Axial Piston Variable Motor
A6VM

Features
- Variable motor with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuits
- For use in mobile and stationary applications
- The wide control range enables the variable motor to satisfy the requirement for high speed and high torque.
- The displacement can be infinitely changed from $V_{g_{\text{max}}}$ to $V_{g_{\text{min}}}$ = 0.
- The output speed is dependent on the flow of the pump and the displacement of the motor.
- The output torque increases with the pressure differential between the high-pressure and low-pressure side and with increasing displacement.
- Wide control range with hydrostatic transmissions
- Wide selection of control devices
- Cost savings through elimination of gear shifts and possibility of using smaller pumps
- Compact, robust motor with long service life
- High power density
- Good starting characteristics
- Small swing torque

Contents
Ordering code for standard program
Technical data
HD – Proportional control hydraulic
EP – Proportional control electric
HZ – Two-point control hydraulic
EZ – Two-point control electric
HA – Automatic control high-pressure related
DA – Automatic control speed-related
Electric travel direction valve (for DA, HA.R)
Dimensions 28 to 1000
Connector for solenoids
Flushing and boost pressure valve
Counterbalance valve BVD and BVE
Swivel angle indicator
Speed sensors
Installation instructions
General instructions
## Ordering code for standard program

<table>
<thead>
<tr>
<th></th>
<th>A6V</th>
<th>M</th>
<th>/63</th>
<th>W</th>
<th>–</th>
<th>V</th>
<th>–</th>
<th>–</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
<td>09</td>
</tr>
</tbody>
</table>

### Hydraulic fluid
- Mineral oil and HFD. HFD for sizes 250 to 1000 only in combination with long-life bearings "L" (without code)
- HFB, HFC hydraulic fluid
  - Sizes 28 to 200 (without code)
  - Sizes 250 to 1000 (only in combination with long-life bearings "L")

### Axial piston unit
- Bent-axis design, variable

### Drive shaft bearing

<table>
<thead>
<tr>
<th></th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
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<tbody>
<tr>
<td>03</td>
<td></td>
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<tr>
<td>Long-life bearing</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<td>●</td>
<td>●</td>
<td>●</td>
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</tr>
</tbody>
</table>

### Operating mode
- Motor (plug-in motor A6VE, see RE 91606)

### Sizes (NG)
- Geometric displacement, see table of values on page 8

### Control devices

#### Proportional control hydraulic
- Δp = 10 bar
- Δp = 25 bar
- Δp = 35 bar

#### Two-point control hydraulic
- HZ1
- HZ2
- HZ3

#### Proportional control electric
- 12 V
- 24 V

#### Two-point control electric
- 12 V
- 24 V

#### Automatic control high-pressure related
- with minimum pressure increase Δp ≤ approx. 10 bar
- with pressure increase Δp = 100 bar

#### Automatic control speed-related
- pSt/pHD = 3/100
- pSt/pHD = 5/100
- pSt/pHD = 8/100

#### Pressure control (only for HD, EP)
- Without pressure control (without code)
- fixed setting
- hydraulic override, two-point
- hydraulic remote control, proportional

### Symbols
- ● = Available
- ○ = On request
- ▲ = Not for new projects
- – = Not available
- □ = Preferred program

1) Fitted as standard with version D (sizes 250 to 1000)
# Ordering code for standard program

<table>
<thead>
<tr>
<th>A6V</th>
<th>M</th>
<th>/</th>
<th>63</th>
<th>W</th>
<th>–</th>
<th>V</th>
<th>–</th>
<th>–</th>
<th>–</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
<td>09</td>
<td>10</td>
</tr>
</tbody>
</table>

### Overrides for controls HA1 and HA2

<table>
<thead>
<tr>
<th>Override Type</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without override (without code)</td>
<td>●●●●●●●●●●●</td>
</tr>
<tr>
<td>Hydraulic override, remote control, proportional</td>
<td>12 V ●●●●●●●●●●● – – – – T</td>
</tr>
<tr>
<td>Electric override, two-point</td>
<td>12 V ●●●●●●●●●●● – – – – U1</td>
</tr>
<tr>
<td>Electric override + electric travel direction valve</td>
<td>12 V ●●●●●●●●●●● – – – – R1</td>
</tr>
<tr>
<td>Electric override + electric travel direction valve</td>
<td>24 V ●●●●●●●●●●● – – – – R2</td>
</tr>
</tbody>
</table>

### Series

<table>
<thead>
<tr>
<th>Series</th>
<th>09 Series 6, index 3</th>
</tr>
</thead>
</table>

### Direction of rotation

<table>
<thead>
<tr>
<th>Direction</th>
<th>63</th>
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</thead>
</table>

### Setting ranges for displacement

<table>
<thead>
<tr>
<th>Setting</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vg min = 0.2 Vg max (without code)</td>
<td>●●●●●●●●●●● – – – –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vg max = Vg max to 0.8 Vg max</td>
<td>– – – – – – – ●●●●●●●●●●● 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vg max = Vg max to 0.8 Vg max</td>
<td>– – – – – – – ●●●●●●●●●●● 2</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Seals

<table>
<thead>
<tr>
<th>Seals</th>
<th>12 FKM (fluor-caoutchouc)</th>
</tr>
</thead>
</table>

### Drive shafts

<table>
<thead>
<tr>
<th>Drive shaft</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splined shaft DIN 5480</td>
<td>●●●●●●●●●●● – – – – A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parallel keyed shaft DIN 6885</td>
<td>– – – – – – – ●●●●●●●●●●● Z</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

### Mounting flanges

<table>
<thead>
<tr>
<th>Mounting flanges</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 3019-2 4-hole</td>
<td>●●●●●●●●●●● – – – – B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-hole</td>
<td>– – – – – – – ●●●●●●●●●●● H</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Port plates for service lines

<table>
<thead>
<tr>
<th>Port plates for service lines</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE flange ports A and B at rear</td>
<td>01</td>
<td>010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAFLange ports A and B at side, opposite</td>
<td>02</td>
<td>020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAE flange ports A and B at side, opposite + rear</td>
<td>15</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Port plate with 1-level pressure-relief valves for mounting a counterbalance valve</td>
<td>BVD</td>
<td>370</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BVE</td>
<td>380</td>
<td></td>
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### Valves (see pages 71 to 76)

<table>
<thead>
<tr>
<th>Valves</th>
<th>0</th>
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<tbody>
<tr>
<td>Without valve</td>
<td>0</td>
</tr>
<tr>
<td>Flushing and boost pressure valve mounted</td>
<td>7</td>
</tr>
<tr>
<td>Counterbalance valve mounted</td>
<td>8</td>
</tr>
</tbody>
</table>

### Notes

- Available [●] = Available  [○] = On request  [▲] = Not for new projects  [–] = Not available  [●●●●●●●●●●●] = Preferred program

2) Specify exact settings for Vg min and Vg max in plain text when ordering: Vg min = ... cm³, Vg max = ... cm³

3) Metric fastening thread

4) Only possible in combination with HA control. Note the restrictions on page 74.

5) Specify ordering code of counterbalance valve according to data sheet (BVD – RE 95522, BVE – RE 95525) separately.

Note the restrictions on page 74.

6) Counterbalance valve MHB32, please contact us.
### Ordering code for standard program

<table>
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<tr>
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<th>28</th>
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<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A6V</strong></td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
<td>09</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>/ 63 W</strong></td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>– V</strong></td>
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</table>

#### Speed sensors (see page 78)

<table>
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<tr>
<th></th>
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<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without speed sensor</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Prepared for HDD speed sensor</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>HDD speed sensor mounted</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Prepared for DSA speed sensor</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>DSA speed sensor mounted</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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</tbody>
</table>

#### Swivel angle sensor (see page 77)

<table>
<thead>
<tr>
<th></th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without swivel angle sensor (without code)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td>Optical swivel angle sensor</td>
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<td>–</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td>Electric swivel angle sensor</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>●</td>
<td>●</td>
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</tbody>
</table>

#### Connector for solenoids (see page 70)

<table>
<thead>
<tr>
<th></th>
<th>28 to 200</th>
<th>250 to 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without connector (without solenoid, only with hydraulic controls)</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>(size 250 to 1000 without code)</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>DEUTSCH – molded connector, 2-pin – without suppressor diode</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>HIRSCHMANN connector – without suppressor diode (without code)</td>
<td>–</td>
<td>●</td>
</tr>
</tbody>
</table>

#### Beginning of control

<table>
<thead>
<tr>
<th></th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>At V₉ min (standard for HA)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>At V₉ max (standard for HD, HZ, EP, EZ, DA)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

#### Standard / special version

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard version (without code)</td>
<td></td>
</tr>
<tr>
<td>Standard version with installation variants, e. g. T ports against standard open or closed</td>
<td>–Y</td>
</tr>
<tr>
<td>Special version</td>
<td>–S</td>
</tr>
</tbody>
</table>

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- ● = Available
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- □ = Preferred program

7) Please contact us.
8) Specify ordering code of sensor according to data sheet (DSA – RE 95133, HDD – RE 95135) separately and observe the requirements on the electronics.
Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids), RE 90222 (HFD hydraulic fluids) and RE 90223 (HFA, HFB, HFC hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable motor A6VM is not suitable for operation with HFA hydraulic fluid. If HFB, HFC, or HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in a closed circuit, the circuit temperature, in an open circuit, the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range ($\nu_{opt}$ see shaded area of the selection diagram). We recommend that the higher viscosity class be selected in each case.

Example: At an ambient temperature of $X \, ^\circ C$, an operating temperature of $60 \, ^\circ C$ is set in the circuit. In the optimum viscosity range ($\nu_{opt}$, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note

The case drain temperature, which is affected by pressure and speed, can be higher than the circuit temperature or reservoir temperature. At no point of the component may the temperature be higher than $115 \, ^\circ C$. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U or using a flushing and boost pressure valve (see pages 71 and 72).

Viscosity and temperature of hydraulic fluid

<table>
<thead>
<tr>
<th>Viscosity [mm²/s]</th>
<th>Temperature</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport and storage at ambient temperature</td>
<td>$T_{min} \geq -50 , ^\circ C$</td>
<td>factory preservation: up to 12 months with standard, up to 24 months with long-term</td>
</tr>
<tr>
<td>(Cold) start-up¹</td>
<td>$\nu_{max} = 1600$</td>
<td>$T_{St} \geq -40 , ^\circ C$</td>
</tr>
<tr>
<td>Permissible temperature difference</td>
<td>$\Delta T \leq 25 , K$</td>
<td>between axial piston unit and hydraulic fluid</td>
</tr>
<tr>
<td>Warm-up phase</td>
<td>$\nu &lt; 1600$ to 400</td>
<td>$T = -40 , ^\circ C$ to $-25 , ^\circ C$</td>
</tr>
<tr>
<td>Operating phase</td>
<td>$\Delta T = approx. , 12 , K$</td>
<td>between hydraulic fluid in the bearing and at port T.</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>$115 , ^\circ C$</td>
<td>The bearing temperature can be reduced by flushing via port U.</td>
</tr>
<tr>
<td>Continuous operation</td>
<td>$\nu = 400$ to 10</td>
<td>$T = -25 , ^\circ C$ to $+90 , ^\circ C$</td>
</tr>
<tr>
<td>Short-term operation²</td>
<td>$\nu_{min} \geq 7$</td>
<td>$T_{max} = +103 , ^\circ C$</td>
</tr>
<tr>
<td>FKM shaft seal¹</td>
<td></td>
<td>$T \leq +115 , ^\circ C$</td>
</tr>
</tbody>
</table>

¹ At temperatures below $-25 \, ^\circ C$, an NBR shaft seal is required (permissible temperature range: $-40 \, ^\circ C$ to $+90 \, ^\circ C$).

² Sizes 250 to 1000, please contact us.
Technical data

Filtration of the hydraulic fluid
Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

Shaft seal
Permissible pressure loading
The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes (t < 0.1 s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or higher than the ambient pressure.

Sizes 28 to 200

Sizes 250 to 1000

Temperature range
The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note
For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering.
Please contact us.

Influence of case pressure on beginning of control
An increase in case pressure affects the beginning of control of the variable motor when using the following control options:

HD, HA.T (sizes 28 to 200) increase
HD, EP, HA, HA.T (sizes 250 to 1000) increase
DA decrease

With the following controls, an increase in the case pressure has no influence on the beginning of control:
EP, HA, HA.R, HA.U (sizes 28 to 200)

The factory settings for the beginning of control are made at $p_{abs} = 2$ bar (sizes 28 to 200) and $p_{abs} = 1$ bar (sizes 250 to 1000) case pressure.

Direction of flow

Direction of rotation, viewed on drive shaft
clockwise counter-clockwise
A to B B to A

Long-life bearings

Sizes 250 to 1000

For long service life and use with HF hydraulic fluids. Identical external dimensions as motor with standard bearings. Subsequent conversion to long-life bearings is possible. Bearings and case flushing via port U is recommended.

Flushing flow (recommended)

<table>
<thead>
<tr>
<th>NG</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_{f,\text{flush}}$ (L/min)</td>
<td>10</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

The values are valid for an ambient pressure $p_{abs} = 1$ bar.
Technical data

Operating pressure range
(operating with mineral oil)

Pressure at service line port A or B

Sizes 28 to 200

Nominal pressure \( p_{\text{nom}} \) 400 bar absolute
Maximum pressure \( p_{\text{max}} \) 450 bar absolute

Single operating period 10 s
Total operating period at 300 h

Sizes 250 to 1000

Nominal pressure \( p_{\text{nom}} \) 350 bar absolute
Maximum pressure \( p_{\text{max}} \) 400 bar absolute

Single operating period 10 s
Total operating period 300 h

Minimum pressure (high-pressure side) 25 bar absolute

Summation pressure \( p_{\text{Su}} \) 700 bar

Rate of pressure change \( R_A \max \)
with integrated pressure-relief valve 9000 bar/s
without pressure-relief valve 16000 bar/s

Minimum pressure – pump mode (inlet)

To prevent damage to the axial piston motor in pump operating mode (change of high-pressure side with unchanged direction of rotation, e. g. when braking), a minimum pressure must be guaranteed at the service line port (inlet). This minimum pressure is dependent on the speed and displacement of the axial piston unit (see characteristic curve below).

Note

Values for other hydraulic fluids, please contact us.
Technical data

Table of values (theoretical values, without efficiency and tolerances; values rounded)

<table>
<thead>
<tr>
<th>Size</th>
<th>NG 28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement geometric1), per revolution</td>
<td>Vg max cm³</td>
<td>28.1</td>
<td>54.8</td>
<td>80</td>
<td>107</td>
<td>140</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>355</td>
<td>500</td>
</tr>
<tr>
<td>Vg min cm³</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vg x cm³</td>
<td>18</td>
<td>35</td>
<td>51</td>
<td>68</td>
<td>88</td>
<td>61</td>
<td>76</td>
<td>188</td>
<td>270</td>
<td>377</td>
<td>762</td>
</tr>
</tbody>
</table>

Speed maximum2) (while adhering to the maximum permissible input flow)

| at Vg max | n nom rpm | 5550 | 4450 | 3900 | 3550 | 3250 | 3100 | 2900 | 2700 | 2240 | 2000 | 1600 |
| at Vg < Vg x (see diagram below) | n max rpm | 8750 | 7000 | 6150 | 5600 | 5150 | 4900 | 4600 | 3600 | 2950 | 2650 | 1600 |
| at Vg < 0 | n max rpm | 10460 | 8350 | 7350 | 6300 | 5750 | 5500 | 5100 | 3600 | 2950 | 2650 | 1600 |

Input flow3)

| at n nom and Vg max | qV max L/min | 156 | 244 | 312 | 380 | 455 | 496 | 580 | 675 | 795 | 1000 | 1600 |

Torque4)

| at Vg max and Δp = 400 bar | T Nm | 179 | 349 | 509 | 681 | 891 | 1019 | 1273 | – | – | – | – |
| at Vg max and Δp = 350 bar | T Nm | 157 | 305 | 446 | 596 | 778 | 891 | 1114 | 1391 | 1978 | 2785 | 5571 |

Rotary stiffness

| Vg max to Vg/2 | c min KNm/rad | 6 | 10 | 16 | 21 | 34 | 35 | 44 | 60 | 75 | 115 | 281 |
| Vg/2 to 0 (interpolated) | c max KNm/rad | 18 | 32 | 48 | 65 | 93 | 105 | 130 | 181 | 262 | 391 | 820 |

Moment of inertia for rotary group JGR kgm² | 0.0014 | 0.0042 | 0.008 | 0.0127 | 0.0207 | 0.0253 | 0.0353 | 0.061 | 0.102 | 0.178 | 0.55 |

Maximum angular acceleration α rad/s² | 47000 | 31500 | 24000 | 19000 | 11000 | 11000 | 11000 | 10000 | 8300 | 5500 | 4000 |

Case volume V L | 0.5 | 0.75 | 1.2 | 1.5 | 1.8 | 2.4 | 2.7 | 3.0 | 5.0 | 7.0 | 16.0 |

Mass (approx.) m kg | 16 | 26 | 34 | 47 | 60 | 64 | 80 | 100 | 170 | 210 | 430 |

1) The minimum and maximum displacement are infinitely adjustable, see ordering code, page 3.
2) The values are valid:
   - for the optimum viscosity range from νopt = 36 to 16 mm²/s
   - with hydraulic fluid based on mineral oils
3) Restriction of input flow with counterbalance valve, see page 74
4) Torque without radial force, with radial force see page 9

Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible startup angular acceleration (lower than the maximum angular acceleration) can be found in data sheet 90261.

Permissible displacement in relation to speed

Determining the operating characteristics

| Input flow | qV = \frac{V_g \cdot n}{1000 \cdot \eta_v} | [L/min] |
| Speed | n = \frac{qV \cdot 1000 \cdot \eta_v}{V_g} | [min⁻¹] |
| Torque | T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi} | [Nm] |
| Power | P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{qV \cdot \Delta p \cdot \eta_t}{600} | [kW] |

V_g = Displacement per revolution in cm³
Δp = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency (η_t = η_v \cdot η_{mh})

5) Values in this range on request
## Technical data

### Permissible radial and axial forces of the drive shafts

<table>
<thead>
<tr>
<th>Size</th>
<th>NG</th>
<th>28</th>
<th>28</th>
<th>55</th>
<th>55</th>
<th>80</th>
<th>80</th>
<th>107</th>
<th>107</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive shaft</td>
<td>ø</td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td>25</td>
<td>35</td>
<td>30</td>
<td>40</td>
<td>35</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>Maximum radial force(^1) at distance (a) (from shaft collar)</td>
<td>(F_q)</td>
<td>(F_{q \text{ max}}) N</td>
<td>4838</td>
<td>6436</td>
<td>8069</td>
<td>7581</td>
<td>10283</td>
<td>10266</td>
<td>12215</td>
<td>13758</td>
</tr>
<tr>
<td></td>
<td>(a)</td>
<td>mm</td>
<td>17.5</td>
<td>14</td>
<td>20</td>
<td>17.5</td>
<td>22.5</td>
<td>20</td>
<td>25</td>
<td>22.5</td>
</tr>
<tr>
<td>with permissible torque</td>
<td>(T_{\text{max}}) Nm</td>
<td>179</td>
<td>179</td>
<td>349</td>
<td>281</td>
<td>509</td>
<td>444</td>
<td>681</td>
<td>681</td>
<td>891</td>
</tr>
<tr>
<td>(\Delta p) at (V_g) max</td>
<td>(p_{\text{nom perm.}}) bar</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>322</td>
<td>400</td>
<td>349</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Maximum axial force(^2)</td>
<td>(F_{\text{ax max}}) N</td>
<td>315</td>
<td>315</td>
<td>500</td>
<td>500</td>
<td>710</td>
<td>710</td>
<td>900</td>
<td>900</td>
<td>1030</td>
</tr>
<tr>
<td>Permissible axial force per bar operating pressure</td>
<td>(F_{\text{ax perm/bar}}) N/bar</td>
<td>4.6</td>
<td>4.6</td>
<td>7.5</td>
<td>7.5</td>
<td>9.6</td>
<td>9.6</td>
<td>11.3</td>
<td>11.3</td>
<td>13.3</td>
</tr>
</tbody>
</table>

\(1\) With intermittent operation.  
\(2\) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.  
\(3\) When at a standstill or when axial piston unit operating in non-pressurized conditions. Higher forces are permissible when under pressure, please contact us.  
\(4\) Please contact us.

### Note

Influence of the direction of the permissible axial force:

\(+F_{\text{ax max}}\)  = Increase in service life of bearings  
\(-F_{\text{ax max}}\)  = Reduction in service life of bearings (avoid)

### Effect of radial force \(F_q\) on the service life of bearings

By selecting a suitable direction of radial force \(F_q\), the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

#### Toothed gear drive

- \(\phi_{\text{opt}} = 45^\circ\)  
- \(\phi_{\text{opt}} = 45^\circ\)  
- \(\phi_{\text{opt}} = 70^\circ\)  

#### V-belt drive

- \(\phi_{\text{opt}} = 10^\circ\)  
- \(\phi_{\text{opt}} = 70^\circ\)
HD – Proportional control hydraulic

The proportional hydraulic control provides infinite setting of the displacement, proportional to the pilot pressure applied to port X.

- Beginning of control at \( V_{g \text{ max}} \) (maximum torque, minimum speed at minimum pilot pressure)
- End of control at \( V_{g \text{ min}} \) (minimum torque, maximum permissible speed at maximum pilot pressure)

**Note**
- Maximum permissible pilot pressure: \( p_{St} = 100 \text{ bar} \)
- The control oil is internally taken out of the high-pressure side of the motor (A or B). For reliable control, an operating pressure of at least 30 bar is required in A (B). If a control operation is performed at an operating pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port G via an external check valve. For lower pressures, please contact us.
- Please note that pressures up to 450 bar can occur at port G.
- Please state the desired beginning of control in plain text when ordering, e.g.: beginning of control at 10 bar.
- The beginning of control and the HD characteristic are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 6) and thus a parallel shift of the characteristic.
- A leakage flow of maximum 0.3 L/min can escape at port X due to internal leakage (operating pressure > pilot pressure). The control is to be suitably configured to avoid an independent build-up of pilot pressure.

**HD1**

**Pilot pressure increase \( \Delta p_{St} = 10 \text{ bar} \)**

A pilot pressure increase of 10 bar at port X results in a decrease in displacement from \( V_{g \text{ max}} \) to 0 cm\(^3\) (sizes 28 to 200) or from \( V_{g \text{ max}} \) to 0.2 \( V_{g \text{ max}} \) (sizes 250 to 1000).

Beginning of control, setting range ______________2 to 20 bar

Standard setting:
Beginning of control at 3 bar (end of control at 13 bar)

**HD2**

**Pilot pressure increase \( \Delta p_{St} = 25 \text{ bar} \)**

A pilot pressure increase of 25 bar at port X results in a decrease in displacement from \( V_{g \text{ max}} \) to 0 cm\(^3\) (sizes 28 to 200) or from \( V_{g \text{ max}} \) to 0.2 \( V_{g \text{ max}} \) (sizes 250 to 1000).

Beginning of control, setting range ______________5 to 35 bar

Standard setting:
Beginning of control at 10 bar (end of control at 35 bar)

**HD3**

**Pilot pressure increase \( \Delta p_{St} = 35 \text{ bar} \)**

A pilot pressure increase of 35 bar at port X results in a decrease in displacement from \( V_{g \text{ max}} \) to 0.2 \( V_{g \text{ max}} \) (sizes 250 to 1000).

Beginning of control, setting range ______________7 to 50 bar

Standard setting:
Beginning of control at 10 bar (end of control at 45 bar)
HD – Proportional control hydraulic

Schematic HD1, HD2, HD3
Sizes 28 to 200

Schematic HD1, HD2, HD3
Sizes 250 to 1000

Note
The spring return feature in the control part is not a safety device

The control part can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator’s commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (immediate stop). If necessary, make sure these are properly implemented.
HD – Proportional control hydraulic

**HD.D**
Pressure control, fixed setting

The pressure control overrides the HD control function. If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint of the pressure control, the motor will swivel towards a larger displacement.

The increase in the displacement and the resulting reduction in pressure cause the control deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

Setting range of the pressure control valve
Sizes 28 to 200 ___________________________ 80 to 400 bar
Sizes 250 to 1000 _________________________ 80 to 350 bar

**Schematic HD.D**
Sizes 28 to 200
HD – Proportional control hydraulic

**HD.E**

**Pressure control, hydraulic override, two-point**

**Sizes 28 to 200**

The pressure control setting can be overridden by applying an external pilot pressure at port G2, realizing a 2nd pressure setting.

Required pilot pressure at port G2:

\[p_{St} = \text{20 to 50 bar}\]

Please state the 2nd pressure setting in plain text when ordering.

**Schematic HD.E**

Sizes 250 to 1000 (HD.D)

Pressure control with 2nd pressure setting for HD.D provided as standard (see page 12).

The pressure control setting can be overridden by applying an external pilot pressure at port G2, realizing a 2nd pressure setting.

Required pilot pressure at port G2:

\[p_{St} \geq 100 \text{ bar}\]

Please state the 2nd pressure setting in plain text when ordering.

**HD.G**

**Pressure control, remote control**

**Sizes 250 to 1000**

When the set pressure value is reached, the remote control pressure control continually regulates the motor to maximum displacement \(V_g \text{ max}\). A pressure-relief valve (not included in the delivery contents), which is located separately from the motor and which is connected to port \(X_3\), assumes the task of controlling the internal pressure cut-off valve.

So long as the target pressure value has not been reached, pressure is evenly applied to the valve from both sides in addition to the force of the spring, and the valve remains closed. The target pressure value is between 80 bar and 350 bar. When the target pressure value is reached at the separate pressure-relief valve, this will open, reliving the pressure on the spring side to the reservoir. The internal control valve switches and the motor swivels to maximum displacement \(V_g \text{ max}\).

The differential pressure at the control valve is set as standard to 25 bar. As a separate pressure-relief valve, we recommend:

| DBD 6 (hydraulic) as per RE 25402 |

The maximum line length should not exceed 2 m.

**Schematic HD.G**
EP – Proportional control electric

The proportional electric control provides infinite setting of the displacement, proportional to the control current applied to the solenoid (sizes 28 to 200) or proportional valve (sizes 250 to 1000).

For sizes 250 to 1000, the pilot oil supply at port P requires an external pressure of \( p_{\text{min}} = 30 \text{ bar} \) (\( p_{\text{max}} = 100 \text{ bar} \)).

- Beginning of control at \( V_g \max \) (maximum torque, minimum speed at minimum control current)
- End of control at \( V_g \min \) (minimum torque, maximum permissible speed at maximum control current)

### Technical data, solenoid

<table>
<thead>
<tr>
<th></th>
<th>EP1</th>
<th>EP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes 28 to 200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>Control current</td>
<td>Beginning of control</td>
<td>400 mA</td>
</tr>
<tr>
<td></td>
<td>End of control</td>
<td>1200 mA</td>
</tr>
<tr>
<td>Limiting current</td>
<td></td>
<td>1.5 A</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
<td>22.7 Ω</td>
</tr>
<tr>
<td>Dither frequency</td>
<td></td>
<td>100 Hz</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection see connector design page 70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following electronic controllers and amplifiers are available for controlling the proportional solenoids:

- BODAS controller RC
  - Series 20 _________________________________ RE 95200
  - Series 21 __________________________________ RE 95201
  - Series 22 _________________________________ RE 95202
  - Series 30 _______________________ RE 95203, RE 95204
  and application software

- Analog amplifier RA __________________________________ RE 95230

- Electric amplifier VT 2000, series 5X (see RE 29904)
  (for stationary application)

Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics

### Technical data, proportional valve

<table>
<thead>
<tr>
<th></th>
<th>EP1</th>
<th>EP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes 250 to 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>Beginning of control at ( V_g \max )</td>
<td>900 mA</td>
<td>450 mA</td>
</tr>
<tr>
<td>End of control at ( V_g \min )</td>
<td>1400 mA</td>
<td>700 mA</td>
</tr>
<tr>
<td>Limiting current</td>
<td></td>
<td>2.2 A</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>2.4 Ω</td>
<td>12 Ω</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection see connector design page 70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See also proportional pressure-reducing valve DRE 4K (RE 29181).

### Note

The spring return feature in the control part is not a safety device

The control part can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator’s commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (immediate stop). If necessary, make sure these are properly implemented.
EP – Proportional control electric

Schematic EP1, EP2
Sizes 28 to 200

Schematic EP1, EP2
Sizes 250 to 1000

Proportional pressure-reducing valve DRE 4K
(see RE 29181)
EP – Proportional control electric

EP.D
Pressure control, fixed setting

The pressure control overrides the EP control function. If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint of the pressure control, the motor will swivel towards a larger displacement.

The increase in the displacement and the resulting reduction in pressure cause the control deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

Setting range of the pressure control valve:
Sizes 28 to 200 ___________________________ 80 to 400 bar
Sizes 250 to 1000 _________________________ 80 to 350 bar

Schematic EP.D
Sizes 28 to 200

Schematic EP.D
Sizes 250 to 1000

Proportional pressure-reducing valve DRE 4K (see RE 29181)
EP – Proportional control electric

**EPE**
Pressure control, hydraulic override, two-point

Sizes 28 to 200
The pressure control setting can be overridden by applying an external pilot pressure at port G₂, realizing a 2nd pressure setting.

Required pilot pressure at port G₂:
\[ p_{St} = 20 \text{ to } 50 \text{ bar} \]

Please state the 2nd pressure setting in plain text when ordering.

**Schematic EPE**

Sizes 250 to 1000 (EP.D)
Pressure control with 2nd pressure setting for EP.D provided as standard (see on page 16).

The pressure control setting can be overridden by applying an external pilot pressure at port G₂, realizing a 2nd pressure setting.

Required pilot pressure at port G₂:
\[ p_{St} \geq 100 \text{ bar} \]

Please state the 2nd pressure setting in plain text when ordering.

---

**EP.G**
Pressure control, remote control

Sizes 250 to 1000
When the set pressure value is reached, the remote control pressure control continually regulates the motor to maximum displacement \( V_g \text{ max} \). A pressure-relief valve (not included in the delivery contents), which is located separately from the motor and which is connected to port X₃, assumes the task of controlling the internal pressure cut-off valve.

So long as the target pressure value has not been reached, pressure is evenly applied to the valve from both sides in addition to the force of the spring, and the valve remains closed. The target pressure value is between 80 bar and 350 bar. When the target pressure value is reached at the separate pressure-relief valve, this will open, reliving the pressure on the spring side to the reservoir. The internal control valve switches and the motor swivels to maximum displacement \( V_g \text{ max} \).

The differential pressure at the control valve is set as standard to 25 bar. As a separate pressure-relief valve, we recommend:

| DBD 6 (hydraulic) as per RE 25402 |

The maximum line length should not exceed 2 m.

**Schematic EP.G**

Proportional pressure-reducing valve DRE 4K (see RE 29181)
HZ – Two-point control hydraulic

The two-point hydraulic control allows the displacement to be set to either $V_{g\ min}$ or $V_{g\ max}$ by switching the pilot pressure at port X on or off.

- Position at $V_{g\ max}$ (without pilot pressure, maximum torque, minimum speed)
- Position at $V_{g\ min}$ (with pilot pressure > 10 bar activated, minimum torque, maximum permissible speed)

**Characteristic HZ**

<table>
<thead>
<tr>
<th>$V_{g\ min}$</th>
<th>Displacement</th>
<th>$V_{g\ max}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**

- Maximum permissible pilot pressure: 100 bar
- The control oil is internally taken out of the high-pressure side of the motor (A or B). For reliable control, an operating pressure of at least 30 bar is required in A (B). If a control operation is performed at an operating pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port G via an external check valve. For lower pressures, please contact us. Please note that pressures up to 450 bar can occur at port G.
- A leakage flow of maximum 0.3 L/min is present at port X (operating pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure is to be relieved from port X to the reservoir.

**Schematic HZ1**

Sizes 28, 140, 160, 200

**Schematic HZ3**

Sizes 55 to 107

**Schematic HZ**

Sizes 250 to 1000
EZ – Two-point control electric

The two-point electric control with switching solenoid (sizes 28 to 200) or control valve (sizes 250 to 1000) allows the displacement to be set to either $V_g_{\text{min}}$ or $V_g_{\text{max}}$ by switching the electric current at the switching solenoid or control valve on or off.

**Note**

The control oil is internally taken out of the high-pressure side of the motor (A or B). For reliable control, an operating pressure of at least 30 bar is required in A (B). If a control operation is performed at an operating pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port G via an external check valve. For lower pressures, please contact us. Please note that pressures up to 450 bar can occur at port G.

**Technical data, solenoid with Ø37**

Sizes 28, 140, 160, 200

<table>
<thead>
<tr>
<th></th>
<th>EZ1</th>
<th>EZ2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{max}}$</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{min}}$</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
<td>21.7 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection</td>
<td>see connector design page 70</td>
<td></td>
</tr>
</tbody>
</table>

**Technical data, solenoid with Ø45**

Sizes 55 to 107

<table>
<thead>
<tr>
<th></th>
<th>EZ3</th>
<th>EZ4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{max}}$</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{min}}$</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>4.8 Ω</td>
<td>19.2 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>30 W</td>
<td>30W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.5 A</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection</td>
<td>see connector design page 70</td>
<td></td>
</tr>
</tbody>
</table>

**Technical data, control valve**

Sizes 250 to 1000

<table>
<thead>
<tr>
<th></th>
<th>EZ1</th>
<th>EZ2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{max}}$</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{min}}$</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>6 Ω</td>
<td>23 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26 W</td>
<td>26W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>2 A</td>
<td>1.04 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection</td>
<td>see connector design page 70</td>
<td></td>
</tr>
</tbody>
</table>
EZ – Two-point control electric

Schematic EZ1, EZ2
Sizes 250 to 1000
HA – Automatic control high-pressure related

The automatic high-pressure related control adjusts the displacement automatically depending on the operating pressure.

The displacement of the A6VM motor with HA control is $V_{g\ min}$ (maximum speed and minimum torque). The control unit measures internally the operating pressure at A or B (no control line required) and upon reaching the beginning of control, the controller swivels the motor from $V_{g\ min}$ to $V_{g\ max}$ with increase of pressure. The displacement is modulated between $V_{g\ min}$ and $V_{g\ max}$, thereby depending on load conditions.

- Beginning of control at $V_{g\ min}$ (minimum torque, maximum speed)
- End of control at $V_{g\ max}$ (maximum torque, minimum speed)

Note
- For safety reasons, winch drives are not permissible with beginning of control at $V_{g\ min}$ (standard for HA).
- The control oil is internally taken out of the high-pressure side of the motor (A or B). For reliable control, an operating pressure of at least 30 bar is required in A (B). If a control operation is performed at an operating pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port G via an external check valve. For lower pressures, please contact us.

Please note that pressures up to 450 bar can occur at port G.

- The beginning of control and the HA characteristic are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 7) and thus a parallel shift of the characteristic. Only for HA1T (sizes 28 to 200) and HA1, HA2, HA.T, (sizes 250 to 1000).

- A leakage flow of maximum 0.3 L/min is present at port X (operating pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure is to be relieved from port X to the reservoir. Only for control HA.T.
HA – Automatic control high-pressure related

HA1
With minimum pressure increase

An operating pressure increase of $\Delta p \leq$ approx. 10 bar results in an increase in displacement from $0 \text{ cm}^3$ to $V_{g\text{ max}}$ (sizes 28 to 200) or from $0.2 \ V_{g\text{ max}}$ to $V_{g\text{ max}}$ (sizes 250 to 1000).

Beginning of control, setting range
Sizes 28 to 200 ___________________________ 80 to 350 bar
Sizes 250 to 1000 _________________________ 80 to 340 bar

Please state the desired beginning of control in plain text when ordering, e. g.: beginning of control at 300 bar.

Characteristic HA1

<table>
<thead>
<tr>
<th>Operating pressure $p$[bar]</th>
<th>$V_{g\text{ min}}$</th>
<th>$V_{g}/V_{g\text{ min}}$</th>
<th>$V_{g\text{ max}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>0.8</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Schematic HA1
Sizes 28 to 200

Schematic HA1
Sizes 250 to 1000
**HA – Automatic high-pressure related control**

**HA2**

**With pressure increase**

An operating pressure increase of $\Delta p = \text{approx. } 100 \text{ bar}$ results in an increase in displacement from $0 \text{ cm}^3$ to $V_{g_{\text{max}}}$ (sizes 28 to 200) or from $0.2 V_{g_{\text{max}}}$ to $V_{g_{\text{max}}}$ (sizes 250 to 1000).

**Beginning of control, setting range**

Sizes 28 to 200 ___________________________ 80 to 350 bar  
Sizes 250 to 1000 _________________________ 80 to 250 bar

Please state the desired beginning of control in plain text when ordering, e.g.: beginning of control at 200 bar.

**Characteristic HA2**

![Characteristic HA2 graph](image)

**Schematic HA2**

Sizes 28 to 200

![Schematic HA2 sizes 28 to 200](image)

Sizes 250 to 1000

![Schematic HA2 sizes 250 to 1000](image)
HA – Automatic control high-pressure related

HA.T
Override hydraulic remote control, proportional

With the HA.T3 control, the beginning of control can be influenced by applying a pilot pressure to port X.

For each 1 bar of pilot pressure increase, the beginning of control is reduced by 17 bar (sizes 28 to 200) or 8 bar (sizes 250 to 1000).

Example (sizes 28 to 200):

<table>
<thead>
<tr>
<th>Beginning of control setting</th>
<th>300 bar</th>
<th>300 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot pressure at port X</td>
<td>0 bar</td>
<td>10 bar</td>
</tr>
<tr>
<td>Beginning of control at</td>
<td>300 bar</td>
<td>130 bar</td>
</tr>
</tbody>
</table>

Note
Maximum permissible pilot pressure 100 bar.

Schematic HA1.T
Sizes 250 to 1000

Schematic HA2.T
Sizes 28 to 200
HA – Automatic control high-pressure related

HA.U1, HA.U2
Override electric two-point

Sizes 28 to 200

With the HA.U1 or HA.U2 control, the beginning of control can be overridden by an electric signal to a switching solenoid. When the override solenoid is energized, the variable motor swivels to maximum swivel angle, without intermediate position. The beginning of control is adjustable between 80 and 300 bar (specify required setting in plain text when ordering).

Technical data, solenoid with Ø45

<table>
<thead>
<tr>
<th></th>
<th>U1</th>
<th>U2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>No override</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Displacement Vg max</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>4.8 Ω</td>
<td>19.2 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>30 W</td>
<td>30 W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.5 A</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection</td>
<td>see connector design page 70</td>
<td></td>
</tr>
</tbody>
</table>

Schematic HA1U1, HA1U2

Schematic HA2U1, HA2U2
HA – Automatic control high-pressure related

HA.R1, HA.R2
Override electric,
travel direction valve electric (see page 29)

Sizes 28 to 200

With the HA.R1 or HA.R2 control, the beginning of control can be overridden by an electric signal to switching solenoid b.
When the override solenoid b is energized, the variable motor swivels to maximum swivel angle, without intermediate position.

The travel direction valve ensures that the preselected pressure side of the hydraulic motor (A or B) is always connected to the HA control, and thus determines the swivel angle, even if the high-pressure side changes (e. g. -travel drive during a downhill operation). This thereby prevents undesired jerky deceleration and/or braking characteristics.

Depending on the direction of rotation (direction of travel), the travel direction valve is actuated through the pressure spring or the switching solenoid a (see page 29 for further details).

Technical data, solenoid a with Ø37
(travel direction valve)

<table>
<thead>
<tr>
<th></th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>No override</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Operating pressure in ccw</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>energized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>de-energized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>de-energized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>de-energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
<td>21.7 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26.2 W</td>
<td>26.6 W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection see connector design page 70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Technical data, solenoid b with Ø45
(electric override)

<table>
<thead>
<tr>
<th></th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>No override</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Displacement V_{g max}</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>4.8 Ω</td>
<td>19.2 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>30 W</td>
<td>30 W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.5 A</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection see connector design page 70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DA – Automatic control speed-related

The variable motor A6VM with automatic speed-related control is intended for use in hydrostatic travel drives in combination with the variable pump A4VG with DA control.

A drive-speed-related pilot pressure signal is generated by the A4VG variable pump, and that signal, together with the operating pressure, regulates the swivel angle of the hydraulic motor. Increasing pump speed, i.e. increasing pilot pressure, causes the motor to swivel to a smaller displacement (lower torque, higher speed), depending on the operating pressure.

If the operating pressure exceeds the pressure setpoint set on the controller, the variable motor swivels to a larger displacement (higher torque, lower speed).

Pressure ratio \(p_{St}/p_{HD}\): 3/100, 5/100, 8/100

DA closed loop control is only suitable for certain types of drive systems and requires review of the engine and vehicle parameters to ensure that the motor is used correctly and that machine operation is safe and efficient. We recommend that all DA applications be reviewed by a Bosch Rexroth application engineer.

Detailed information is available from our sales department and on the Internet at www.boschrexroth.com/da-control.

Note

The beginning of control and the DA characteristic are influenced by case pressure. An increase in case pressure causes a decrease in the beginning of control (see page 6) and thus a parallel shift of the characteristic.

DA, DA1, DA4
Hydraulic travel direction valve

Dependent on the direction of rotation (travel direction), the travel direction valve is switched by using pilot pressures connections \(X_1\) or \(X_2\).

<table>
<thead>
<tr>
<th>Direction of rotation</th>
<th>Operating pressure in</th>
<th>Pilot pressure in</th>
</tr>
</thead>
<tbody>
<tr>
<td>cw</td>
<td>A</td>
<td>(X_1)</td>
</tr>
<tr>
<td>ccw</td>
<td>B</td>
<td>(X_2)</td>
</tr>
</tbody>
</table>

Schematic DA1, DA4
Sizes 28 to 200

Schematic DA
Sizes 250 to 1000
DA – Automatic control speed-related

**DA2, DA3, DA5, DA6**

*Electric travel direction valve + electric $V_g_{\text{max}}$-circuit*

The travel direction valve is either spring offset or switched by energizing switching solenoid a, depending on the direction of rotation (travel direction).

When the switching solenoid b is energized, the DA control is overridden and the motor swivels to maximum displacement (high torque, lower speed) (electric $V_g_{\text{max}}$-circuit).

**Technical data, solenoid a with Ø37**

(Travel direction valve)

<table>
<thead>
<tr>
<th></th>
<th>DA2, DA5</th>
<th>DA3, DA6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td><strong>Direction of rotation</strong></td>
<td><strong>Operating pressure in</strong></td>
<td></td>
</tr>
<tr>
<td>ccw B</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>cw A</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
<td>217 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Type of protection see connector design page 70

**Technical data, solenoid b with Ø37**

(Electric override)

<table>
<thead>
<tr>
<th></th>
<th>DA2, DA5</th>
<th>DA3, DA6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>No override</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Displacement $V_g_{\text{max}}$</td>
<td>energized</td>
<td>energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
<td>217 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td>Minimum required current</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Type of protection see connector design page 70
Electric travel direction valve (for DA, HA.R)

Application in travel drives in closed circuits. The travel direction valve of the motor is actuated by an electric signal that also switches the swivel direction of the travel drive pump (e.g. A4VG with DA control valve).

If the pump in the closed circuit is switched to the neutral position or into reverse, the vehicle may experience jerky deceleration or braking, depending on the vehicle’s mass and current travel speed.

When the travel direction valve of the pump (e.g. 4/3-directional valve of the DA-control) is switched to

- the neutral position,
  the electric circuitry causes the previous signal on the travel direction valve on the motor to be retained.

- reversing,
  the electric circuitry causes the travel direction valve on the motor to switch to the other travel direction following a time delay (approx. 0.8 s) with respect to the pump.

As a result, jerky deceleration or braking is prevented in both cases.

Schematic – electric travel direction valve

Note
The shown diodes and relays are not included in the delivery of the motor.
Dimensions size 28

EP1, EP2 – Proportional control electric
Port plate 02 – SAE flange ports A and B at side, opposite

Drive shafts

<table>
<thead>
<tr>
<th>A</th>
<th>Splined shaft DIN 5480 W30x2x14x9g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>Splined shaft DIN 5480 W25x1.25x18x9g</td>
</tr>
</tbody>
</table>

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
### Dimensions size 28

**Location of the service line ports on the port plates (view Z)**

02 SAE flange ports A and B at side, opposite

01 SAE flange ports A and B at rear

---

**Ports**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size(^1))</th>
<th>Maximum pressure [bar](^2))</th>
<th>State(^6))</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line Fastening thread A/B</td>
<td>SAE J518(^3)) DIN 13</td>
<td>3/4 in M10 x 1.5; 17 deep</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td>T₁</td>
<td>Drain line</td>
<td>DIN 3852(^5))</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>X(^4))</td>
</tr>
<tr>
<td>T₂</td>
<td>Drain line</td>
<td>DIN 3852(^5))</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>O(^4))</td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
<tr>
<td>G₂</td>
<td>2nd pressure setting (HD,E, EP,E)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>X</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852(^5))</td>
<td>M16 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X₁, X₂</td>
<td>Pilot signal (DA1, DA4)</td>
<td>DIN 2353-CL BB-ST</td>
<td></td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X₁</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X₃</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>M₁</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

---

1) Observe the general instructions on page 80 for the maximum tightening torques.

2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 79).

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)
Dimensions size 28

**EP.D**
Proportional control electric, with pressure control fixed setting

**EP.E**
Proportional control electric, with pressure control hydraulic override, two-point

**HD1, HD2**
Proportional control hydraulic

**HD.D**
Proportional control hydraulic, with pressure control fixed setting

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 28

**EZ1, EZ2**
Two-point control electric

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**HA1R1, HA2R2**
Automatic control high-pressure related, with override electric and travel direction valve electric

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric V_g_max-circuit

X_1, X_2 pipe fitting 8B-ST according to DIN 2353-CL
Use installed fittings!

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 55

EP1, EP2 – Proportional control electric
Port plate 02 – SAE flange ports A and B at side, opposite

Drive shafts

A  Splined shaft DIN 5480
   W35x2x16x9g

Z  Splined shaft DIN 5480
   W30x2x14x9g

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
**Dimensions size 55**

**Location of the service line ports on the port plates (view Z)**

<table>
<thead>
<tr>
<th>Port designation</th>
<th>Port for description</th>
<th>Standard</th>
<th>Size</th>
<th>Maximum pressure [bar]</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J518</td>
<td>3/4 in</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>Fastening thread A/B</td>
<td>DIN 13</td>
<td>M10 x 1.5; 17 deep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Drain line</td>
<td>DIN 3852</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>T2</td>
<td>Drain line</td>
<td>DIN 3852</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>O</td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
<tr>
<td>G2</td>
<td>2nd pressure setting (HD, EP)</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>X</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X1, X2</td>
<td>Pilot signal (DA1, DA4)</td>
<td>DIN 2353-CL</td>
<td>8B-ST</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X1</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X3</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>M1</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

1. Observe the general instructions on page 80 for the maximum tightening torques.
2. Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3. Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4. Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 79).
5. The spot face can be deeper than specified in the appropriate standard.
6. O = Must be connected (plugged on delivery)
   X = Plugged (in normal operation)
Dimensions size 55

**EP.D**
Proportional control electric, with pressure control fixed setting

**HD1, HD2**
Proportional control hydraulic

**HD.D**
Proportional control hydraulic, with pressure control fixed setting

**EP.E**
Proportional control electric, with pressure control hydraulic override, two-point

**HD.E**
Proportional control hydraulic, with pressure control hydraulic override, two-point

**HZ3**
Two-point control hydraulic

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 55

**EZ3, EZ4**
Two-point control electric

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**HA1R1, HA2R2**
Automatic control high-pressure related, with override electric and travel direction valve electric

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric $V_{\text{max}}$-circuit

---

1) Port plate 1 – SAE flange ports A and B at rear

X₁, X₂ pipe fitting 8B-ST according to DIN 2353-CL
Use installed fittings!
Dimensions size 80

EP1, EP2 – Proportional control electric
Port plate 02 – SAE flange ports A and B at side, opposite

Drive shafts
A  Splined shaft DIN 5480
   W40x2x18x9g

Z  Splined shaft DIN 5480
   W35x2x16x9g

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
## Dimensions size 80

### Location of the service line ports on the port plates (view Z)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size</th>
<th>Maximum pressure [bar]</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J518</td>
<td>1 in</td>
<td>1) 450 o</td>
<td>o</td>
</tr>
<tr>
<td></td>
<td>Fastening thread A/B</td>
<td>DIN 13</td>
<td>M12</td>
<td>2) 1.75; 17 deep</td>
<td></td>
</tr>
<tr>
<td>T₁</td>
<td>Drain line</td>
<td>DIN 3852</td>
<td>M18</td>
<td>3) 1.5; 12 deep</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T₂</td>
<td>Drain line</td>
<td>DIN 3852</td>
<td>M18</td>
<td>3) 1.5; 12 deep</td>
<td>o</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852</td>
<td>M18</td>
<td>4) 1.5; 12 deep</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G₂</td>
<td>2nd pressure setting (HD, E, EP)</td>
<td>DIN 3852</td>
<td>M14</td>
<td>5) 1.5; 12 deep</td>
<td>x</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852</td>
<td>M18</td>
<td>6) 1.5; 12 deep</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852</td>
<td>M14</td>
<td>6) 1.5; 12 deep</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₁, X₂</td>
<td>Pilot signal (DA1, DA4)</td>
<td>DIN 2353-CL</td>
<td>8B-ST</td>
<td>7) 40 o</td>
<td>o</td>
</tr>
<tr>
<td>X₃</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852</td>
<td>M14</td>
<td>8) 1.5; 12 deep</td>
<td>o</td>
</tr>
<tr>
<td>M₁</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852</td>
<td>M14</td>
<td>9) 1.5; 12 deep</td>
<td>x</td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
    X = Plugged (in normal operation)
Dimensions size 80

**EP.D**
Proportional control electric, with pressure control fixed setting

**HD1, HD2**
Proportional control hydraulic

**HD.D**
Proportional control hydraulic, with pressure control fixed setting

**HD.E**
Proportional control hydraulic, with pressure control hydraulic override, two-point

**HZ3**
Two-point control hydraulic

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 80

**EZ3, EZ4**
Two-point control electric

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**HA1R1, HA2R2**
Automatic control high-pressure related, with override electric and travel direction valve electric

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric $V_{g\text{max}}$-circuit

---

1) Port plate 1 – SAE flange ports A and B at rear

HA1 and HA2, X plugged
HA1T and HA2T, X open

---

$X_1$, $X_2$ pipe fitting 8B-ST according to DIN 2353-CL
Use installed fittings!
Dimensions size 107

EP1, EP2 – Proportional control electric
Port plate 02 – SAE-SAE flange ports A and B at side, opposite

Drive shafts

A  Splined shaft DIN 5480
   W45x2x21x9g

Z  Splined shaft DIN 5480
   W40x2x18x9g

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
Dimensions size 107

Location of the service line ports on the port plates (view Z)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size</th>
<th>Maximum pressure [bar]</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J518(1)</td>
<td>1 in</td>
<td>450</td>
<td>O(6)</td>
</tr>
<tr>
<td>T_1</td>
<td>Drain line</td>
<td>DIN 3852(3)</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>X(4)</td>
</tr>
<tr>
<td>T_2</td>
<td>Drain line</td>
<td>DIN 3852(3)</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>O(4)</td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
<tr>
<td>G_2</td>
<td>2nd pressure setting (HD,E, EP.E)</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>X</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852(3)</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td>X_1, X_2</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X_3</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X_4</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>M_1</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852(3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)
Dimensions size 107

EP.D
Proportional control electric, with pressure control fixed setting

HD1, HD2
Proportional control hydraulic

HD.D
Proportional control hydraulic, with pressure control fixed setting

HD.E
Proportional control hydraulic, with pressure control hydraulic override, two-point

HZ3
Two-point control hydraulic

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 107

**EZ3, EZ4**
Two-point control electric

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**HA1R1, HA2R2**
Automatic control high-pressure related, with override electric and travel direction valve electric

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric $V_{g \text{max}}$-circuit

1) Port plate 1 – SAE flange ports A and B at rear

X1, X2 pipe fitting 8B-ST according to DIN 2353-CL
Use installed fittings!
Dimensions size 140

EP1, EP2 – Proportional control electric
Port plate 02 – SAE flange ports A and B at side, opposite

1) To shaft collar
2) Center of gravity
3) Port plate 1 – SAE flange ports A and B at rear

Drive shaft

Z Splined shaft DIN 5480
W45x2x21x9g

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
Dimensions size 140

Location of the service line ports on the port plates (view Z)

02 SAE flange ports
A and B at side, opposite

01 SAE flange ports
A and B at rear

Ports

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size(^1)</th>
<th>Maximum pressure [bar](^2)</th>
<th>State(^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J518(^3)</td>
<td>1 1/4 in M14 x 2; 19 deep</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>Fastening thread A/B</td>
<td>DIN 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T(_1)</td>
<td>Drain line</td>
<td>DIN 3852(^5)</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>X(^4)</td>
</tr>
<tr>
<td>T(_2)</td>
<td>Drain line</td>
<td>DIN 3852(^5)</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>O(^5)</td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
<tr>
<td>G(_2)</td>
<td>2nd pressure setting (HD,E, EP,E)</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>X</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852(^5)</td>
<td>M22 x 1.5; 14 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X(_1), X(_2)</td>
<td>Pilot signal (DA1, DA4)</td>
<td>DIN 2353-CL BB-ST</td>
<td>40</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>X(_1)</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X(_3)</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>M(_1)</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852(^5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T\(_1\) or T\(_2\) must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
    X = Plugged (in normal operation)
Dimensions size 140

**EP.D**
Proportional control electric, with pressure control fixed setting

**HD1, HD2**
Proportional control hydraulic

**EP.E**
Proportional control electric, with pressure control hydraulic override, two-point

**HD.D**
Proportional control hydraulic, with pressure control fixed setting

**HD.E**
Proportional control hydraulic, with pressure control hydraulic override, two-point

**HZ1**
Two-point control hydraulic

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 140

**EZ1, EZ2**
Two-point control electric

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**HA1R1, HA2R2**
Automatic control high-pressure related, with override electric and travel direction valve electric

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric $V_{\text{max}}$-circuit

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 160

EP1, EP2 – Proportional control electric
Port plate 02 – SAE-SAE flange ports A and B at side, opposite

Drive shafts

A  Splined shaft DIN 5480
W50x2x24x9g

Z  Splined shaft DIN 5480
W45x2x21x9g

Observe the general instructions on page 80 for the maximum tightening torques.

Center bore according to DIN 332 (thread according to DIN 13)
Dimensions size 160

Location of the service line ports on the port plates (view Z)

02 SAE flange ports A and B at side, opposite

01 SAE flange ports A and B at rear

Ports

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size(^1)</th>
<th>Maximum pressure [bar](^2)</th>
<th>State(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line Fastening thread A/B</td>
<td>SAE J518(^3)</td>
<td>1 1/4 in M14 x 2; 19 deep</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td>T(_1)</td>
<td>Drain line</td>
<td>DIN 3852(^3)</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>X(^4)</td>
</tr>
<tr>
<td>T(_2)</td>
<td>Drain line</td>
<td>DIN 3852(^3)</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>O(^4)</td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
<tr>
<td>G(_2)</td>
<td>2nd pressure setting (HD,E, EP,E)</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>X</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852(^3)</td>
<td>M22 x 1.5; 14 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td>X(_1), X(_2)</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X(_3)</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>X(_4)</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>M(_1)</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852(^3)</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T\(_1\) or T\(_2\) must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)
Dimensions size 160

**EP.D**
Proportional control electric, with pressure control fixed setting

**EP.E**
Proportional control electric, with pressure control hydraulic override, two-point

**HD1, HD2**
Proportional control hydraulic

**HD.D**
Proportional control hydraulic, with pressure control fixed setting

**HD.E**
Proportional control hydraulic, with pressure control hydraulic override, two-point

**HZ1**
Two-point control hydraulic

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
**Dimensions size 160**

**EZ1, EZ2**
Two-point control electric

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric $V_{g,max}$-circuit

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

X₁, X₂ pipe fitting 8B-ST according to DIN 2353-CL
Use installed fittings!
Dimensions size 200

EP1, EP2 – Proportional control electric
Port plate 02 – SAE-SAE flange ports A and B at side, opposite

Drive shaft
A  Splined shaft DIN 5480
   W50x2x24x9g

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
### Dimensions size 200

Location of the service line ports on the port plates (view Z)

**Ports**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size(^1))</th>
<th>Maximum pressure [bar](^2))</th>
<th>State(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line Fastening thread A/B</td>
<td>SAE J518(^3)) DIN 13</td>
<td>1 1/4 in M14 x 2; 19 deep</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td>T(_1)</td>
<td>Drain line</td>
<td>DIN 3852(^5))</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>X(^4))</td>
</tr>
<tr>
<td>T(_2)</td>
<td>Drain line</td>
<td>DIN 3852(^5))</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>O(^4))</td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
<tr>
<td>G(_2)</td>
<td>2nd pressure setting (HD, E, EP, E)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>X</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852(^5))</td>
<td>M22 x 1.5; 14 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td>X, X(_2)</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X(_1)</td>
<td>Pilot signal (DA1, DA4)</td>
<td>DIN 2353-CL BB-ST</td>
<td>40</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>X(_3)</td>
<td>Pilot signal (DA2, DA3, DA5, DA6)</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>O</td>
</tr>
<tr>
<td>M(_1)</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852(^5))</td>
<td>M14 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T\(_1\) or T\(_2\) must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)  
   X = Plugged (in normal operation)

---

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 200

**EP.D**
Proportional control electric, with pressure control fixed setting

**HD1, HD2**
Proportional control hydraulic

**HD.D**
Proportional control hydraulic, with pressure control fixed setting

**HD.E**
Proportional control hydraulic, with pressure control hydraulic override, two-point

**HZ1**
Two-point control hydraulic
Dimensions size 200

**EZ1, EZ2**
Two-point control electric

**HA1U1, HA2U2**
Automatic control high-pressure related, with override electric, two-point

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**DA1, DA4**
Automatic control speed related, with hydraulic travel direction valve

**DA2, DA3, DA5, DA6**
Automatic control speed related, with electric travel direction valve and electric $V_{\text{max}}$-circuit

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

$X_1, X_2$ pipe fitting 8B-ST according to DIN 2353-CL
Use installed fittings!
Dimensions size 250

HD1, HD2 – Proportional control hydraulic
HZ – Two-point control hydraulic
Port plate 02 – SAE flange ports A and B at side, opposite

Drive shafts
Z  Splined shaft DIN 5480
   W50x2x24x9g

P  Cyl. shaft with key
   AS14x9x80
   (DIN 6885)

Service line port (detail Y)

1) Port plate 01/15 – SAE flange ports A and B at rear

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
Dimensions size 250

Location of the service line ports on the port plates (view Z)

02 SAE flange ports
A and B at side, opposite

01 SAE flange ports
A and B at rear

15 SAE flange port
A and B at side, opposite, A₁ and B₁ at rear

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A, B</td>
<td>Service line Fastening thread A/B</td>
<td>SAE J518³)</td>
<td>1 1/4 in</td>
<td>M14 x 2; 19 deep</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>A₁, B₁</td>
<td>Additional service line for plate 15 Fastening thread A₁/B₁</td>
<td>SAE J518³)</td>
<td>1 1/4 in</td>
<td>M14 x 2; 19 deep</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>T₁</td>
<td>Drain line</td>
<td>DIN 3852⁵)</td>
<td>M22 x 1.5; 14 deep</td>
<td>3</td>
<td>X⁴)</td>
</tr>
<tr>
<td></td>
<td>T₂</td>
<td>Drain line</td>
<td>DIN 3852⁵)</td>
<td>M22 x 1.5; 14 deep</td>
<td>3</td>
<td>O⁴)</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>G₂</td>
<td>2nd pressure setting (HD.D, EP.D)</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>Pilot oil supply (EP)</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>X₁, X₂</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X₃</td>
<td>Remote control valve (HD.G, EP.G)</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Measuring striking chamber</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Mₐ, Mₐ</td>
<td>Measuring pressure A/B</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Mₘₐ</td>
<td>Measuring pilot pressure</td>
<td>DIN 3852⁵)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
</tbody>
</table>

¹) Observe the general instructions on page 80 for the maximum tightening torques.
²) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
³) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
⁴) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 79).
⁵) The spot face can be deeper than specified in the appropriate standard.
⁶) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
Dimensions size 250

**EP1, EP2**
Proportional control electric

**HD.D, HD.G**
Proportional control hydraulic,
with pressure control fixed setting; remote control (EP.G)

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related,
with override hydraulic remote control, proportional

**EP.D, EP.G**
Proportional control electric,
with pressure control fixed setting; remote control (EP.G)

**EZ1, EZ2**
Two-point control electric

**DA**
Automatic control speed related,
with hydraulic travel direction valve

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
**Dimensions size 355**

**HD1, HD2 – Proportional control hydraulic**

**HZ – Two-point control hydraulic**

Port plate 02 – SAE flange ports A and B at side, opposite

---

**Drive shafts**

<table>
<thead>
<tr>
<th>Z</th>
<th>Splined shaft DIN 5480 W60x2x28x9g</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Cyl. shaft with key AS18x11x100 (DIN 6885)</td>
</tr>
</tbody>
</table>

**Service line port (detail Y)**

---

1) Port plate 01/15 – SAE flange ports A and B at rear

1) Observe the general instructions on page 80 for the maximum tightening torques.

2) Center bore according to DIN 332 (thread according to DIN 13)
Dimensions size 355

Location of the service line ports on the port plates (view Z)

<table>
<thead>
<tr>
<th>Ports</th>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size&lt;sup&gt;1)&lt;/sup&gt;</th>
<th>Maximum pressure [bar]&lt;sup&gt;2)&lt;/sup&gt;</th>
<th>State&lt;sup&gt;3)&lt;/sup&gt;</th>
</tr>
</thead>
</table>
| A, B  | Service line | Fastening thread A/B | SAE J518<sup>3)</sup>  
SAE J518<sup>3)</sup>  
DIN 13 | 1 1/2 in  
M16 x 2; 24 deep | 400 | O |
| A<sub>1</sub>, B<sub>1</sub> | Additional service line for plate | Fastening thread A<sub>1</sub>/B<sub>1</sub> | SAE J518<sup>3)</sup>  
DIN 13 | 1 1/2 in  
M16 x 2; 24 deep | 400 | O |
| T<sub>1</sub> | Drain line | DIN 3852<sup>5)</sup>  
M33 x 2; 18 deep | 3 | X<sup>4)</sup> |
| T<sub>2</sub> | Drain line | DIN 3852<sup>5)</sup>  
M33 x 2; 18 deep | 3 | O<sup>4)</sup> |
| G    | Synchronous control | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 400 | X |
| G<sub>2</sub> | 2nd pressure setting (HD.D, EP.D) | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 400 | X |
| P    | Pilot oil supply (EP) | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 100 | O |
| U    | Bearing flushing | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 3 | X |
| X    | Pilot signal (HA1 and HA2) | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 3 | X |
| X<sub>1</sub>, X<sub>2</sub> | Pilot signal (DA) | DIN 2353-CL  
BB-ST | 40 | O |
| X<sub>3</sub> | Remote control valve (HD.G, EP.G) | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 400 | O |
| M    | Measuring stroking chamber | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 400 | X |
| M<sub>A</sub>, M<sub>B</sub> | Measuring pressure A/B | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 400 | X |
| M<sub>LS</sub> | Measuring pilot pressure | DIN 3852<sup>5)</sup>  
M14 x 1.5; 12 deep | 400 | X |

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)  
   X = Plugged (in normal operation)
Dimensions size 355

**EP1, EP2**
Proportional control electric

**HD.D, HD.G**
Proportional control hydraulic, with pressure control fixed setting; remote control (EP.G)

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**EP.D, EP.G**
Proportional control electric, with pressure control fixed setting; remote control (EP.G)

**EZ1, EZ2**
Two-point control electric

**DA**
Automatic control speed related, with hydraulic travel direction valve

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 500

HD1, HD2 – Proportional control hydraulic
HZ – Two-point control hydraulic
Port plate 02 – SAE flange ports A and B at side, opposite

Drive shafts
Z  Spined shaft DIN 5480
   W70x3x22x9g

P  Cyl. shaft with key
   AS20x12x100
   (DIN 6885)

Service line port (detail Y)

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
# Dimensions size 500

**Location of the service line ports on the port plates (view Z)**

<table>
<thead>
<tr>
<th>Port</th>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size</th>
<th>Maximum pressure [bar]</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>SAE flange ports A</td>
<td>Service line A</td>
<td>SAE J518&lt;sup&gt;3)&lt;/sup&gt;</td>
<td>1 1/2 in</td>
<td>M16 x 2; 24 deep</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>B at side, opposite</td>
<td>Fastening thread A/B</td>
<td>DIN 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>SAE flange ports A</td>
<td>Service line A</td>
<td>SAE J518&lt;sup&gt;3)&lt;/sup&gt;</td>
<td>1 1/2 in</td>
<td>M16 x 2; 24 deep</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>B at rear</td>
<td>Fastening thread A/B</td>
<td>DIN 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SAE flange port A</td>
<td>Service line A</td>
<td>SAE J518&lt;sup&gt;3)&lt;/sup&gt;</td>
<td>1 1/2 in</td>
<td>M16 x 2; 24 deep</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>B at side, opposite</td>
<td>Fastening thread A/B</td>
<td>DIN 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A&lt;sub&gt;1&lt;/sub&gt; and B&lt;sub&gt;1&lt;/sub&gt; at rear</td>
<td>Additional service line for plate 15</td>
<td>SAE J518&lt;sup&gt;3)&lt;/sup&gt;</td>
<td>1 1/2 in</td>
<td>M16 x 2; 24 deep</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Fastening thread A&lt;sub&gt;1&lt;/sub&gt;/B&lt;sub&gt;1&lt;/sub&gt;</td>
<td>DIN 13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>Drain line</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M33 x 2; 18 deep</td>
<td>3</td>
<td>X&lt;sup&gt;4)&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M18 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>G&lt;sub&gt;2&lt;/sub&gt;</td>
<td>2nd pressure setting</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M18 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(HD.D, EP.D)</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>Pilot oil supply (EP)</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M18 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M14 x 1.5; 12 deep</td>
<td>100</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>X&lt;sub&gt;1&lt;/sub&gt;, X&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Pilot signal (DA)</td>
<td>DIN 2353-CL 8B-ST</td>
<td>M14 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X&lt;sub&gt;3&lt;/sub&gt;</td>
<td>Remote control valve (HD.G, EP.G)</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>M&lt;sub&gt;A&lt;/sub&gt;, M&lt;sub&gt;B&lt;/sub&gt;</td>
<td>Measuring pressure A/B</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>M&lt;sub&gt;St&lt;/sub&gt;</td>
<td>Measuring pilot pressure</td>
<td>DIN 3852&lt;sup&gt;5)&lt;/sup&gt;</td>
<td>M14 x 1.5; 12 deep</td>
<td>400</td>
<td>X</td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
Dimensions size 500

**EP1, EP2**
Proportional control electric

**HD.D, HD.G**
Proportional control hydraulic, with pressure control fixed setting; remote control (EP.G)

**EP.D, EP.G**
Proportional control electric, with pressure control fixed setting; remote control (EP.G)

**EZ1, EZ2**
Two-point control electric

**HA1, HA2 / HA1T, HA2T**
Automatic control high-pressure related, with override hydraulic remote control, proportional

**DA**
Automatic control speed related, with hydraulic travel direction valve

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Dimensions size 1000

HD1, HD2 – Proportional control hydraulic
HZ – Two-point control hydraulic
Port plate 02 – SAE-SEAE flange ports A and B at side, opposite

Drive shafts
A Splined shaft DIN 5480 W90x3x28x9g

Service line port (detail Y)

1) Port plate 01/15 – SAE flange ports A and B at rear

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Center bore according to DIN 332 (thread according to DIN 13)
Dimensions size 1000

Location of the service line ports on the port plates (view Z)

<table>
<thead>
<tr>
<th>Port Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size 1)</th>
<th>Maximum pressure [bar] 2)</th>
<th>State 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J518 3) DIN 13</td>
<td>2 in M20 x 2.5; 24 deep</td>
<td>400 O</td>
<td></td>
</tr>
<tr>
<td>A1, B1</td>
<td>Additional service line for plate 15</td>
<td>SAE J518 3) DIN 13</td>
<td>2 in M20 x 2.5; 24 deep</td>
<td>400 O</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Drain line</td>
<td>DIN 3852 5)</td>
<td>M42 x 2; 20 deep</td>
<td>3 X 4)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Drain line</td>
<td>DIN 3852 5)</td>
<td>M42 x 2; 20 deep</td>
<td>3 O 4)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Synchronous control</td>
<td>DIN 3852 5)</td>
<td>M18 x 1.5; 12 deep</td>
<td>400 X</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>2nd pressure setting (HD.D, EP.D)</td>
<td>DIN 3852 5)</td>
<td>M18 x 1.5; 12 deep</td>
<td>400 X</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Pilot oil supply (EP)</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100 O</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852 5)</td>
<td>M18 x 1.5; 12 deep</td>
<td>3 X</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HD, HZ, HA1T/HA2T)</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>100 O</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Pilot signal (HA1 and HA2)</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>3 X</td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>Remote control valve (HD.G, EP.G)</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400 O</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Measuring stroking chamber</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400 X</td>
<td></td>
</tr>
<tr>
<td>MA, MB</td>
<td>Measuring pressure A/B</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400 X</td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>Measuring pilot pressure</td>
<td>DIN 3852 5)</td>
<td>M14 x 1.5; 12 deep</td>
<td>400 X</td>
<td></td>
</tr>
</tbody>
</table>

1) Observe the general instructions on page 80 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
4) Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 79).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
   X = Plugged (in normal operation)
Dimensions size 1000

EP1, EP2
Proportional control electric

HD.D, HD.G
Proportional control hydraulic,
with pressure control fixed setting; remote control (EP.G)

HA1, HA2 / HA1T, HA2T
Automatic control high-pressure related,
with override hydraulic remote control, proportional

EP.D, EP.G
Proportional control electric,
with pressure control fixed setting; remote control (EP.G)

EZ1, EZ2
Two-point control electric

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
**Connector for solenoids**

**DEUTSCH DT04-2P-EP04**

**Sizes 28 to 200**

Molded, 2-pin, without bidirectional suppressor diode

There is the following type of protection with mounted mating connector:

- **IP67** ___________________________ DIN/EN 60529
- **IP69K** ___________________________ DIN 40050-9

**Circuit symbol**

![Circuit symbol](image)

**Mating connector**

**DEUTSCH DT06-2S-EP04**

Bosch Rexroth Mat. No. R902601804

Consisting of:

- 1 housing ___________________________ DT06-2S-EP04
- 1 wedge ___________________________ W2S
- 2 sockets ___________________________ 0462-201-16141

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.

**HIRSCHMANN DIN EN 175 301-803-A/ISO 4400**

**Sizes 250 to 1000**

Without bidirectional suppressor diode

There is the following type of protection with mounted mating connector:

- **IP65** ___________________________ DIN/EN 60529

The seal ring in the cable fitting is suitable for line diameters of 4.5 mm to 10 mm.

The HIRSCHMANN connector is included in the delivery contents of the motor.

**Changing connector orientation**

If necessary, you can change the connector orientation by turning the solenoid housing.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
3. Retighten the mounting nut. Tightening torque: 5+1 Nm. (WAF26, 12-sided DIN 3124)

On delivery, the connector orientation may differ from that shown in the brochure or drawing.
Flushing and boost pressure valve

The flushing and boost pressure valve is used to remove heat from the hydraulic circuit.

In an open circuit, it is used only for flushing the housing.

In a closed circuit, it ensures a minimum boost pressure level in addition to the case flushing.

Hydraulic fluid is directed from the respective low pressure side into the motor housing. This is then fed into the reservoir, together with the case drain fluid. The hydraulic fluid, removed out of the closed circuit must be replaced by cooled hydraulic fluid from the boost pump.

The valve is mounted onto the port plate or integrated (depending on the control type and size).

**Cracking pressure of pressure retaining valve**
(observe when setting the primary valve)

fixed setting ________________________________ 16 bar

**Switching pressure of flushing piston** \( \Delta p \) ________________ 8±1 bar

**Flushing flow** \( q_v \)

Orifices can be used to set the flushing flows as required.

Following parameters are based on:
\( \Delta p_{ND} = p_{ND} - p_G = 25 \text{ bar} \) and \( v = 10 \text{ mm}^2/\text{s} \)

(p\(_{ND}\) = low pressure, \( p_G \) = case pressure)

<table>
<thead>
<tr>
<th>Size</th>
<th>Flushing flow ( q_v ) [L/min]</th>
<th>Mat. No. of orifice</th>
</tr>
</thead>
<tbody>
<tr>
<td>28, 55</td>
<td>3.5</td>
<td>R909651766</td>
</tr>
<tr>
<td>80</td>
<td>5</td>
<td>R909419695</td>
</tr>
<tr>
<td>107</td>
<td>8</td>
<td>R909419696</td>
</tr>
<tr>
<td>140, 160, 200</td>
<td>10</td>
<td>R909419697</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>R909419697</td>
</tr>
<tr>
<td>355, 500, 1000</td>
<td>16</td>
<td>R910803019</td>
</tr>
</tbody>
</table>

With sizes 28 to 200, orifices can be supplied for flushing flows from 3.5 to - 10 L/min. For other flushing flows, please state the required flushing flow when ordering. The flushing flow without orifice is approx. 12 to 14 L at low pressure \( \Delta p_{ND} = 25 \text{ bar} \).
## Flushing and boost pressure valve

### Dimensions

**Sizes 28 to 200**

<table>
<thead>
<tr>
<th>NG</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>214</td>
<td>125</td>
<td>161</td>
<td>–</td>
</tr>
<tr>
<td>55</td>
<td>243</td>
<td>133</td>
<td>176</td>
<td>236</td>
</tr>
<tr>
<td>80</td>
<td>273</td>
<td>142</td>
<td>193</td>
<td>254</td>
</tr>
<tr>
<td>107</td>
<td>288</td>
<td>144</td>
<td>200</td>
<td>269</td>
</tr>
<tr>
<td>140</td>
<td>321</td>
<td>154</td>
<td>218</td>
<td>–</td>
</tr>
<tr>
<td>160</td>
<td>328</td>
<td>154</td>
<td>220</td>
<td>–</td>
</tr>
<tr>
<td>200</td>
<td>345</td>
<td>160</td>
<td>231</td>
<td>–</td>
</tr>
</tbody>
</table>

**Sizes 250 to 1000**

<table>
<thead>
<tr>
<th>NG</th>
<th>A1</th>
<th>A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>357</td>
<td>402</td>
</tr>
<tr>
<td>355</td>
<td>397</td>
<td>446</td>
</tr>
<tr>
<td>500</td>
<td>440</td>
<td>504</td>
</tr>
<tr>
<td>1000</td>
<td>552</td>
<td>629</td>
</tr>
</tbody>
</table>

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Counterbalance valve BVD and BVE

Function

Travel drive/winch counterbalance valves are designed to reduce the danger of overspeeding and cavitation of axial piston motors in open circuits. Cavitation occurs if the motor speed is greater than it should be for the given input flow while braking, travelling downhill, or lowering a load.

If the inlet pressure drops, the counterbalance spool throttles the return flow and brakes the motor until the inlet pressure returns to approx. 20 bar.

Note

- BVD available for sizes 55 to 200 and BVE available for sizes 107 to 200.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set. Ordering example: A6VM80HA1T/63W–VAB38800A + BVD20F27S/41B–V03K16D0400S12
- For safety reasons, controls with beginning of control at \( V_g \) \( \text{min} \) (e. g. HA) are not permissible for winch drives!
- The counterbalance valve does not replace the mechanical service brake and park brake.
- Observe the detailed notes on the BVD counterbalance valve in RE 95522 and BVE counterbalance valve in RE 95525.
- For the design of the brake release valve, we must know for the mechanical park brake:
  - the pressure at the start of opening
  - the volume of the counterbalance spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
  - the required closing time for a warm device (oil viscosity approx. 15 mm²/s)

Travel drive counterbalance valve BVD...F

Application option

- Travel drive on wheeled excavators

Example schematic for travel drive for wheeled excavators
A6VM80HA1T/63W–VAB38800A + BVD20F27S/41B–V03K16D0400S12
Counterbalance valve BVD and BVE

Winch counterbalance valve BVD...W and BVE

Application options
- Winch drive in cranes (BVD and BVE)
- Track drive in excavator crawlers (BVD)

Example schematic for winch drive in cranes
A6VM80HD1D/63W–VAB38800B + BVE25W38S/51ND-V100K00D4599T30S00-0

Permissible input flow or pressure in operation with DBV and BVD/BVE

<table>
<thead>
<tr>
<th>Motor NG</th>
<th>Without valve</th>
<th>Restricted values in operation with DBV and BVD/BVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>400/450</td>
<td>244</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>312</td>
</tr>
<tr>
<td>107</td>
<td>380</td>
<td>32</td>
</tr>
<tr>
<td>140</td>
<td>455</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>496</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>580</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>350/400</td>
<td>675</td>
</tr>
</tbody>
</table>

DBV ___________________________ pressure-relief valve
BVD ___________________________ counterbalance valve, double-acting
BVE ___________________________ counterbalance valve, one-sided
Counterbalance valve BVD and BVE

Dimensions

**A6VM...HA**

![Diagram of A6VM...HA counterbalance valve]

**A6VM...HD or EP**

![Diagram of A6VM...HD or EP counterbalance valve]

| A6VM NG...plate | Counterbalance valve Type | Ports A, B | Dimensions A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 |
|-----------------|--------------------------|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 55...38         | BVD20...17               | 3/4 in    | 311 302 143 50 98 139 75 222 326 50 |
| 80...38         | BVD20...27               | 1 in      | 340 331 148 55 98 139 75 222 355 46 |
| 107...37        | BVD20...28               | 1 in      | 362 353 152 59 98 139 84 234 377 41 |
| 107...38        | BVD25...38               | 1 1/4 in  | 380 370 165 63 120.5 175 84 238 395 56 |
| 140...38        | BVD25...38               | 1 1/4 in  | 411 401 168 67 120.5 175 84 238 426 53 |
| 160...38        | BVD25...38               | 1 1/4 in  | 417 407 170 68 120.5 175 84 238 432 51 |
| 200...38        | BVD25...38               | 1 1/4 in  | 448 438 176 74 120.5 175 84 299 463 46 |
| 107...38        | BVE25...38               | 1 1/4 in  | 380 370 171 63 137 214 84 238 397 63 |
| 140...38        | BVE25...38               | 1 1/4 in  | 411 401 175 67 137 214 84 238 423 59 |
| 160...38        | BVE25...38               | 1 1/4 in  | 417 407 176 68 137 214 84 238 432 59 |
| 200...38        | BVE25...38               | 1 1/4 in  | 448 438 182 74 137 214 84 299 463 52 |

### Ports

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Version</th>
<th>A6VM Plate Standard</th>
<th>Size</th>
<th>Maximum pressure [bar]</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J518</td>
<td>see table above</td>
<td>420</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Infeed</td>
<td>BVD20</td>
<td>DIN 3852</td>
<td>M22 x 1.5; 14 deep</td>
<td>30</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BVD25, BVE25</td>
<td>DIN 3852</td>
<td>M27 x 2; 16 deep</td>
<td>30</td>
<td>X</td>
</tr>
<tr>
<td>Br</td>
<td>Brake release, reduced high-pressure</td>
<td>L</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 25 deep</td>
<td>30</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BVE25</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 25 deep</td>
<td>30</td>
<td>O</td>
</tr>
<tr>
<td>G_ext</td>
<td>Brake release, high-pressure</td>
<td>S</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 25 deep</td>
<td>420</td>
<td>X</td>
</tr>
<tr>
<td>M_A, M_B</td>
<td>Measuring pressure A and B</td>
<td>ISO 6149</td>
<td>M18 x 1.5; 15.4 deep</td>
<td>420</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

1) At the mounting version for the controls HD and EP, the cast-in port designations A and B on the counterbalance valve BVD do not correspond with the connection drawing of the A6VM motor.

The designation of the ports on the installation drawing of the motor is binding!

2) Observe the general instructions on page 80 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) The spot face can be deeper than specified in the appropriate standard.

5) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)
Counterbalance valve BVD and BVE

Mounting the counterbalance valve

When delivered, the counterbalance valve is mounted to the motor with two tacking screws (transport protection). The tacking screws may not be removed while mounting the service lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be mounted to the motor port plate using the provided tacking screws. The counterbalance valve is finally mounted to the motor by screwing on the SAE flange with the following screws:

6 screws (1, 2, 3, 4, 5, 8) ______________________________ length B1+B2+B3
2 screws (6, 7) ______________________________ length B3+B4

Tighten the screws in two steps in the specified sequence from 1 to 8 (see following scheme).

In the first step, the screws must be tightened with half the tightening torque, and in the second step with the maximum tightening torque (see following table).

<table>
<thead>
<tr>
<th>Thread</th>
<th>Strength class</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6 x 1 (tacking screw)</td>
<td>10.9</td>
<td>15.5</td>
</tr>
<tr>
<td>M10</td>
<td>10.9</td>
<td>75</td>
</tr>
<tr>
<td>M12</td>
<td>10.9</td>
<td>130</td>
</tr>
<tr>
<td>M14</td>
<td>10.9</td>
<td>205</td>
</tr>
</tbody>
</table>

1) SAE flange
2) Tacking screw (M6 x 1, length = B1 + B2, DIN 912)

<table>
<thead>
<tr>
<th>NG...plate</th>
<th>55...38</th>
<th>80...38, 107...37, 107, 140, 160, 200...38</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1(2)</td>
<td>M10 x 1.5</td>
<td>M12 x 1.75</td>
</tr>
<tr>
<td></td>
<td>17 deep</td>
<td>15 deep</td>
</tr>
<tr>
<td>B2</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>B3</td>
<td>customer-specific</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>M10 x 1.5</td>
<td>M12 x 1.75</td>
</tr>
<tr>
<td></td>
<td>15 deep</td>
<td>16 deep</td>
</tr>
</tbody>
</table>

3) Minimum required thread reach 1 x Ø-thread
Swivel angle indicator (sizes 250 to 1000)

Optical swivel angle indicator (V)
The swivel position is indicated by a pin on the side of the port plate. The length of pin protruding depends on the position of the lens plate.

If the pin is flush with the port plate, the motor is at the beginning of control. At max. swivel, the pin length is 8 mm (visible after removing the cap nut).

Example: beginning of control at \( V_{g,\text{max}} \)

<table>
<thead>
<tr>
<th>NG</th>
<th>A1</th>
<th>A2 (^2)</th>
<th>A3</th>
<th>A4</th>
<th>A5 (^3)</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>136.5</td>
<td>256</td>
<td>73</td>
<td>238</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>355</td>
<td>159.5</td>
<td>288</td>
<td>84</td>
<td>266</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>500</td>
<td>172.5</td>
<td>331</td>
<td>89</td>
<td>309</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>1000</td>
<td>208.5</td>
<td>430</td>
<td>114</td>
<td>402</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>

1) Size
2) Dimension to mounting flange
3) Required clearance for removal of cap nut

Electric swivel angle indicator (E)
The motor position is measured by an inductive position transducer. This converts the stroke of the control device into an electric signal.

This signal is used to forward the swivel position to an electric controller.

Inductive position transducer, type IW9–03–01

type of protection according to DIN/EN 60529: IP65

Example: beginning of control at \( V_{g,\text{min}} \)
Speed sensors

Version A6VM...U and A6VM...F ("prepared for speed sensor", i.e. without sensor) is equipped with a toothed ring on the rotary group.

On deliveries "prepared for speed sensor", the port is plugged with a pressure-resistant cover.

With the speed sensor DSA or HDD mounted, a signal proportional to the motor speed can be generated. The sensors measure the speed and direction of rotation.

Ordering code, technical data, dimensions and details on the connector, plus safety information about the sensor can be found in the relevant data sheet.

DSA  ______________________________ RE 95133
HDD  ______________________________ RE 95135

Version "V" (sizes 28 to 200)

Suitable for mounting the DSA speed sensor. The sensor is fastened at the upper reservoir port T1.

Note

With speed measuring, only port T2 can be used to drain the case drain.

Version "H" (sizes 355 and 500)

Suitable for mounting the HDD speed sensor. The sensor is flanged onto the port provided for this purpose with two mounting bolts.

We recommend ordering the A6VM variable motor complete with installed sensor.

Schematic

Sizes 28 to 200

Sizes 250 to 1000

Dimensions

Version "V" with DSA sensor (sizes 28 to 200)

Dimensions

Version "H" with HDD sensor (sizes 355 and 500)

<table>
<thead>
<tr>
<th>Size</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of teeth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSA A</td>
<td>Insertion depth (tolerance -0.25)</td>
<td>18.4</td>
<td>18.4</td>
<td>18.4</td>
<td>18.4</td>
<td>18.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Contact surface</td>
<td>75</td>
<td>79</td>
<td>88</td>
<td>93</td>
<td>96</td>
<td>101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>66.2</td>
<td>75.2</td>
<td>77.2</td>
<td>91.2</td>
<td>91.7</td>
<td>95.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD A'</td>
<td>Insertion depth (tolerance ± 0.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B'</td>
<td>Contact surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Before finalizing your design, request a binding installation drawing. Dimensions in mm.
Installation instructions

General
During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

Particularly in the installation position "drive shaft upwards" filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain fluid in the motor housing must be directed to the reservoir via the highest available drain port (T1, T2).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Installation position
See the following examples 1 to 8.
Further installation positions are possible upon request.
Recommended installation positions: 1 and 2.

Note
In certain installation conditions, an influence on the control characteristics can be expected. Gravity, dead weight and case pressure can cause minor shifts in control characteristics and changes in response time.

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleed</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–</td>
<td>T1</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td>T2</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>T1</td>
</tr>
<tr>
<td>4</td>
<td>U</td>
<td>T1</td>
</tr>
<tr>
<td>5</td>
<td>U (L1)</td>
<td>T1 (L1)</td>
</tr>
<tr>
<td>6</td>
<td>L1</td>
<td>T2 (L1)</td>
</tr>
<tr>
<td>7</td>
<td>L1</td>
<td>T1 (L1)</td>
</tr>
<tr>
<td>8</td>
<td>U</td>
<td>T1 (L1)</td>
</tr>
</tbody>
</table>

L1  Filling / air bleed
U  Bearing flushing / air bleed port
T1, T2  Drain port
hT(min)  Minimum required immersion depth (200 mm)
h(min)  Minimum required spacing to reservoir bottom (100 mm)

Below-reservoir installation (standard)
Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Above-reservoir installation
Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.
Recommendation for installation position 8 (drive shaft upward): A check valve in the drain line (cracking pressure 0.5 bar) can prevent draining of the motor housing.
General instructions

- The motor A6VM is designed to be used in open and closed circuits.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Service line ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports can only be used to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- The product is not approved as a component for the safety concept of a general machine according to ISO 13849.
- The following tightening torques apply:
  - Fittings: Observe the manufacturer’s instruction regarding tightening torques for the fittings used.
  - Mounting bolts: For mounting bolts with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
  - Female threads in the axial piston unit: The maximum permissible tightening torques $M_{G\, \text{max}}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.
  - Threaded plugs: For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs $M_v$ apply. For values, see the following table.

<table>
<thead>
<tr>
<th>Ports Standard</th>
<th>Size of thread</th>
<th>Maximum permissible tightening torque of the female threads $M_{G, \text{max}}$</th>
<th>Required tightening torque of the threaded plugs $M_v$(^1)</th>
<th>WAF hexagon socket of the threaded plugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN 3852</td>
<td>M12 x 1.5</td>
<td>50 Nm</td>
<td>25 Nm(^2)</td>
<td>6 mm</td>
</tr>
<tr>
<td></td>
<td>M14 x 1.5</td>
<td>80 Nm</td>
<td>35 Nm</td>
<td>6 mm</td>
</tr>
<tr>
<td></td>
<td>M16 x 1.5</td>
<td>100 Nm</td>
<td>50 Nm</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td>M18 x 1.5</td>
<td>140 Nm</td>
<td>60 Nm</td>
<td>8 mm</td>
</tr>
<tr>
<td></td>
<td>M22 x 1.5</td>
<td>210 Nm</td>
<td>80 Nm</td>
<td>10 mm</td>
</tr>
<tr>
<td></td>
<td>M25 x 1.5</td>
<td>230 Nm</td>
<td>120 Nm</td>
<td>12 mm</td>
</tr>
<tr>
<td></td>
<td>M27 x 2</td>
<td>330 Nm</td>
<td>135 Nm</td>
<td>12 mm</td>
</tr>
<tr>
<td></td>
<td>M33 x 2</td>
<td>540 Nm</td>
<td>225 Nm</td>
<td>17 mm</td>
</tr>
<tr>
<td></td>
<td>M42 x 2</td>
<td>720 Nm</td>
<td>360 Nm</td>
<td>22 mm</td>
</tr>
</tbody>
</table>

\(^1\) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.

\(^2\) In the "lightly oiled" state, the $M_v$ is reduced to 17 Nm for M12 x 1.5.