injuries from worn parts!

- Wear individual protective equipment.
- Do not move fingers along the cutting edges.
- Be particularly careful and attentive.

Draft

12.2 Decommissioning

Decommissioning means that the plant is not in operation for a longer period of time but remains at the installation site for recommissioning later.

1. Move plant into home position.
2. Install a restraint device if necessary.
3. Switch off plant at the main switch.
4. Clean the system and protect it against corrosion.
5. Protect plant against loss of data and deep discharge.

12.3 Shutdown

Shutdown means that the system is shut down permanently and/or is prepared for removal.

1. Stop system and wait for it to come to a standstill.
2. Remove material if necessary.
3. Switch off the system at the main switch and secure it against being switched on again.
4. First disassemble or dismantle after switching off the power (electricity, pneumatics) and after residual energy has safely dissipated (at least 3 minutes).
5. Remove electrical supply line (first at the terminal, then on the machine).
6. Remove compressed air supply line.
7. Remove network connection.
8. Clean the system and protect it against corrosion.
9. Protect open cable ends against penetration of dirt.
10. Do not remove cable identifications.

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12.4 Disassembling

The system consists of recyclable materials.

NOTE

Environmental damage!

Improper recycling endangers the environment!

- Dispose of materials separately and properly.
- Regional disposal regulations must be observed.

1. Strip the system down into its constituent parts.
2. Dispose of greases and oils separately.
3. Sort the constituent parts by material and dispose of according to the local regulations.

12.5 Disposal



When disposing of packaging, consumables and spare parts, including the machine and its accessories, the relevant national environmental protection regulations must be complied with.

For the environmentally compatible utilization and disposal of its electronic components, please contact the certified disposal company for electronic waste or return it to TOX® PRESSOTECHNIK.

For further information about the take-back and forms see www.tox.com in the service sector.

Regarding questions about disposal please contact TOX® PRESSOTECHNIK GmbH & Co. KG (see [Contact and source of supply, Page 11](#)).

13 Appendices

13.1 DECLARATION OF INCORPORATION

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DECLARATION OF INCORPORATION

in accordance with the Machinery Directive (2006/42/EC), Annex II 1 B

Original declaration of incorporation

TOX® PRESSOTECHNIK GMBH & CO. KG herewith declares that the concept and design of the incomplete machine specified hereinafter and the execution traded by us

Designation/function	Pneumohydraulic drive
Product name/module	TOX®-Powerpackage
Model/typ	X-S, X-K X-KT, X-ES mit X-AT, X-ES mit HZL X-KW X-ATD, X-SD, X-KD X-ATSD X-ATSL, X-SSL, X-KSL
Serial number	See type plate

complies with the relevant requirements of the Machinery Directive (2006/42/EC).

Insofar as the requirements of Annex 1 apply to the incomplete machine, the relevant health and safety requirements shall be documented in the technical documents according to Annex VII Section B.

Applied harmonized standards:

DIN EN ISO 12100:2011-03	Safety of machinery - General principles for design - Risk assessment and risk minimization
DIN EN ISO 4414:2011-04	Pneumatic fluid power - General rules and safety requirements for systems and their components

This incomplete machine may not be commissioned until it has been ascertained that the incomplete machine in which the component is to be installed complies with the requirements of the Machinery Directive (2006/42/EC).

The technical documents specific to this incomplete machine are available and can be transmitted electronically to national authorities in response to a reasoned request.

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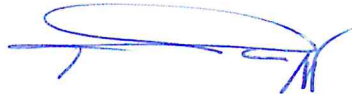
The technical documents belonging to the incomplete machine according to Annex VII Part B have been produced.

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Place, date Weingarten, 01.02.2018

Manufacturer TOX® PRESSOTECHNIK GMBH & CO. KG

Signature



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