TOX®-Powerpackage
X-KT-System
The pneumohydraulic split system

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www.tox-pressotechnik.com
The TOX®-Powerpackage X-KT-System consists of the pressure intensifier X-ES and one or more drive cylinders. Depending on the required press force, dimensions and cycle-time each system is configured individually to customers needs. Drive cylinders can be selected from either the TOX®-Hydraulic Cylinder HZL or the pneumohydraulic TOX®-Working Cylinder X-AT.

Advantages of the X-KT-System:
+ Press forces 2 – 1700 kN
+ Long power strokes
+ Compact measurements
+ Easy controls
+ Use up to 6 drive cylinders per intensifier
+ Low noise
+ Connection via TOX®-Hydrosplit Coupling
+ Easy colour-guided pneumatic plug-in-system

The TOX®-Pressure Intensifier X-ES is connected to the drive cylinders via hydraulic hoses and TOX®-Hydrosplit Couplings. The changeover from fast approach stroke to power stroke is performed automatically according to the dynamic pressure principle. The speed of the changeover can be regulated via a control throttle. The unit is controlled by a 4/2 or 5/2-way valve.

As standard, the pressure intensifiers are designed for air pressure of 6 bar. Other air pressures or combinations on request.

The TOX®-Pressure Intensifier X-ES with fast approach stroke function features:
+ Absolute air-oil separation
+ Integrated bypass for reliable operation of the system
+ Ring reservoir for significantly reduced overall length
+ Can be mounted in any orientation
+ Air spring included
+ Simple pneumatic controls like for any double acting pneumatic cylinder
+ Closed oil system
+ All X-KT-Systems with fast approach support

Press with TOX®-Powerpackage X-KT-System: 1 pressure intensifier and 6 drive cylinders.

1 High pressure connection
2 High pressure measuring and control connection
3 Oil filling nipple
4 Bleed plate
5 Air connection fast approach stroke
6 Air connection return stroke
7 Return stroke air hose
8 Oil level indicator
9 Patented anti-overfill device
10 Intensifier piston
11 Hydrosplit coupling
12 Fast approach stroke hose (only for X-AT)
602 Power stroke valve
632 Valve block ZVX
TOX®-Hydraulic Cylinder HZL

The TOX®-Hydraulic Cylinder HZL features an absolute air-oil separation. Fast approach stroke and return stroke are conducted by the pressure intensifier X-ES. That allows the return stroke to be operated with air pressure only (min. 3 bar).

Advantages of the TOX®-Hydraulic Cylinder HZL

+ Compact design
+ Single-bearing working piston
+ Absolute air-oil separation
+ Fixed stop in approach stroke (elastomer cushioning optional)
+ Options: stroke monitoring ZHU and travel transducer ZKW
+ Budget solution
+ Also available with total stroke adjustment (version 151)

See pages 5 + 6

TOX®-Working Cylinder X-AT

The pneumatic TOX®-Working Cylinder X-AT with double-bearing working piston and absolute air-oil separation provides fast approach stroke and return stroke by applying pressure to the working cylinder. This results in high stroke forces, fast approach and return stroke forces. The power stroke is carried out by the TOX®-Pressure Intensifier X-ES.

Advantages of the TOX®-Working Cylinder X-AT

+ High fast approach and return stroke forces
+ Short cycle-times
+ Fixed stop with elastomer cushioning
+ Prepared for stroke monitoring ZHU and external linear position sensor ZHW up to X-AT-030
+ Hydraulic cushioning for return stroke
+ Bypass ZLB and hydraulic end position cushioning ZHD

See page 7
Design of a TOX®-X-KT-System

Example calculation of a combination of TOX®-Pressure Intensifier X-ES and TOX®-Hydraulic Cylinder HZL:

To figure out what combination of TOX®-Pressure Intensifier X-ES and TOX®-Working Cylinders HZL is appropriate for you, we give you the following sample calculation. The values you have to provide are shown in red. That means: you define the required press force, total stroke and power stroke of the cylinder. Furthermore you have to determine the number of cylinders installed to one intensifier and the hose lengths. Following this sample calculation also combinations of TOX-Hydraulic Cylinders HZL with total stroke adjustment or TOX®-Pressure Intensifiers X-ES with TOX®-Working Cylinders can be specified.

Example: You need 50 kN press force, 100 mm total stroke, 14 mm power stroke and you want 2 HZL connected to one intensifier X-ES. You need one hydrosplit coupling ZHK for each working cylinder (factor for calculation: ZHK 020 = 1.5) and one hose with 800 mm length. (defined data: data from table on page 5, calculated figures)

The required press force e.g. 50 kN leads to the selection of a cylinder with max. 76 kN press force. The calculation results in 197 bar required oil pressure. Attention: max. 250 bar possible!

Calculation for system selection

| Max. oil pressure bar | 250 | ÷ | Max. press force kN | 76 | x | Required press force for application kN | 60 | = | Required oil pressure for application bar | 197 |

The volume required in your case can be determined by multiplying the required power stroke (e.g. 14 mm) by the type specific volume factor V (e.g. 3.1). The factors F₁ + F₂ are added to the previous result (whereby F₂ depends on the hose length e.g. 800 mm). Then add a factor of 1.5 for each ZHK 020 hydrosplit coupling, equals 56.6. Finally, this multiplied by the number of cylinders e.g. 2, results in 113.2 cm³ oil volume. This leads to the selection of an intensifier X-ES with 123 cm³, the X-ES 125.000.0123.48.

<table>
<thead>
<tr>
<th>Required total delivery volume for power stroke</th>
<th>Required delivery volume per 1 mm power stroke</th>
<th>Required power stroke for the application</th>
<th>Factor 1 depending on total stroke</th>
<th>Factor 2 per 100 mm hose length</th>
<th>Required delivery volume for power stroke</th>
<th>Amount cylinders</th>
<th>Required total delivery volume for power stroke for the application</th>
</tr>
</thead>
<tbody>
<tr>
<td>V 3.1 x 14 mm</td>
<td>F₁ 6.9</td>
<td>F₂ (0.6 x 8) / (ZH 020)</td>
<td>56.6 cm³</td>
<td>2</td>
<td>113.2 cm³</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The stroke required for your application leads to the selection of a cylinder with a total stroke of 100 mm and defines the type of cylinder. Multiply the delivery volume factor V by the number of cylinders (e.g. 2) equals in the total delivery volume of 620 cm³. Check whether this is possible with the selected intensifier. This intensifier delivers e.g. 1300 cm³. Therefore it’s enough.

<table>
<thead>
<tr>
<th>Required total delivery volume for fast approach stroke</th>
<th>Required delivery volume per 1 mm total stroke</th>
<th>Total stroke of cylinder</th>
<th>Required delivery volume for fast approach stroke</th>
<th>Amount cylinders</th>
<th>Required total delivery volume for fast approach stroke for the application</th>
</tr>
</thead>
<tbody>
<tr>
<td>V 3.1 x 100 mm</td>
<td></td>
<td></td>
<td>310 cm³</td>
<td>2</td>
<td>620 cm³</td>
</tr>
</tbody>
</table>

The oil pressure calculated e.g. 197 bar is devided by the oil pressure produced by the intensifier at 1 bar air pressure (e.g. 40). The result is the required air pressure (e.g. 4.9 bar). In order to obtain high stroke frequencies, the air pressure should always be about 20 % higher (e.g. 5.9 bar). Caution: the maximum pressure / press force of the cylinder must not be exceeded.

Calculated oil pressure 197 bar ÷ 40 = 4.9 bar Required air pressure for application

Note: When using different cylinders and different hose lengths, the calculation of the volume must be done individually for each cylinder. Then add the combined results.
TOX®-Hydraulic Cylinder HZL
with total stroke adjustment max. 250 bar oil pressure

Corresponding TOX®-Pressure Intensifier X-ES see page 5.

Adapter for working piston (with internal thread to fit the piston rod end)
### TOX®-Pressure Intensifier X-ES

**TOX®-Working Cylinder X-AT max. 400 bar oil pressure**

#### Notes:
- The specified press force includes the fast approach force. For mounting specifications see data sheet 10.18 TOX®-Powerpackage, pressure tolerances ± 5 %.
- Dimensions in mm
- Due to the flange connection SAE 2", the X-AT 100 and X-AT 170 types can only be used with intensifiers of the sizes X-ES 250 and X-ES 300.

#### TOX®-Pressure Intensifier X-ES in combination with the TOX®-Working Cylinder X-AT

<table>
<thead>
<tr>
<th>Order no.</th>
<th>X-ES 100.000.0043.89</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>H</th>
<th>O</th>
<th>P</th>
<th>ZHK</th>
<th>O20</th>
<th>O42</th>
<th>Y</th>
<th>ZHK</th>
<th>ZHK</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-ES 100.000.0043.89</td>
<td>110 999 143</td>
<td>9 6 28</td>
<td>85 3 28</td>
<td>130</td>
<td>210</td>
<td>420</td>
<td>2</td>
<td>560</td>
<td>660</td>
<td>280</td>
<td>45</td>
<td>100</td>
<td>2</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>X-ES 100.000.0043.89</td>
<td>210 999 143</td>
<td>9 6 28</td>
<td>85 3 28</td>
<td>130</td>
<td>210</td>
<td>420</td>
<td>2</td>
<td>560</td>
<td>660</td>
<td>280</td>
<td>45</td>
<td>100</td>
<td>2</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>X-ES 100.000.0043.89</td>
<td>310 999 143</td>
<td>9 6 28</td>
<td>85 3 28</td>
<td>130</td>
<td>210</td>
<td>420</td>
<td>2</td>
<td>560</td>
<td>660</td>
<td>280</td>
<td>45</td>
<td>100</td>
<td>2</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Pneumatic connection sizes

- **Connection**
  - **Nominal sizes/Inside Ø hose**
  - **G1/2"**
  - **G3/8"**
  - **G1/2"**
  - **G3/4"**

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**Dimensions in mm**

**TB 10.05_201802.en**

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TOX®-Hydrosplit Coupling type ZHK
Easy separation of pressure intensifier and drive cylinder

In order to ship the components already filled with oil and for easy installation, the TOX®-Hydrosplit Coupling has been developed. This allows to connect all components without any introduction of air to the system and without leakage. The coupling is available as manual or electric switchable.

**TOX®-Hydrosplit Coupling type ZHK 020.000 manually switchable**

<table>
<thead>
<tr>
<th>Connection hose side</th>
<th>Connection intensifier side</th>
<th>Connection hose side</th>
<th>Connection intensifier side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disconnected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part 1

Part 2

Can be used with drives up to HZL 74 / X-AT 050.
For bigger cylinders request the ZHK 042 (with SAE 2” connection.)

**TOX®-Hydrosplit Coupling type ZHK 020.001 with solenoid operated valve**

<table>
<thead>
<tr>
<th>Hose</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>disconnected</td>
<td></td>
</tr>
</tbody>
</table>

Part 1

Part 3

Can be used with drives up to HZL 74 / X-AT 050.

**Features:**
- Valve is operated with a drive cylinder. No pressure drop
- Cylinders can be activated independently. Return stroke position can be controlled
- One valve size can be used on all cylinders
- Improved cycle time
- Prepared for position feedback

**Technical data:**
- Operating voltage: 24 V/DC
- Power consumption: 4.4 W

Includes solenoid DIN 43650 (ISO 4400) design A, with LED
TOX®-Hydrosplit Coupling type ZHK
Combinable with up to 6 drive cylinders

Pressure Intensifier X-ES with up to 3 working cylinders

The pressure intensifiers X-ES 100 and X-ES 125 allow direct mounting of 1 to 3 hydrosplit couplings ZHK 020.

Pressure Intensifier X-ES with 4 and more working cylinders
When mounting 4 to 6 working cylinders to the intensifiers X-ES 100 and X-ES 125 with the hydrosplit coupling, the adapter 603 is used.

The adapter type 603 is always used when mounting hydrosplit couplings ZHK 020 to the intensifiers X-ES 180, X-ES 250 and X-ES 300.

Mounting variants

Mounting variants of TOX®-Hydrosplit Coupling with 1 – 6 hoses. Swivel fitting allows each hose to be independently oriented.
Hydraulic hoses
The connection between the drive cylinders and pneumohydraulic intensifier

<table>
<thead>
<tr>
<th>Connection variants</th>
<th>Cylinder HZL / X-AT side</th>
<th>Intensifier X-ES side</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZS 01</td>
<td></td>
<td></td>
<td>2 x straight connection</td>
</tr>
<tr>
<td>ZS 02</td>
<td></td>
<td></td>
<td>1 x 90° elbow on X-ES, 1 x straight connection on HZL/X-AT</td>
</tr>
<tr>
<td>ZS 03</td>
<td></td>
<td></td>
<td>1 x straight connection on X-ES, 1 x 90° elbow on HZL/X-AT</td>
</tr>
</tbody>
</table>

Allocation of the hydraulic hoses to the drive cylinders

<table>
<thead>
<tr>
<th>Drive</th>
<th>Standard hose lengths</th>
<th>Nominal size</th>
<th>Hoses Ø D</th>
<th>Hose dimensions</th>
<th>Hose weight incl. oil* [kg/m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 001</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>10</td>
<td>21</td>
<td>88</td>
<td>75</td>
</tr>
<tr>
<td>X-AT 002 / X-AT 004</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>12</td>
<td>24</td>
<td>94</td>
<td>85</td>
</tr>
<tr>
<td>X-AT 008</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>16</td>
<td>28.5</td>
<td>101</td>
<td>90</td>
</tr>
<tr>
<td>X-AT 015</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>19</td>
<td>32</td>
<td>118</td>
<td>125</td>
</tr>
<tr>
<td>X-AT 030 / X-AT 050</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>25</td>
<td>39</td>
<td>145</td>
<td>160</td>
</tr>
<tr>
<td>X-AT 100 / X-AT 170</td>
<td>1000 / 1500 / 2000 / 2500 / 3000</td>
<td>50</td>
<td>71</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>HZL 02</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>10</td>
<td>21</td>
<td>88</td>
<td>75</td>
</tr>
<tr>
<td>HZL 05</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>12</td>
<td>24</td>
<td>94</td>
<td>85</td>
</tr>
<tr>
<td>HZL 07 / HZL 11</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>16</td>
<td>28.5</td>
<td>101</td>
<td>90</td>
</tr>
<tr>
<td>HZL 19 / HZL 29</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>19</td>
<td>32</td>
<td>118</td>
<td>125</td>
</tr>
<tr>
<td>HZL 48 / HZL 74</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>25</td>
<td>39</td>
<td>145</td>
<td>160</td>
</tr>
</tbody>
</table>

R_{min}: smallest allowable bending radius
*without screw-type fittings
Dimensions in mm

Ordering example:
ZS 01 - 1000
hose length
variant no.

Other connection variants on request.

Examples of the correct installation of hydraulic hoses

Hoses must be installed so that it can be bled properly!
Pneumatic control diagram (example):

TOX®-Powerpackage X-KT-System for up to 6 drive cylinders (X-AT or HZL) with pneumatic control, power stroke valve and hydrosplit coupling ZHK 020.

Control system for X-KT systems for 1-2 X-AT/HZL with power stroke valve, with fast approach stroke support and control throttle X

Description:
Storage piston during fast approach pressurized with fast approach pressure.
Storage piston during return stroke pressurized with reduced air spring pressure.
Power stroke piston permanently pressurized with reduced air spring pressure.

Not included in the scope of delivery!
Maintenance unit required!
Configuration range: min. 2 bar, max. 10 bar
Additional information
Ordering information

The following ordering example (TOX®-Pressure Intensifier with 2 TOX®-Hydraulic Cylinders HZL) shows, how to order a TOX®-Powerpackage X-KT system (either with working part X-AT or with hydraulic cylinder HZL):

<table>
<thead>
<tr>
<th>Ordering data:</th>
<th>Example:</th>
<th>Quantity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order no. of the intensifier X-ES</td>
<td>X-ES 125.000.0123.48</td>
<td>1</td>
</tr>
<tr>
<td>Order no. of either the TOX®-Working Cylinder X-AT or the TOX®-Hydraulic Cylinder HZL</td>
<td>HZL 07.101.100</td>
<td>2</td>
</tr>
<tr>
<td>Length and variant no. of the hydraulic hose ZS</td>
<td>ZS 01.1000</td>
<td>2</td>
</tr>
<tr>
<td>Type of TOX®-Hydrosplit Coupling and mounting variant</td>
<td>ZHK 020.000, Mounting variant 1</td>
<td>2</td>
</tr>
</tbody>
</table>

You will receive:
• 2 x HZL incl. hoses and hydrosplit coupling
• 1 x X-ES incl. hydrosplit coupling (manually switchable)

The TOX®-Powerpackage X-KT-System will be delivered in detached condition but completely filled with oil.

All components are ready for connection including colour-guided pneumatic plug-in-system.