Axial Piston Variable Pump
A7VO

Series 63
Sizes 28...160
Nominal pressure 350 bar
Peak pressure 400 bar
Open circuit

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Features
- Variable pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open circuits
- For use in mobile and stationary application areas
- The flow is proportional to the drive speed and to the displacement, and is infinitely variable from $q_{v\text{ max}}$ to $q_{v\text{ min}} = 0$
- Wide selection of control devices
- Compact, robust bearing system with long service life
Ordering Code / Standard Program

Axial piston unit
01 Bent-axis design, variable, nominal pressure 350 bar, peak pressure 400 bar

Operation mode
02 Pump in open circuit

Size
03 \( \approx \text{Displacement } V_{g, \text{max}} \text{ in cm}^3 \) 

Control device
04 Power controller
- With pressure cut-off
- With pressure cut-off and stroke limiter
- With stroke limiter
Pressure controller
- With load sensing
Hydraulic control, pilot-pressure related (positive control)
- For pressure cut-off, remote controlled
Electric control with proportional solenoid (positive control)

Series
05 Series 6, index 3

Direction of rotation
06 Viewed from shaft end
- Clockwise
- Counter-clockwise

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

Shaft end
08 Splined shaft, DIN 5480
- Parallel keyed shaft DIN 6885

Mounting flange
09 4-hole – ISO 3019-2

Service line ports
10 SAE flange port B or A at rear (metric fixing thread)
- SAE flange port S at rear (metric fixing thread)

Standard / special version
11 Standard version (without code)
- Special version

= preferred program  ● = available  – = not available
Technical Data

Hydraulic fluid

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

The A7VO variable pump is not suitable for operation with HFA. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering, please indicate the used hydraulic fluid.

Operating viscosity range

We recommend that a viscosity (at operating temperature) for optimum efficiency and service life purposes of

\[
\nu_{\text{opt}} = \text{optimum operating viscosity 16 to 36 mm}^2/\text{s}
\]

be chosen, taken the tank temperature (open circuits) into account.

Limits of viscosity range

The following values apply in extreme cases:

\[
\nu_{\text{min}} = 5 \text{ mm}^2/\text{s}, \quad \text{short-term (t < 3 min)}
\]

\[
\text{at max. permissible temperature of } t_{\text{max}} = +115^\circ\text{C}.
\]

\[
\nu_{\text{max}} = 1600 \text{ mm}^2/\text{s}, \quad \text{short-term (t < 3 min)}
\]

\[
\text{at cold start (p \leq 30 \text{ bar}, n \leq 1000 \text{ rpm, } t_{\text{min}} = -40^\circ\text{C}).}
\]

Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 115°C must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is - depending on pressure and speed - up to 12 K higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40°C and -25°C (cold start phase), please contact us.

For detailed information about use at low temperatures, see RE 90300-03-B.

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 an open circuit the tank temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range \((\nu_{\text{opt}})\) - the 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°C an operating temperature of 60°C is set. In the optimum operating viscosity range \((\nu_{\text{opt}}; \text{shaded area})\) 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 tank temperature. At no point in the system may the temperature be higher than 115°C.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U.

Filtration

The finer the filtration, the higher the cleanliness level of the hydraulic fluid and the longer the service life of the axial piston unit.

To ensure functional reliability of the axial piston unit, the hydraulic fluid must have a cleanliness level of at least

20/18/15 according to ISO 4406.

At very high hydraulic fluid temperatures (90°C to max. 115°C) at least cleanliness level

19/17/14 according to ISO 4406 is required.

If the above classes cannot be observed, please contact us.
Technical Data

Operating pressure range

**Input**

Pressure on port S

The minimum permissible inlet pressure depends on the drive speed. The following limit values must not be exceeded or undercut.

\[ p_{\text{abs min}} = 0.8 \text{ bar} \]

The maximum pressure \( p_{\text{abs max}} \) also depends on the speed (see diagram on page 5).

**Output**

Maximum pressure on port B or A (pressure data according to DIN 24312)

<table>
<thead>
<tr>
<th>Drive shaft</th>
<th>Nominal pressure ( p_N )</th>
<th>Peak pressure ( p_{\text{max}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without radial loading</td>
<td>350 bar</td>
<td>400 bar</td>
</tr>
<tr>
<td>(coupling)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With radial loading (^1))</td>
<td>315 bar</td>
<td>350 bar</td>
</tr>
<tr>
<td>(pinion, v-belt)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Note permissible radial loading, see page 6

Nominal pressure: Max. design pressure at which fatigue strength is ensured.

Peak pressure: Max. operating pressure which is permissible for short-term \( t < 0.1 \text{ s} \).

**Direction of flow**

Direction of rotation, viewed from shaft end

- Clockwise
- Counter-clockwise

- S to B
- S to A

**Case drain fluid**

The case drain chamber is connected to the suction chamber. A case drain line to the tank is not required (both R-ports are plugged).

**Exception:**

On the version with pressure controller or pressure cut-off, a case drain line is required for discharge from port \( T_1 \) to the tank.

**Shaft seal ring**

**Permissible pressure load**

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 at operating temperature 3 bar absolute not be exceeded (max. permissible case drain pressure 6 bar absolute at reduced speed, see diagram). Short-term \( t < 0.1 \text{ s} \) 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.

**Temperature range**

The FKM shaft seal ring is permissible for case drain temperatures of \(-25^\circ C \) to \(+115^\circ C \).

**Note:**

For application cases below \(-25^\circ C \), an NBR shaft seal ring is necessary (permissible temperature range: \(-40^\circ C \) to \(+90^\circ C \)).

Please state NBR shaft seal ring in plain text when ordering. Please consult us.
## Technical Data

### Table of values

<table>
<thead>
<tr>
<th>Size</th>
<th>Displacement $V_g\text{ max}$ cm$^3$</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed max. 1) at $V_g\text{ max}$</td>
<td>$n_{v1}\text{ max}$ rpm</td>
<td>3150</td>
<td>2500</td>
<td>2240</td>
<td>2150</td>
<td>1900</td>
</tr>
<tr>
<td>at $V_g &lt; 0.74 \times V_g\text{ max}$ (see diagram)</td>
<td>$n_{v2}\text{ max}$ rpm</td>
<td>4250</td>
<td>3400</td>
<td>3000</td>
<td>2900</td>
<td>2560</td>
</tr>
<tr>
<td>Speed max. 2) at $V_g\text{ max}$ and $n_{v1}$</td>
<td>$n_{v2}\text{ max}$ rpm</td>
<td>4750</td>
<td>3750</td>
<td>3350</td>
<td>3200</td>
<td>2850</td>
</tr>
<tr>
<td>Flow at $n_{v1}$ and $V_g\text{ max}$</td>
<td>$q_{v1}\text{ max}$ L/min</td>
<td>89</td>
<td>137</td>
<td>179</td>
<td>230</td>
<td>304</td>
</tr>
<tr>
<td>Power at $q_{v1}\text{ max}$ and $\Delta p = 350$ bar</td>
<td>$P_{v1}\text{ max}$ kW</td>
<td>52</td>
<td>80</td>
<td>105</td>
<td>134</td>
<td>177</td>
</tr>
<tr>
<td>Torque at $V_g\text{ max}$ and $\Delta p = 350$ bar</td>
<td>$T_{v1}\text{ max}$ Nm</td>
<td>156</td>
<td>305</td>
<td>446</td>
<td>596</td>
<td>891</td>
</tr>
<tr>
<td>Rotary stiffness $V_g\text{ max}$ to $0.5 \times V_g\text{ max}$</td>
<td>$c_{v1}\text{ min}$ Nm/rad</td>
<td>5546</td>
<td>10594</td>
<td>15911</td>
<td>21469</td>
<td>36073</td>
</tr>
<tr>
<td>Rotary stiffness $V_g\text{ max}$ to $0.5 \times V_g\text{ max}$</td>
<td>$c_{v1}\text{ max}$ Nm/rad</td>
<td>16541</td>
<td>32103</td>
<td>48971</td>
<td>67666</td>
<td>104622</td>
</tr>
<tr>
<td>Moment of inertia for rotary group</td>
<td>$J_{TW}$ kgm$^2$</td>
<td>0.0042</td>
<td>0.0042</td>
<td>0.0080</td>
<td>0.0127</td>
<td>0.0253</td>
</tr>
<tr>
<td>Angular acceleration maximum</td>
<td>$a$ rad/s$^2$</td>
<td>35900</td>
<td>31600</td>
<td>24200</td>
<td>19200</td>
<td>15300</td>
</tr>
<tr>
<td>Filling capacity at $V_g\text{ max}$</td>
<td>$V_L$ L</td>
<td>0.5</td>
<td>0.75</td>
<td>1.2</td>
<td>1.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Mass (approx.)</td>
<td>$m$ kg</td>
<td>17</td>
<td>25</td>
<td>40</td>
<td>49</td>
<td>71</td>
</tr>
</tbody>
</table>

1) The values shown are valid for absolute pressure ($p_{abs}$) 1 bar at suction port $S$ and for operation with mineral fluids with a specific mass of 0.88 kg/l.

2) Maximum speed (limiting speed) with increased inlet pressure $p_{abs}$ at suction port $S$ and $V_g < V_g\text{ max}$

**Caution:** Exceeding the permissible limit values may result in a loss of function, a reduction in 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 RE 90261.

### Determining the size

<table>
<thead>
<tr>
<th>Flow</th>
<th>$q_v = \frac{V_g \times n \times \eta_v}{1000}$ L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque</td>
<td>$T = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{mh}}$ Nm</td>
</tr>
<tr>
<td>Power</td>
<td>$P = \frac{2 \pi \times T \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$ kW</td>
</tr>
</tbody>
</table>

$V_g$ = Displacement per revolution in cm$^3$

$\Delta p$ = Differential pressure in bar

$n$ = Speed in rpm

$\eta_v$ = Volumetric efficiency

$\eta_{mh}$ = Mechanical-hydraulic efficiency

$\eta_t$ = Overall efficiency ($\eta_t = \eta_v \times \eta_{mh}$)

**Minimum permissible inlet pressure at suction port $S$ with increased speed**

In order to avoid damage to the pump (cavitation) a minimum inlet pressure at the suction port must be assured. The minimum inlet pressure depends on the speed and the displacement of the variable pump.

**Note:**

- Max. speed $n_{max}$ (limiting speed, see table of values)
- Min. and max. permissible pressure at port $S$
Technical Data

Permissible radial and axial loading on the drive shaft

The specified values are maximum values and do not apply to continuous operation.

<table>
<thead>
<tr>
<th>Size</th>
<th>Radial force, max. at distance a from shaft collar</th>
<th>Radial force/bar operating pressure</th>
<th>Axial force, max.</th>
<th>Permissible axial force/bar operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F_{q\text{ max}}$ N</td>
<td>$F_{q}/\text{bar}$ N/bar</td>
<td>$F_{ax\text{ max}}$ N</td>
<td>$\pm F_{ax\text{ perm}/\text{bar}}$ N/bar</td>
</tr>
<tr>
<td>28</td>
<td>5696</td>
<td>14.2</td>
<td>315</td>
<td>4.6</td>
</tr>
<tr>
<td>55</td>
<td>9280</td>
<td>23.2</td>
<td>500</td>
<td>7.5</td>
</tr>
<tr>
<td>80</td>
<td>11657</td>
<td>29.1</td>
<td>710</td>
<td>9.6</td>
</tr>
<tr>
<td>107</td>
<td>13580</td>
<td>34</td>
<td>900</td>
<td>11.3</td>
</tr>
<tr>
<td>160</td>
<td>18062</td>
<td>45.2</td>
<td>1120</td>
<td>15.1</td>
</tr>
</tbody>
</table>

1) For toothed gear drive (DIN 867) with minimum pinion pitch circle diameter $D_{R\text{ min}}$ and $V_{g\text{ max}}$ ($D_{R\text{ min}} = 2.5 \times D_{\text{ shaft end}}$). Necessary pre-tension/bar operating pressure (radial force) for transmitting the torque with v-belt drive (DIN 7753) with minimum gear diameter $D_{K\text{ min}}$ and $V_{g\text{ max}}$ ($D_{K\text{ min}} = 5 \times D_{\text{ shaft end}}$).

2) Max. permissible axial force when at a downtime or when axial piston unit operating in depressurized condition.

When considering the permissible axial force, the force-transfer direction must be taken into account.

$- F_{ax\text{ max}} = \text{increase in service life of bearings}$

$+ F_{ax\text{ max}} = \text{reduction in service life of bearings (avoid if possible)}$

Effect of radial force $F_{q}$ on the service life of bearings

By selecting a suitable force-transfer direction of $F_{q}$, the stress on the bearings caused by the internal transmission forces can be reduced, thus achieving the optimum service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

Toothed gear drive

![Toothed gear drive diagram](image)

V-belt drive

![V-belt drive diagram](image)
LR - Power Controller

The power controller controls the displacement of the pump depending on the operating pressure so that a defined drive power is not exceeded at a constant drive speed.

\[ p_B \cdot V_g = \text{constant} \]

\( p_B \) = operating pressure; \( V_g \) = displacement

The precision of the control along the hyperbolic characteristic provides for optimum power utilization.

Operating pressure is applied to the rocker via a measuring piston. This is countered by the force of an externally adjustable spring. This determines the power setting.

If the operating pressure exceeds the set force of the spring, the rocker actuates the control valve and the pump swivels back (towards \( V_g \min \)). Here, the leverage on the rocker is shortened and the operating pressure is able to rise in the same ratio as the displacement is reduced with exceeding the drive power (\( p_B \cdot V_g = \text{constant} \)).

When not under pressure, the pump is swiveled back to its initial position at \( V_g \max \) by a return spring.

Setting range for start of control \( 50 \text{ – } 220 \) bar

The hydraulic output power (LR characteristic) is influenced by the efficiency of the pump.

Please state in clear text when ordering:

- Drive power \( P \) in kW
- Drive speed \( n \) in rpm
- Max. flow \( q_{v \max} \) in l/min

After clarifying the details a power diagram can be created by our computer.
**LR - Power Controller**

**LRD  Power Controller with Pressure Cut-Off**

The pressure cut-off corresponds to a pressure control which, after reaching the set pressure, adjusts the displacement of the pump to $V_{g\ min}$.

This function overlies the power control, i.e. the power control is executed at levels below the pressure setting.

The pressure cut-off has a fixed default pressure setting.

Setting range for pressure cut-off 200 – 350 bar

When ordering, please state the pressure cut-off setting in plain text.

**Note:**

- The maximum permissible setting for the pressure cut-off must be a factor of 5 greater than that at start of power control.
  
  Example: start of control (power control): 50 bar
  
  max. permissible setting for pressure cut-off: $50 \text{ bar} \times 5 = 250 \text{ bar}$

- On versions with pressure cut-off, a case drain line to the tank is needed (port T1).
  
  When the case drain port is plugged and $t_{tank} \leq 50^{\circ}C$, the permissible actuated time for the pressure cut-off is ≤ 2 min.

- A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the setting for pressure cut-off when it starts to open.
LRH1 Hydraulic stroke limiter
(negative control)

Control from $V_{g \text{max}}$ to $V_{g \text{min}}$

With increasing pilot pressure the pump swivels to a smaller displacement.

Setting range for start of control ___________ 4 – 15 bar

Please specify start of control in plain text when ordering.

Initial position without actuation signal (pilot pressure): $V_{g \text{max}}$

LRH1 characteristic

Pilot pressure increase $(V_{g \text{max}} - V_{g \text{min}})$ __________ $\Delta p = 25$ bar

LRH1 circuit diagram

LRDH1 circuit diagram
**DR - Pressure Controller**

Within its control range, the pressure controller maintains the pressure in a hydraulic system at a constant level, even if the flow is variable. The variable pump supplies only the amount of hydraulic fluid that is actually required by the consumers. If the operating pressure exceeds the setpoint value set at the integrated pressure control valve, the pump will automatically move back and the control deviation will be reduced.

When not under pressure, the pump is swiveled back to its initial position at $V_{g\max}$ by a control spring.

Setting range for pressure control $50 \rightarrow 350$ bar

When ordering, please state the pressure controller setting in plain text.

**Note:**
- On versions with DR pressure controller, a case drain line from port $T_1$ to the tank is needed.
- A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the controller setting when it starts to open.

**Zero stroke operation**

The standard version is configured for intermittent pressure control operation. Short-term zero stroke operation ($< 10$ min.) is permissible to an operating pressure of $p_{\text{max}} = 315$ bar at a tank temperature $\leq 50^\circ$C.

For long-term periods of zero stroke operation the bearings should be flushed at port $U$.

**DR characteristic**

![Diagram of DR characteristic](image)

**DR circuit diagram**

![Diagram of DR circuit](image)

**Flushing volumes (recommended)**

<table>
<thead>
<tr>
<th>Size</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_{\text{flush}}$ (l/min)</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

Temperature of flushing fluid $\leq$ tank temperature
DRG Pressure Controller

DRG Pressure controller, remote controlled

A sequence valve with port plate assumes the pressure control function. The valve is located separate from the pump, whereby the simple line length of 5 m should not be exceeded. The valve is supplied with high pressure from port A1 of the pump. The control pressure from the valve is fed back to the pump via port X3, which adjusts the displacement of the pump to \( V_{g\, \text{min}} \). Please ensure that the ports T on the sequence valve and T1 on the pump are fed back to the tank (cooler).

Setting range for pressure control: 50 – 315 bar

When ordering, please state the pressure controller setting in plain text.

Note:

- A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the controller setting when it starts to open.

The sequence valve and port plate must be ordered separately.

Sequence valve: DZ5DP2-1X/315YMSO21 (Mat.No. R900495604)
Port plate: G 115/1 (Mat.No. R900424379)

DRG characteristic

![DRG characteristic graph]

Flow \( q_v \) in l/min

DRG circuit diagram

![DRG circuit diagram]

Item (1) is not included in supply of the pump.
DR - Pressure Controller

**DRS Pressure controller with load sensing**

The load-sensing controller is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the actuator flow requirement.

The flow depends here on the cross section of the external measuring orifice (1) fitted between the pump outlet and the actuator. The flow is independent of the load pressure below the pressure control setting and within the control range of the pump.

The measuring orifice is usually a separately arranged load sensing directional valve (control block). The position of the directional valve piston determines the opening cross section of the measuring orifice and thus the flow of the pump.

The load-sensing control compares pressure before and after the measuring orifice and maintains the pressure drop (differential pressure $\Delta p$) and thus the flow constant.

If the differential pressure $\Delta p$ increases, the pump is swiveled back (towards $V_g\min$), and if the differential pressure $\Delta p$ decreases, the pump is swiveled out (towards $V_g\max$), until equilibrium is restored in the valve.

$$\Delta p_{\text{Measuring orifice}} = p_{\text{Pump}} - p_{\text{Consumer}}$$

**Setting range for $\Delta p$**

14 – 25 bar

**Standard setting**

18 bar (please state in clear text).

The standby pressure in zero stroke operation (measuring orifice plugged) is slightly above the $\Delta p$ setting

(1) The measuring orifice (control block) is not included in the supply.
HD - Hydraulic Control, Pilot-Pressure Related

The pilot-pressure related control proportionally and infinitely variable the displacement if the pump with a pilot pressure at port X₁.

Maximum permissible pilot pressure \( p_{St \, max} = 40 \) bar

Control from \( V_g \, min \) to \( V_g \, max \).

With increasing pilot pressure the pump swivels to a higher displacement.

Setting range for start of control \( 4 \) – \( 15 \) bar

Please specify start of control in plain text when ordering.

A control pressure of 40 bar is needed to swivel the pump from its initial position \( V_g \, min \) to \( V_g \, max \).

The required control pressure is taken either from the operating pressure, or from the externally applied control pressure at the \( Y_3 \) port.

To ensure the control even at low operating pressure < 40 bar the port \( Y_3 \) must be supplied with an external control pressure of approx. 40 bar.

**Characteristic HD1**

Pilot pressure increase \( V_g \, min \) to \( V_g \, max \) \( \Delta p = 10 \) bar

![Characteristic HD1](image)

**Characteristic HD2**

Pilot pressure increase \( V_g \, min \) to \( V_g \, max \) \( \Delta p = 25 \) bar

![Characteristic HD2](image)
HD - Hydraulic Control, Pilot-Pressure Related

HD.G Hydraulic control, for pressure cut-off, remote controlled

A sequence valve with port plate assumes the pressure cut-off function. The valve is located separate from the pump, whereby the simple line length of 5 m should not be exceeded. The valve is supplied with high pressure from port A₁ of the pump. The control pressure for the pump is fed into the valve via port X₃ and is diverted to the tank at port A on the port plate of the sequence valve, enabling the pump to be controlled to \( V_{g \text{ min}} \) if the set pressure setpoint is exceeded.

Setting range for pressure control \( 50 - 315 \) bar

When ordering, please state the pressure controller setting in plain text.

Note:
- Port A from the sequence valve must be fed back to the tank (cooler)
- A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the controller setting when it starts to open.

The sequence valve and port plate must be ordered separately.

Sequence valve: DZ5DP2-1X/315XYMSO20  
(Mat.No. R900490554)
Port plate: G 115/t (Mat.No. R900424379)

HD.G characteristic

The spring return in the control unit is not a security device.

The control spool and/or the positioning piston can be blocked in an undefined position by internal contamination – e.g. impure hydraulic fluid, abrasion or residual contamination from system components. As a result, the variable pump can no longer provide the speed and torque specified by the operator.

- Install an appropriate emergency-off function to ensure that the driven consumer can be brought to a safe position (e.g. immediate stop).
- Maintain the specified cleanliness level 20/18/15 (< 90°C) or 19/17/14 (> 90°C) in accordance with ISO 4406.
With the electric control with proportional solenoid, the pump displacement is adjusted proportionally and steplessly to the current by means of the magnetic force.

Control from $V_{g \text{ min}}$ to $V_{g \text{ max}}$

With increasing control current the pump swivels to a higher displacement.

A control pressure of 40 bar is needed to swivel the pump from its initial position $V_{g \text{ min}}$ to $V_{g \text{ max}}$.

The required control pressure is taken either from the operating pressure, or from the externally applied control pressure at the $Y_3$ port.

To ensure the control even at low operating pressure < 40 bar the port $Y_3$ must be supplied with an external control pressure of approx. 40 bar.

**Note:**
The pump with EP control in the fluid tank may only be installed if mineral hydraulic oil are used and the fluid temperature in the tank is no greater than 80°C.

The following electronic controllers and amplifiers are available for controlling the proportional solenoids (sizes 28 to 200) (information is also available on the Internet at www.boschrexroth.com/mobile-electronics):
- 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

The use of a proportional amplifier means that the control time can be influenced.

**Technical data solenoid**

<table>
<thead>
<tr>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td>Control current</td>
</tr>
<tr>
<td>Start of control at $V_{g \text{ max}}$</td>
</tr>
<tr>
<td>End of control at $V_{g \text{ max}}$</td>
</tr>
<tr>
<td>Limiting current</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
</tr>
<tr>
<td>Dither frequency</td>
</tr>
<tr>
<td>Actuated time</td>
</tr>
<tr>
<td>Type of protection (HIRSCHMANN) according to DIN EN 60529</td>
</tr>
</tbody>
</table>

**EP characteristic**

![EP characteristic graph](image)

**EP circuit diagram**

![EP circuit diagram](image)

**ED.G** Electric control, for pressure cut-off, remote controlled

see HD.G

**Note**

The spring return in the control unit is not a security device.

The control spool and/or the positioning piston can be blocked in an undefined position by internal contamination – e.g. impure hydraulic fluid, abrasion or residual contamination from system components. As a result, the variable pump can no longer provide the speed and torque specified by the operator.

- Install an appropriate emergency-off function to ensure that the driven consumer can be brought to a safe position (e.g. immediate stop).
- Maintain the specified cleanliness level 20/18/15 (< 90°C) or 19/17/14 (> 90°C) in accordance with ISO 4406.
Unit Dimensions, Size 28

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation.

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 28

Shaft ends

Z  Splined shaft DIN 5480
   W25x1.25x30x18x9g

P  Cyl. shaft with key
   DIN 6885, AS8x7x40

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Fixing Thread</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Service line port (high-pressure series)</td>
<td>SAE J518</td>
<td>3/4 in</td>
</tr>
<tr>
<td>A</td>
<td>Service line port (high-pressure series)</td>
<td>SAE J518</td>
<td>1 1/2 in</td>
</tr>
<tr>
<td>S</td>
<td>Suction port (standard series)</td>
<td>SAE J518</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing 3)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Air bleed 3)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>High pressure 3)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Pilot fluid drain 4)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>Override 3)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>Y3</td>
<td>External control pressure 3)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>X1</td>
<td>Pilot pressure</td>
<td>DIN 3852</td>
<td></td>
</tr>
</tbody>
</table>

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 32
3) Plugged
4) Plugged, only DR, ..D.. open

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 28

**LRD**
Power controller with pressure cut-off

**DR/DRG**
Pressure controller, remote controlled

**HD1/HD1G/HD2/HD2G**
Hydraulic control for pressure cut-off, remote controlled

**EP/EPG**
Electric control for pressure cut-off, remote controlled

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 55

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 55

Shaft ends

Z  Splined shaft DIN 5480
   W30x2x30x14x9g

P  Cyl. shaft with key
   DIN 6885, AS8x7x50

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Function</th>
<th>Series</th>
<th>Fixing Thread</th>
<th>Diameter</th>
<th>Depth</th>
<th>Torque</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B and A</td>
<td>Service line port (high-pressure series)</td>
<td>SAE J518</td>
<td>DIN 13</td>
<td>M10x1.5; 17 deep</td>
<td>3/4 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Suction port (standard series)</td>
<td>SAE J518</td>
<td>DIN 13</td>
<td>M12x1.75; 20 deep</td>
<td>2 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing 3)</td>
<td>DIN 3852</td>
<td>M18x1.5; 12 deep</td>
<td>140 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Air bleed 3)</td>
<td>DIN 3852</td>
<td>M18x1.5; 12 deep</td>
<td>140 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>High pressure 3)</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Pilot fluid drain 4)</td>
<td>DIN 3852</td>
<td>M12x1.5; 12 deep</td>
<td>50 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>Override 3)</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y3</td>
<td>External control pressure 3)</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X1</td>
<td>Pilot pressure</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X4</td>
<td>Load pressure</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
<td>4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 32
3) Plugged
4) Plugged, only DR, ..D.. open

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 55

**LRD**  
Power controller with pressure cut-off

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

**LRDH1**  
Power controller with pressure cut-off, stroke limiter

**DR/DRG**  
Pressure controller, remote controlled

**DRS**  
Pressure controller with load sensing

**HD1/HD1G/HD2/HD2G**  
Hydraulic control for pressure cut-off, remote controlled

**EP/EPG**  
Electric control for pressure cut-off, remote controlled
Unit Dimensions, Size 80

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 80

Shaft ends

**Z**  Splined shaft DIN 5480
   W35x2x30x16x9g

**P**  Cyl. shaft with key
   DIN 6885, AS10x8x56

Ports

- **B and A**  Service line port (high-pressure series)
  - Fixing thread: SAE J518 DIN 13 M12x1.75; 17 deep

- **S**  Suction port (standard series)
  - Fixing thread: SAE J518 DIN 13 M12x1.75; 17 deep

- **U**  Bearing flushing ³)
  - Fixing thread: DIN 3852 M18x1.5; 12 deep 140 Nm ³)

- **R**  Air bleed ³)
  - Fixing thread: DIN 3852 M18x1.5; 12 deep 140 Nm ³)

- **A1**  High pressure ³)
  - Fixing thread: DIN 3852 M16x1.5; 12 deep 100 Nm ³)

- **T1**  Pilot fluid drain ⁴)
  - Fixing thread: DIN 3852 M12x1.5; 12 deep 50 Nm ²)

- **X3**  Override ³)
  - Fixing thread: DIN 3852 M16x1.5; 12 deep 100 Nm ³)

- **Y3**  External control pressure ³)
  - Fixing thread: DIN 3852 M14x1.5; 12 deep 80 Nm ³)

- **X1**  Pilot pressure
  - Fixing thread: DIN 3852 M14x1.5; 12 deep 80 Nm ³)

- **X4**  Load pressure
  - Fixing thread: DIN 3852 M14x1.5; 12 deep 80 Nm ³)

¹) Center bore according to DIN 332 (thread according to DIN 13)
²) Please observe the general notes for the max. tightening torques on page 32
³) Plugged
⁴) Plugged, only DR, ..D.. open
Unit Dimensions, Size 80

**LRD**
Power controller with pressure cut-off

**LRDH1**
Power controller with pressure cut-off, stroke limiter

**DR/DRG**
Pressure controller, remote controlled

**DRS**
Pressure controller with load sensing

**HD1/HD1G/HD2/HD2G**
Hydraulic control for pressure cut-off, remote controlled

**EP/EPG**
Electric control for pressure cut-off, remote controlled

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 107

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
**Unit Dimensions, Size 107**

**Shaft ends**

- **Z** Spline shaft DIN 5480
  - W40x2x30x18x9g
  - Shaft ends

- **P** Cyl. shaft with key
  - DIN 6885, AS12x8x63

**Ports**

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Fixing Thread</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Service line port (high-pressure series)</td>
<td>SAE J518, 1 in</td>
</tr>
<tr>
<td>A</td>
<td>Pilot</td>
<td>DIN 13, M12x1.75; 17 deep</td>
</tr>
<tr>
<td>S</td>
<td>Suction port (standard series)</td>
<td>SAE J518, 2 1/2 in</td>
</tr>
<tr>
<td>U</td>
<td>Bearing flushing</td>
<td>DIN 3852, M18x1.5; 12 deep</td>
</tr>
<tr>
<td>R</td>
<td>Air bleed</td>
<td>DIN 3852, M18x1.5; 12 deep</td>
</tr>
<tr>
<td>A1</td>
<td>High pressure</td>
<td>DIN 3852, M16x1.5; 12 deep</td>
</tr>
<tr>
<td>T1</td>
<td>Pilot fluid drain</td>
<td>DIN 3852, M12x1.5; 12 deep</td>
</tr>
<tr>
<td>X3</td>
<td>Override</td>
<td>DIN 3852, M18x1.5; 12 deep</td>
</tr>
<tr>
<td>Y3</td>
<td>External control pressure</td>
<td>DIN 3852, M14x1.5; 12 deep</td>
</tr>
<tr>
<td>X1</td>
<td>Pilot pressure</td>
<td>DIN 3852, M14x1.5; 12 deep</td>
</tr>
<tr>
<td>X4</td>
<td>Load pressure</td>
<td>DIN 3852, M14x1.5; 12 deep</td>
</tr>
</tbody>
</table>

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 32
3) Plugged
4) Plugged, only DR, D.. open

---

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 107

**LRD**
Power controller with pressure cut-off

**LRDH1**
Power controller with pressure cut-off, stroke limiter

**DR/DRG**
Pressure controller, remote controlled

**DRS**
Pressure controller with load sensing

**HD1/HD1G/HD2/HD2G**
Hydraulic control for pressure cut-off, remote controlled

**EP/EPG**
Electric control for pressure cut-off, remote controlled

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 160

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation.

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 160

Shaft ends

Z  Splined shaft DIN 5480
    W45x2x30x21x9g

P  Cyl. shaft with key
    DIN 6885, AS14x9x70

Ports

B and A  Service line ports (high-pressure series)  SAE J518  1 ⅛ in
    Fixing thread  DIN 13  M14x1.5; 19 deep
S  Suction port (standard series)  SAE J518  3 in
    Fixing thread  DIN 13  M16x1.5; 24 deep
U  Bearing flushing ²)
R  Air bleed ²)
A1  High pressure ³)
T1  Pilot fluid drain ⁴)
X3  Override ³)
Y3  External control pressure ³)
X1  Pilot pressure
X4  Load pressure

²) Center bore according to DIN 332 (thread according to DIN 13)
³) Please observe the general notes for the max. tightening torques on page 32
⁴) Plugged

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 160

**LRD**
Power controller with pressure cut-off

**LRDH1**
Power controller with pressure cut-off, stroke limiter

**DR/DRG**
Pressure controller, remote controlled

**DRS**
Pressure controller with load sensing

**HD1/HD1G/HD2/HD2G**
Hydraulic control for pressure cut-off, remote controlled

**EP/EPG**
Electric control for pressure cut-off, remote controlled

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

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 chamber is internally connected to the suction chamber. A case drain line to the tank is not required.

Exception: when operated with pressure controller or pressure cut-off.
In all operational states, the suction line must flow into the tank below the minimum fluid level.
The minimum suction pressure at port S must not fall below 0.8 bar absolute.

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

Below-tank installation (standard)
Pump below the minimum fluid level of the tank.
Recommended installation positions: 1 and 2.

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleeding</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R1</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>R2</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>R1, R2</td>
<td>S</td>
</tr>
<tr>
<td>4</td>
<td>U</td>
<td>S</td>
</tr>
</tbody>
</table>
General Notes

- The A7VO pump is designed to be used in open circuits.
- Project planning, assembly and commissioning of the pump 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 pump and especially on the solenoids. Take suitable safety precautions, e.g. wear protective clothing.
- There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).
- Tightening torques:
  - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
  - Manufacturer’s instructions for the max. permissible tightening torques of the used fittings must be observed!
  - For DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.
- The data and information contained herein must be adhered to.