Axial Piston Variable Pump
A4VTG

Data sheet

Series 33
Sizes NG71, 90
Nominal pressure 400 bar
Maximum pressure 450 bar
Closed circuit
For the drum drive in mobile concrete mixers

Features
- Variable axial piston pump of swashplate design for hydrostatic drives in closed circuit
- The flow is proportional to the drive speed and displacement.
- The flow increases as the angle of the swashplate is adjusted from zero to its maximum value.
- Flow direction changes smoothly when the swashplate is moved through the neutral position.
- Two pressure-relief valves are provided on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overload.
- The high-pressure relief valves also function as boost valves.
- The integrated boost pump acts as a feed pump and control pressure supply.
- The maximum boost pressure is limited by a built-in boost pressure-relief valve.

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### Ordering code for standard program

<table>
<thead>
<tr>
<th>A4VT</th>
<th>G</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>/</th>
<th>33</th>
<th>M</th>
<th>N</th>
<th>C4</th>
<th>F</th>
<th>A</th>
<th>S</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>07</td>
<td>08</td>
<td>09</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Axial piston unit**
- 01 Swashplate design, variable, nominal pressure 400 bar, maximum pressure 450 bar, mobile concrete mixers

**Operation mode**
- 02 Pump, closed circuit

**Size**
- 03 Displacement $V_g \text{ max}\ in \ cm^3$

**Control device**
- 04 Proportional control hydraulic, mechanical servo, hexagon shaft with lever to the rear
  - U = 12 V DC
  - U = 24 V DC

**Connector for solenoids**
- 05 Without
- DEUTSCH - molded connector, 2-pin – without suppressor diode

**Auxiliary functions**
- 06 Without
- With mechanical stroke limiter, externally adjustable
- With ports $X_3$, $X_4$ for stroking chamber pressure
- With mechanical stroke limiter and ports $X_3$, $X_4$

**Series**
- 07 Series 3, Index 3

**Version of port and fixing threads**
- 08 Metric

**Direction of rotation**
- 09 Viewed from drive shaft
  - clockwise
  - counter-clockwise

**Seals**
- 10 NBR (nitrile-caoutchouc), shaft seal ring in FKM (fluor-caoutchouc)

**Mounting flange**
- 11 SAE J744, 127-4

**Drive shaft**
- 12 Splined shaft ANSI B92.1a–1976
  - 1 3/8 in 21T 16/32DP without coupling flange
  - 1 1/2 in 23T 16/32DP without coupling flange
  - 1 1/2 in 23T 16/32DP with coupling flange

**Service line ports**
- 13 SAE flange port
  - A and B on same side
  - A and B on same side

---

1) Mounting position of the lever not specified on delivery, to be aligned by the customer
2) Connectors for other electric components can deviate.
Ordering code for standard program

<table>
<thead>
<tr>
<th>A4VT</th>
<th>G</th>
<th>/</th>
<th>33</th>
<th>M</th>
<th>N</th>
<th>C4</th>
<th>F</th>
<th>A</th>
<th>S</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>

**Boost pump**

14 With integrated boost pump

**Through drive**

15 Flange SAE J744

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Symbol</th>
<th>Designation</th>
<th>Coupling for splined shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>82-2</td>
<td>↔</td>
<td>A2</td>
<td>5/8 in 9T 16/32DP S2</td>
</tr>
<tr>
<td>101-2</td>
<td>↔</td>
<td>B2</td>
<td>7/8 in 13T 16/32DP S4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Symbol</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>071</td>
<td>⚫</td>
<td>0000</td>
</tr>
<tr>
<td>090</td>
<td>⚫</td>
<td>A2S2</td>
</tr>
<tr>
<td></td>
<td>⚫</td>
<td>B2S4</td>
</tr>
</tbody>
</table>

**High-pressure valves**

16 With high-pressure relief valve, direct controlled

**Filtration boost circuit**

17 Filtration in the boost pump suction line

**Standard / special version**

18 Standard version

<table>
<thead>
<tr>
<th>Standard version</th>
<th>-0</th>
</tr>
</thead>
</table>

Special version

<table>
<thead>
<tr>
<th>Special version</th>
<th>-S</th>
</tr>
</thead>
</table>

combined with attachment part or attachment pump

Note

Short designation X refers to a special version not covered by the ordering code.

⚫ = Available  ○ = On request  ⚪ = Not available

3) Coupling for splined shaft acc. ANSI B92.1a-1976
Technical data

Hydraulic fluid

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

The A4VTG variable pump is not suitable for operation with HFA, HFB and HFC. If HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals must be observed.

Please contact us.

When ordering, indicate the hydraulic fluid that is to be used.

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.

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 recommended 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 operating 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, is always higher than the circuit temperature. At no point of the component may the temperature be higher than 115 $^\circ C$, however. 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, please contact us.

Viscosity and temperature

<table>
<thead>
<tr>
<th>Viscosity $[\text{mm}^2/\text{s}]$</th>
<th>Temperature Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>$T_{min} \geq -50 , ^\circ C$ $T_{opt} = +5 , ^\circ C \text{ to } +20 , ^\circ C$ up to 12 months with standard factory conservation up to 24 months with long-term factory conservation</td>
</tr>
</tbody>
</table>

(Cold) start-up

- $\nu_{max} = 1600$
- $T_{SI} \geq +40 \, ^\circ C$
- $\Delta T \leq 25 \, K$
- Permissible temperature difference

- between axial piston unit and hydraulic fluid

Warm-up phase

- $\nu < 1600$ to 400
- $T = -40 \, ^\circ C \text{ to } -25 \, ^\circ C$
- at $p_{room}$, 0.5 $\times n_{room}$ and $t \leq 15 \, \text{ min}$

Operating phase

Temperature difference

- $\Delta T = \text{approx. 5 K}$

Continuous operation

- $\nu = 400$ to 10
- $T = -25 \, ^\circ C \text{ to } +90 \, ^\circ C$
- no restriction within the permissible data

Short-term operation

- $\nu_{min} = < 10$ to 5
- $T_{max} = +115 \, ^\circ C$
- $t < 3 \, \text{ min}$, $p < 0.3 \times p_{room}$

Shaft seal ring FKM

- $T \leq +115 \, ^\circ C$
- see page 5

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

Filtration of the hydraulic fluid

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

To ensure the functional reliability of the axial piston unit, a gravimetric evaluation is necessary for the hydraulic fluid to determine the amount of contamination by solid matter and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

Depending on the system and the application, for the A4VTG, we recommend

Filter cartridges $\beta_{20} \geq 100$.

With an increasing differential pressure at the filter cartridges, the $\beta$-value must not deteriorate.

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. For notes on filtration types, see page 16.

Shaft seal ring

Permissible pressure loading

The service life of the shaft seal ring is affected by the speed of the pump and the case drain pressure. It is recommended that the average, continuous case drain pressure 3 bar absolute at operating temperature not be exceeded (maximum permissible case drain pressure 6 bar absolute at reduced speed, see diagram). Short-term (t < 0.1 s) pressure spikes of up to 10 bar absolute are permitted. The service life of the shaft seal ring decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or greater than the external pressure on the shaft seal ring.

![Diagram showing permissible pressure loadings for different Nomenclature groups NG71 and NG90]

Temperature range

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

Note

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

Please contact us.
Technical data

Operating pressure range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal pressure $p_{nom}$</td>
<td>400 bar absolute</td>
</tr>
<tr>
<td>Maximum pressure $p_{max}$</td>
<td>450 bar absolute</td>
</tr>
<tr>
<td>Single operating period</td>
<td>10 s</td>
</tr>
<tr>
<td>Total operating period</td>
<td>300 h</td>
</tr>
<tr>
<td>Minimum pressure (high-pressure side)</td>
<td>25 bar</td>
</tr>
<tr>
<td>Minimum pressure (inlet)</td>
<td>10 bar</td>
</tr>
<tr>
<td>(boost pressure setting must be higher depending on system)</td>
<td></td>
</tr>
<tr>
<td>Rate of pressure change $R_{A\text{max}}$</td>
<td>9000 bar/s</td>
</tr>
</tbody>
</table>

Boost pump

Pressure at suction port S

- Duration $p_{S\text{min}}$ ($\nu \leq 30 \text{ mm}^2/\text{s}$) $\geq 0.8$ bar absolute
- at cold starts, short-term ($t < 3 \text{ min}$) $\geq 0.5$ bar absolute
- Maximum $p_{S_{\text{max}}}$ $\leq 5$ bar absolute

Standard adjustment $p_{Sp}$ (at $n = 1500 \text{ rpm}$) $\geq 22$ bar

Nominal pressure $p_{Sp\text{ nom}}$ $\geq 30$ bar

Maximum pressure $p_{Sp\text{ max}}$ $\geq 40$ bar

Control pressure

To ensure the function of the control, the following control pressure is required depending on the speed and operating pressure (measurement point, port $P_0$):

For controls EP and HW

Minimum control pressure $p_{St\text{ min}}$ (at $n = 1500 \text{ rpm}$) $\geq 22$ bar

Definition

Nominal pressure $p_{nom}$

The nominal pressure corresponds to the maximum design pressure.

Maximum pressure $p_{max}$

The maximum pressure corresponds the maximum operating pressure within the single operating period. The sum of the single operating period must not exceed the total operating period.

Minimum pressure (high-pressure side)

Minimum pressure on the high-pressure side (A or B) that is required in order to prevent damage to the axial piston unit.

Minimum pressure (inlet)

Minimum pressure in inlet (A or B) that is required in order to prevent damage to the axial piston unit.

Rate of pressure change $R_A$

Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.
Table of values (theoretical values, without efficiency levels and tolerances; values rounded)

<table>
<thead>
<tr>
<th>Size</th>
<th>NG</th>
<th>71</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>variable pump</td>
<td>$V_{g\text{ max}}$ cm³</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>boost pump (at $p = 20$ bar)</td>
<td>$V_{g\text{ Sp}}$ cm³</td>
<td>20.5</td>
</tr>
<tr>
<td>Speed</td>
<td>$V_{g\text{ max}}$ at $n_{\text{nom}}$ rpm</td>
<td>$n_{\text{nom}}$ rpm</td>
<td>3300</td>
</tr>
<tr>
<td></td>
<td>$V_{g\text{ Sp}}$ at $n_{\text{min}}$ rpm</td>
<td>$n_{\text{min}}$ rpm</td>
<td>500</td>
</tr>
<tr>
<td>Flow</td>
<td>$V_{g\text{ max}}$ at $n_{\text{nom}}$ l/min</td>
<td>$q_{v\text{ max}}$ l/min</td>
<td>234</td>
</tr>
<tr>
<td>Power¹</td>
<td>at $n_{\text{nom}}$ $H$ and $V_{g\text{ max}}$</td>
<td>$P_{\text{max}}$ kW</td>
<td>156</td>
</tr>
<tr>
<td>Torque²</td>
<td>at $V_{g\text{ max}}$ and $D_p = 400$ bar</td>
<td>$T_{\text{max}}$ Nm</td>
<td>452</td>
</tr>
<tr>
<td></td>
<td>$D_p = 100$ bar</td>
<td>$T$ Nm</td>
<td>113</td>
</tr>
<tr>
<td>Rotary stiffness</td>
<td>drive shaft V8</td>
<td>$c$ Nm/rad</td>
<td>120900</td>
</tr>
<tr>
<td></td>
<td>drive shaft V9</td>
<td>$c$ Nm/rad</td>
<td>–</td>
</tr>
<tr>
<td>Moment of inertia for rotary group</td>
<td>$J_{GR}$ kgm²</td>
<td>0.0097</td>
<td>0.0149</td>
</tr>
<tr>
<td>Maximum angular acceleration³</td>
<td>$\alpha$ rad/s²</td>
<td>21000</td>
<td>18000</td>
</tr>
<tr>
<td>Filling capacity</td>
<td>$V$ L</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Mass approx. (without through drive)</td>
<td>$m$ kg</td>
<td>51</td>
<td>53</td>
</tr>
</tbody>
</table>

¹) Without boost pump
²) The area of validity lies between the minimum required and maximum permissible speed.
   It applies for external stimuli (e. g. engine 2 to 8 times rotary frequency, cardan shaft twice the rotary frequency).
   The limit value applies for a single pump only.
   The load capacity of the connection parts must be considered.

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. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Determining the size

Flow \[ q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad [L/min] \]

Torque \[ T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{\text{inh}}} \quad [Nm] \]

Power \[ P = \frac{2 \cdot \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad [kW] \]

$V_g = $ Displacement per revolution in cm³
$\Delta p = $ Differential pressure in bar
$n = $ Speed in rpm
$\eta_v = $ Volumetric efficiency
$\eta_{\text{inh}} = $ Mechanical-hydraulic efficiency
$\eta_t = $ Total efficiency ($\eta_t = \eta_v \cdot \eta_{\text{inh}}$)
### Technical data

#### Permissible radial and axial loading on drive shaft

<table>
<thead>
<tr>
<th>Size</th>
<th>NG</th>
<th>71</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive shaft</td>
<td>in</td>
<td>1 3/8</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Radial force maximum at distance a</td>
<td></td>
<td>5600</td>
<td>7100</td>
</tr>
<tr>
<td>(from shaft collar)</td>
<td></td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Axial force maximum</td>
<td></td>
<td>4242</td>
<td>4330</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2758</td>
<td>2670</td>
</tr>
</tbody>
</table>

**Note**

Special requirements apply in the case of belt drives. Please contact us.

Force-transfer direction of the permissible axial force:

+ $F_{ax\,\text{max}}$ = Increase in service life of bearings

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

#### Permissible input and through-drive torques

<table>
<thead>
<tr>
<th>Size</th>
<th>NG</th>
<th>NG</th>
<th>71</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque at $V_g,\text{max}$ and $\Delta p = 400$ bar</td>
<td></td>
<td>T$_{\text{max}}$</td>
<td>Nm</td>
<td>452</td>
</tr>
<tr>
<td>Input torque at drive shaft, maximum</td>
<td>V8</td>
<td>1 3/8 in</td>
<td>T$_{E,\text{max}}$</td>
<td>Nm</td>
</tr>
<tr>
<td></td>
<td>V9</td>
<td>1 1/2 in</td>
<td>T$_{E,\text{max}}$</td>
<td>Nm</td>
</tr>
<tr>
<td>Maximum through-drive torque</td>
<td></td>
<td>T$_{D,\text{max}}$</td>
<td>Nm</td>
<td>250</td>
</tr>
</tbody>
</table>

1) Efficiency not considered
2) For drive shafts with no radial force
HW – Proportional control hydraulic, mechanical servo

The output flow of the pump can be steplessly varied in the range between 0 to 100%, proportional to the rotation of the control lever between 0° and ±29°.

A feedback lever connected to the stroke piston maintains the pump flow for any given position of the control lever between 0° and 29°.

Swivel angle β at the control lever for deflection:
Start of control at β = 3°
End of control at β = 29° (maximum displacement Vg max)
Mechanical stop for β: ±40°

The maximum required torque at the lever is 170 Ncm. To prevent damage to the HW control unit, a positive mechanical stop must be provided for the HW control lever.

Note
Spring centering enables the pump, depending on pressure and speed, to move automatically to the neutral position (Vg = 0) as soon as there is no longer any torque on the control lever of the HW control unit (regardless of deflection angle).
EP – Proportional control electric

The output flow of the pump can be steplessly varied in the range between 0 to 100 %, proportional to the electrical current supplied to solenoid a or b.

The electrical energy is converted into a force acting on the control piston. This control piston then directs control hydraulic fluid into and out of the stroke cylinder to adjust pump displacement as required.

A feedback lever connected to the stroke piston maintains the pump flow for any given current within the control range.

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
  and application software

- Analog amplifier RA _________________________ RE 95230

Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics.
EP – Proportional control  electric

Circuit diagram

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

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a safe position (e.g. immediate stop).
Dimensions size 71

HW – Proportional control hydraulic, mechanical servo

Standard: suction port S at top (02)

Option: suction port S at bottom (01): port plate turned through 180°

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

Note
Mounting position of the lever not specified on delivery, to be aligned by the customer
# Dimensions size 71

## Drive shaft

![Splined shaft](image)

**C8** Splined shaft 1 3/8 in with coupling flange

**V8** Splined shaft 1 3/8 in 21T 16/32DP (SAE J744)

---

### Ports

<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&lt;sup&gt;4)&lt;/sup&gt;</td>
<td>1 in</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td>S</td>
<td>Suction</td>
<td>DIN 3852</td>
<td>M42 x 2; 20 deep</td>
<td>5</td>
<td>O</td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>Tank</td>
<td>DIN 3852</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>O&lt;sup&gt;5)&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Tank</td>
<td>DIN 3852</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>X&lt;sup&gt;5)&lt;/sup&gt;</td>
</tr>
<tr>
<td>R</td>
<td>Air bleed</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X&lt;sub&gt;1&lt;/sub&gt;, X&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Control pressure (upstream of orifice)</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>X&lt;sub&gt;3&lt;/sub&gt;, X&lt;sub&gt;4&lt;/sub&gt;&lt;sup&gt;6)&lt;/sup&gt;</td>
<td>Stroking chamber pressure</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>P&lt;sub&gt;0&lt;/sub&gt;</td>
<td>Pilot pressure, inlet</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<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</td>
<td>M12 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

---

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also page 22).
6) Optional, see page 18

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
Dimensions size 90

HW – Proportional control hydraulic, mechanical servo

Standard: suction port S at top (02)

Option: suction port S at bottom (01): port plate turned through 180°

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

Note
Mounting position of the lever not specified on delivery, to be aligned by the customer.
Dimensions size 90

Drive shaft

C9  Splined shaft 1 1/2 in with coupling flange

V9  Splined shaft 1 1/2 in 23T 16/32DP1) (SAE J744)

Ports

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size2)</th>
<th>Maximum pressure [bar]3)</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line</td>
<td>SAE J5184)</td>
<td>1 in</td>
<td>450</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>Fixing thread A/B</td>
<td>DIN 13</td>
<td>M12 x 1.75; 17 deep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Suction</td>
<td>DIN 3852</td>
<td>M42 x 2; 20 deep</td>
<td>5</td>
<td>O</td>
</tr>
<tr>
<td>T1</td>
<td>Tank</td>
<td>DIN 3852</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>O5)</td>
</tr>
<tr>
<td>T2</td>
<td>Tank</td>
<td>DIN 3852</td>
<td>M26 x 1.5; 16 deep</td>
<td>3</td>
<td>X5)</td>
</tr>
<tr>
<td>R</td>
<td>Air bleed</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>X1, X2</td>
<td>Control pressure</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>(upstream of orifice)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3, X46)</td>
<td>Stroking chamber pressure</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>P5</td>
<td>Pilot pressure, inlet</td>
<td>DIN 3852</td>
<td>M14 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
<tr>
<td>MA, MB</td>
<td>Measuring pressure A, B</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>450</td>
<td>X</td>
</tr>
</tbody>
</table>

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Depending on installation position, T1 or T2 must be connected (see also page 22).
6) Optional, see page 18
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

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

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

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Symbol</th>
<th>Designation</th>
<th>Diameter</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without</td>
<td></td>
<td></td>
<td>071</td>
<td>090</td>
</tr>
<tr>
<td>82-2</td>
<td>A2</td>
<td>5/8 in 9T</td>
<td>0000</td>
<td></td>
</tr>
<tr>
<td>101-2</td>
<td>B2</td>
<td>7/8 in 13T</td>
<td>A2S2</td>
<td></td>
</tr>
</tbody>
</table>

1) Coupling for splined shaft according to ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 24 for the maximum tightening torques.
3) O-ring included in the delivery contents
Overview of attachments

<table>
<thead>
<tr>
<th>Through drive</th>
<th>Coupling for splined shaft</th>
<th>Short code</th>
<th>Attachment – 2nd pump</th>
<th>External gear pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange</td>
<td></td>
<td></td>
<td>A10VG NG (shaft)</td>
<td>Size F NG4 to 22</td>
</tr>
<tr>
<td>82-2 (A)</td>
<td>5/8 in</td>
<td>A2S2</td>
<td>A10VO/31 NG (shaft)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A10VO/53 NG (shaft)</td>
<td></td>
</tr>
<tr>
<td>101-2 (B)</td>
<td>7/8 in</td>
<td>B2S4</td>
<td></td>
<td>Size N NG20 to 32</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Size G NG38 to 45</td>
</tr>
</tbody>
</table>

1) Rexroth recommends special versions of the gear pumps. Please contact us.

High-pressure relief valves

The two high-pressure relief valves protect the hydrostatic transmission (pump and motor) from overload. They limit the maximum pressure in the respective high-pressure line and serve simultaneously as boost valves.

Standard adjustment $\Delta p_{HD} \leq 400$ bar

Please contact us regarding other pressure settings.

Setting diagram

Note

The valve settings are made at $n = 1000$ rpm and at $V_{g, max}$ ($q_{v_1}$). There may be deviations in the opening pressures with other operating parameters.
Mechanical stroke limiter

The mechanical stroke limiter is an auxiliary function allowing the maximum displacement of the pump to be steplessly reduced, regardless of the control unit used.

The stroke of the stroke cylinder and hence the maximum swivel angle of the pump are limited by means of two adjusting screws.

Ports X₃ and X₄
for stroking chamber pressure

<table>
<thead>
<tr>
<th>Designation</th>
<th>Port for</th>
<th>Standard</th>
<th>Size¹</th>
<th>Maximum pressure [bar]²</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₃, X₄</td>
<td>Stroking chamber pressure</td>
<td>DIN 3852</td>
<td>M12 x 1.5; 12 deep</td>
<td>40</td>
<td>X</td>
</tr>
</tbody>
</table>

¹) Observe the general instructions on page 24 for the maximum tightening torques.

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

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

Version S
Filtration in the suction line of the boost pump

Filter type _____________________ filter without bypass

Recommendation ___________ with contamination indicator

Flow resistance at the filter cartridge:

With $\nu = 30 \text{ mm}^2/\text{s}, n = n_{\text{max}}$ __________ $\Delta p \leq 0.1 \text{ bar}$

With $\nu = 1000 \text{ mm}^2/\text{s}, n = n_{\text{max}}$ __________ $\Delta p \leq 0.3 \text{ bar}$

Pressure at port S of the boost pump

Suction pressure $p_{S_{\text{min}}} (\nu \leq 30 \text{ mm}^2/\text{s})$ __________ $\geq 0.8 \text{ bar absolute}$

At cold start short-term $(t < 3 \text{ min})$ __________ $\geq 0.5 \text{ bar absolute}$

Suction pressure $p_{S_{\text{max}}}$ __________ $\leq 5 \text{ bar absolute}$

The filter is not included in the delivery contents.

Circuit diagram
Connector for solenoids

DEUTSCH DT04-2P-EP04, 2-pin
Molded, without bidirectional suppressor diode
Type of protection according to DIN/EN 60529:
IP67 and IP69K

Circuit symbol
Without bidirectional suppressor diode

Mating connector
DEUTSCH DT06-2S-EP04
Rexroth Mat. No. R902601804
Consisting of:
- 1 case DT designation
- 1 wedge W2S
- 2 female connectors 0462-201-16141
The mating connector is not included in the delivery contents. This can be supplied by Rexroth on request.

Solenoid with emergency actuation and spring return

Note
Manual override (emergency actuation) can be applied in the event of a malfunction in the electrical system. Not approved for continuous operation!

Changing connector position
If necessary, you can change the position of the connector by turning the solenoid.
To do this, proceed as follows:
1. Loosen the fixing nut (1) of the solenoid. To do this, turn the fixing nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the fixing nut. Tightening torque of the fixing nut: 5 +1 Nm (WAF 26, 12-sided DIN 3124)
On delivery, the position of the connector may differ from that shown in the brochure or drawing.
Installation situation for coupling assembly

To ensure that rotating components (coupling hub) and fixed components (case, retaining ring) do not come into contact with each other, the installation conditions described here must be observed. This depends on the size and the splined shaft.

**SAE splined shaft** (spline according to ANSI B92.1a-1976)

- Drive shaft V8, V9
  The outer diameter of the coupling hub must be smaller than the inner diameter of the retaining ring \( d_2 \) in the area near the drive shaft collar (dimension \( x_2 - x_3 \)).

- Drive shaft with mounted coupling flange C8, C9
  The depicted installation conditions are already taken into account by Rexroth.

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

<table>
<thead>
<tr>
<th>Size</th>
<th>Mounting flange</th>
<th>( \phi d_1 )</th>
<th>( \phi d_2 ) min</th>
<th>( \phi d_3 )</th>
<th>( \phi d_4 )</th>
<th>( x_1 )</th>
<th>( x_2 )</th>
<th>( x_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>127-4</td>
<td>45</td>
<td>66.5</td>
<td>81 ±0.1</td>
<td>127</td>
<td>7.0</td>
<td>12.7</td>
<td>8 ±0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+0.2</td>
<td>–0.5</td>
<td>+0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>–0.6</td>
</tr>
<tr>
<td>90</td>
<td>127-4</td>
<td>50</td>
<td>66.5</td>
<td>81 ±0.1</td>
<td>127</td>
<td>7.0</td>
<td>12.7</td>
<td>8 ±0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+0.2</td>
<td>–0.5</td>
<td>+0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>–0.6</td>
</tr>
</tbody>
</table>
Installation instructions

General

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

The case drain fluid in the case interior must be directed to the tank via the highest tank port (T1, T2). The minimum suction pressure at port S must not fall below 0.8 bar absolute (cold start 0.5 bar absolute).

In all operational states, the suction line and tank line must flow into the tank below the minimum fluid level.

Installation position

See examples below. Additional installation positions are available upon request.

Recommended installation positions: 1 and 2.

Below-tank installation (standard)
Pump below minimum fluid level of the tank.

Above-tank installation
Pump above minimum fluid level of the tank.

Observe the maximum permissible suction height
hs,max = 800 mm.

1 2 3 4
SB ht min hmin amin
R S + T1 3 L2 (S) + R L2 (S) + L1
– S + T2

hs,max = 800 mm, hmin = 200 mm, hmin = 100 mm, SB = baffle (baffle plate)

When designing the reservoir, ensure adequate distance amin between the suction line and the case drain line to prevent the heated, return flow from being drawn directly back into the suction line.

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleed</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R</td>
<td>S + T1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>S + T2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleed</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>L2 (S) + R</td>
<td>L2 (S) + L1</td>
</tr>
<tr>
<td>4</td>
<td>L2 + L1 (T2)</td>
<td>L2 + L1 (T2)</td>
</tr>
</tbody>
</table>
Notes
General instructions

- The A4VTG pump is designed to be used in a closed circuit.
- Project planning, assembly and commissioning of the axial piston unit require the involvement of qualified personnel.
- The service line ports and function ports are only designed to accommodate hydraulic lines.
- 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 operational state of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Pressure ports:
  The ports and fixing 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 operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The data and notes contained herein must be adhered to.
- The following tightening torques apply:
  - Threaded hole for axial piston unit:
    The maximum permissible tightening torques $M_{G\text{ max}}$ are maximum values for the threaded holes and must not be exceeded. For values, see the following table.
  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the used fittings.
  - Fixing screws:
    For fixing screws according to DIN 13, we recommend checking the tightening torque individually according to VDI 2230.
  - Locking screws:
    For the metal locking screws supplied with the axial piston unit, the required tightening torques of locking screws $M_v$ apply. For values, see the following table.
- The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

<table>
<thead>
<tr>
<th>Threaded port sizes</th>
<th>Maximum permissible tightening torque of the threaded holes $M_{G\text{ max}}$</th>
<th>Required tightening torque of the locking screws $M_v$</th>
<th>WAF hexagon socket for the locking screws</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 x 1.5 DIN 3852</td>
<td>50 Nm</td>
<td>25 Nm</td>
<td>6 mm</td>
</tr>
<tr>
<td>M14 x 1.5 DIN 3852</td>
<td>80 Nm</td>
<td>35 Nm</td>
<td>6 mm</td>
</tr>
<tr>
<td>M26 x 1.5 DIN 3852</td>
<td>230 Nm</td>
<td>120 Nm</td>
<td>12 mm</td>
</tr>
<tr>
<td>M42 x 2 DIN 3852</td>
<td>720 Nm</td>
<td>360 Nm</td>
<td>22 mm</td>
</tr>
</tbody>
</table>