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

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 (44 psi)).

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)

<table>
<thead>
<tr>
<th>Calculation for system selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. oil pressure bar</td>
</tr>
</tbody>
</table>

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!

<table>
<thead>
<tr>
<th>Required total delivery volume for power stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required delivery volume per 1 mm power stroke</td>
</tr>
<tr>
<td>V 3.1</td>
</tr>
</tbody>
</table>

The volume required in your case can be determined by multiplying the required press force (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 fast approach stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required delivery volume per 1 mm total stroke</td>
</tr>
<tr>
<td>V 3.1</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.

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 max. 250 bar (3,600 psi) oil pressure

TOX®-Pressure Intensifier X-ES in combination with the TOX®-Hydraulic Cylinder HZL

Order no. A B C D E F G H Q V

**Attention**: Pressure and force values to be considered as calculation basis for preselection. The real values can differ.

**Warning**: Pressure tolerance ± 5%

**Note**: Unless specified otherwise the max. permissible oil pressure is 400 bar for all intensifiers of the type X-ES. It must not be exceeded.

---

**Conversion help:**
1 kN = 224.8 lbf
1 daN = 2.25 lbf
1 bar = 14.5 psi

---

**Press Force at 200 bar (at 1 bar air pressure) F:**

<table>
<thead>
<tr>
<th>Order no.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>Q</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>HZL 74.101.200</td>
<td>770</td>
<td>1050</td>
<td>655</td>
<td>31.4</td>
<td>35.0</td>
<td>0.7</td>
<td>275</td>
<td>366</td>
<td>10xM24x40</td>
<td>200 G3/4&quot;</td>
</tr>
<tr>
<td>HZL 74.101.150</td>
<td>770</td>
<td>1050</td>
<td>655</td>
<td>31.4</td>
<td>155.0</td>
<td>0.7</td>
<td>275</td>
<td>466</td>
<td>10xM24x40</td>
<td>200 G3/4&quot;</td>
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<tr>
<td>HZL 74.101.100</td>
<td>770</td>
<td>1050</td>
<td>655</td>
<td>31.4</td>
<td>100.0</td>
<td>0.7</td>
<td>275</td>
<td>348</td>
<td>10xM24x40</td>
<td>200 G3/4&quot;</td>
</tr>
<tr>
<td>HZL 74.101.050</td>
<td>770</td>
<td>1050</td>
<td>655</td>
<td>31.4</td>
<td>50.0</td>
<td>0.7</td>
<td>275</td>
<td>285</td>
<td>10xM24x40</td>
<td>200 G3/4&quot;</td>
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<tr>
<td>HZL 11.101.200</td>
<td>192</td>
<td>210</td>
<td>125</td>
<td>7.9</td>
<td>17.3</td>
<td>0.7</td>
<td>125</td>
<td>285</td>
<td>6xM16x25</td>
<td>100 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 11.101.150</td>
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<td>210</td>
<td>125</td>
<td>7.9</td>
<td>13.7</td>
<td>0.7</td>
<td>125</td>
<td>235</td>
<td>6xM16x25</td>
<td>100 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 11.101.100</td>
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<td>210</td>
<td>125</td>
<td>7.9</td>
<td>9.6</td>
<td>0.7</td>
<td>125</td>
<td>195</td>
<td>6xM16x25</td>
<td>100 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 11.101.050</td>
<td>192</td>
<td>210</td>
<td>125</td>
<td>7.9</td>
<td>4.8</td>
<td>0.7</td>
<td>125</td>
<td>125</td>
<td>6xM16x25</td>
<td>100 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 05.101.200</td>
<td>48</td>
<td>40</td>
<td>25</td>
<td>2.0</td>
<td>14.6</td>
<td>0.6</td>
<td>65</td>
<td>190</td>
<td>6xM12x16</td>
<td>40 G3/8&quot;</td>
</tr>
<tr>
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<td>40</td>
<td>25</td>
<td>2.0</td>
<td>11.2</td>
<td>0.6</td>
<td>65</td>
<td>150</td>
<td>6xM12x16</td>
<td>40 G3/8&quot;</td>
</tr>
<tr>
<td>HZL 05.101.100</td>
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<td>0.6</td>
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<td>120</td>
<td>6xM12x16</td>
<td>40 G3/8&quot;</td>
</tr>
<tr>
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<td>40</td>
<td>25</td>
<td>2.0</td>
<td>6.0</td>
<td>0.6</td>
<td>65</td>
<td>100</td>
<td>6xM12x16</td>
<td>40 G3/8&quot;</td>
</tr>
<tr>
<td>HZL 02.101.200</td>
<td>23</td>
<td>17</td>
<td>10</td>
<td>0.9</td>
<td>2.4</td>
<td>0.6</td>
<td>55</td>
<td>158</td>
<td>6xM16x12</td>
<td>42 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 02.101.150</td>
<td>23</td>
<td>17</td>
<td>10</td>
<td>0.9</td>
<td>2.0</td>
<td>0.6</td>
<td>55</td>
<td>150</td>
<td>6xM16x12</td>
<td>42 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 02.101.100</td>
<td>23</td>
<td>17</td>
<td>10</td>
<td>0.9</td>
<td>1.7</td>
<td>0.6</td>
<td>55</td>
<td>208</td>
<td>6xM16x12</td>
<td>42 G1/2&quot;</td>
</tr>
<tr>
<td>HZL 02.101.050</td>
<td>23</td>
<td>17</td>
<td>10</td>
<td>0.9</td>
<td>1.3</td>
<td>0.6</td>
<td>55</td>
<td>200</td>
<td>6xM16x12</td>
<td>42 G1/2&quot;</td>
</tr>
</tbody>
</table>
TOX®-Hydraulic Cylinder HZL with total stroke adjustment max. 250 bar (3,600 psi) oil pressure

Adapter for working piston (with internal thread to fit the piston rod end)

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

Dimensions in mm

Type | Fits to | ØA | B | L1 | L | M | W | Vd | SW
--- | --- | --- | --- | --- | --- | --- | --- | --- | ---
HZL 02.016.020.000 | HZL 02 | 22 | 20 | M12x1.5 | M16x1.5 | 15 | 4 | 14 | 19
HZL 02.016.020.000 | HZL 05 | 30 | 20 | M16x1.5 | 2M22x2 | 20 | 7 | 18 | 27
HZL 02.016.020.000 | HZL 06 | 45 | 30 | M24x1.5 | M30x2 | 25 | 7 | 26 | 41
HZL 030.039.040.000 | HZL 19 | 56 | 40 | M30x2 | M39x2 | 35 | - | - | 50

Conversion help:
1 kN = 224.8 lbf
1 daN = 225 lbf
1 bar = 14.5 psi
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.

* Pneumatic supply at the intensifier X-ES (connection sizes see X-ES).

** Attention: Pressure and force values to be considered as calculation basis for preselection. The real values can differ.

Note: Unless specified otherwise the max. permissible oil pressure is 400 bar for all intensifiers of the type X-ES. It must not be exceeded.

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

Note: 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

** Attention: Pressure and force values to be considered as calculation basis for preselection. The real values can differ.

*** Pressure tolerance ± 5%

**** Weight data for X-ES including pneumatic control and hydrosplit coupling ZHK 020.
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**

![Diagram of the coupling](image)

Part 1
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**

![Diagram of the coupling](image)

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

Connection variants

<table>
<thead>
<tr>
<th>Variant no.</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>
</tbody>
</table>
| ZS 02       |                          |                       | 1 x 90° elbow on X-ES
               |                          |                       | 1 x straight connection on HZL/X-AT |
| ZS 03       |                          |                       | 1 x straight connection on X-ES
               |                          |                       | 1 x 90° elbow on HZL/X-AT |

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 A B C Hmin Rmin</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 75 84 220 150</td>
<td>0.6</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 85 92 275 200</td>
<td>0.8</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 90 74 320 240</td>
<td>1.3</td>
</tr>
<tr>
<td>X-AT 015</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>19</td>
<td>32</td>
<td>118 125 137 375 280</td>
<td>1.8</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>145 160 100 420 270</td>
<td>2.6</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>200 200 176 1120 920</td>
<td>6.8</td>
</tr>
<tr>
<td>HZL 02</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>10</td>
<td>21</td>
<td>88 75 84 220 150</td>
<td>0.6</td>
</tr>
<tr>
<td>HZL 05</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>12</td>
<td>24</td>
<td>94 85 92 275 200</td>
<td>0.8</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 90 74 320 240</td>
<td>1.3</td>
</tr>
<tr>
<td>HZL 19/HZL 29</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>19</td>
<td>32</td>
<td>118 125 137 375 280</td>
<td>1.8</td>
</tr>
<tr>
<td>HZL 48/HZL 74</td>
<td>500 / 1000 / 1500 / 2000 / 2500 / 3000</td>
<td>25</td>
<td>39</td>
<td>145 160 100 420 270</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Rmin: 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

right
wrong
right
right

Hoses must be installed so that it can be bled properly!
Additional information
Pneumatic control diagram

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, 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.