Variable Displacement Pump A11VO
for open circuits

Sizes 40... 260
Series 1
Nominal pressure 350 bar
Peak pressure 400 bar

Features

- Variable displacement pump with axial piston drive swashplate design for hydrostatic drives in open circuits
- Designed primarily for use in mobile applications
- Pump operation either self-priming, with tank charging or charging pump
- A comprehensive range of variable units is available for different control functions
- Power can be adjusted from the outside, even when the machine is running
- The through drive is suitable for attachment of gear pumps and axial piston pumps up to the same size, i.e. 100% through drive
- The volume flow is adjustable in proportion to the drive speed and displacement and is infinitely variable from $q_{V_{\text{max}}}$ to $q_{V_{\text{min}}} = 0$
## Fluid
Mineral oil (no short code)

## Axial piston unit
Variable displacement, swashplate design | A11V

## Charging pump (impeller)

<table>
<thead>
<tr>
<th>Fluid</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>without pump</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with pump</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

## Operating mode
Pump, open circuits

## Size
\( V_{g,\text{max}} \) (cm³)

<table>
<thead>
<tr>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
</table>

## Control devices

<table>
<thead>
<tr>
<th>Power control</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>with override</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cross-sensing</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>high pressure dependent</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>pilot pressure dependent, negative</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>pilot pressure dependent, positive</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with 12V solenoid, negative</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with 24V solenoid, negative</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with pressure cut-off</td>
<td>D</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>2-stage</td>
<td>E</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>remote controlled</td>
<td>G</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with load sensing</td>
<td>S</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>electric override</td>
<td>S2</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>hydraulic override</td>
<td>S5</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with stroke limiter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>negative control, ( \Delta p = 25 \text{ bar} )</td>
<td>H1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>negative control, ( \Delta p = 10 \text{ bar} )</td>
<td>H5</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>positive control, ( \Delta p = 25 \text{ bar} )</td>
<td>H2</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>positive control, ( \Delta p = 10 \text{ bar} )</td>
<td>H6</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>positive control, ( U = 12 \text{ V} )</td>
<td>U1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>positive control, ( U = 24 \text{ V} )</td>
<td>U2</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

### Pressure control

<table>
<thead>
<tr>
<th>Pressure control</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>with load sensing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic control, ( \Delta p = 10 \text{ bar} )</td>
<td>HD1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>pilot pressure dependent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with pressure cut-off</td>
<td>D</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with pressure cut-off, remote controlled</td>
<td>G</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Electric control, ( U = 12 \text{ V} )</td>
<td>EP1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>with proportional solenoid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with pressure cut-off</td>
<td>D</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

For controls with several additional functions, follow the order of the columns. Only one option possible in each column (e.g. LRDCH2).

Note that the following combinations are not possible with the power control:

\( \ldots \text{GS, GS2, GS5, EC} \) and the combination \( \ldots \text{DG} \) in conjunction with stroke limiters H1, H2, H5, H6, U1 and U2.

- = available
○ = available on request
– = not available

= preferred program (preferred types see page 48)
### Axial piston unit
- **Charging pump**
- **Operating mode**
- **Size**
- **Control devices**

### Series
- **Index**
  - Sizes 40...130: 0
  - Sizes 190...260: 1

### Direction of rotation
- Viewed on shaft end: clockwise
  - **R**
  - anti-clockwise
  - **L**

### Seals
- NBR (nitrile rubber), shaft seal FKM (fluoride rubber)
  - **N**

### Shaft end

<table>
<thead>
<tr>
<th>Size</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splined shaft DIN 5480 for individual pumps and pump combinations</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Cylindrical shaft with key DIN 6885</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Splined shaft ANSI B92.1a-1976 standard for single pump</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>standard for combination pump</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Mounting flange
- SAE J744 – 2 hole
  - ✔ ✔ – – – – – C
- SAE J744 – 4 hole
  - – – ✔ ✔ ✔ ✔ ✔ D

### Connection for service lines
- Pressure port and suction port SAE side ports (metric threads)
  - ✔ ✔ ✔ ✔ ✔ ✔ ✔ 12

### Through drive (for mounting options see page 30)

<table>
<thead>
<tr>
<th>Flange SAE J744 2)</th>
<th>Splined shaft hub</th>
</tr>
</thead>
<tbody>
<tr>
<td>– – 82-2 (A) 5/8in</td>
<td>9T 16/32DP 3) ✔ ✔ ✔ ✔ ✔ K00</td>
</tr>
<tr>
<td>3/4in 11T 16/32DP 3)</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ K52</td>
</tr>
</tbody>
</table>

### Swivel angle display
- without swivel angle display (no short code)
  - ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ V
- with optical swivel angle display
  - ✔ – ✔ ✔ ✔ ✔ ✔ ✔ R
- with electric swivel angle display

1) S shaft suitable for combination pump  
2) 2 =^ 2 hole, 4 =^ 4 hole  
3) Splined shaft hub to DIN 5480  
4) Splined shaft hub to ANSI B92.1a-1976 (splined shaft allocation to SAE J744, see pages 42/43)
Technical Data

Hydraulic Fluid

We request that before starting a project, detailed information about the choice of hydraulic fluids and application conditions are taken from our catalogue sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic oils) and RE 90223 (HF hydraulic fluids).

The A11VO variable displacement pump is not suitable for operation with HFA, HFB and HFC. When operating with HFD or environmentally acceptable hydraulic fluids, restrictions in the technical data should be noted – please contact us (the hydraulic fluid used should be stated in clear text in the order).

Operating viscosity range

We recommend that the operating viscosity (at operating temperature), for both the efficiency and life of the unit, be chosen within the optimum range of:

\[ \nu_{\text{opt}} = \text{opt. operating viscosity} 16\ldots36 \text{ mm}^2/\text{s} \]

referred to tank temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

- \( \nu_{\text{min}} = 5 \text{ mm}^2/\text{s} \)
- short term, at a max. permissible leakage oil temperature \( t_{\text{max}} = 115^\circ\text{C} \)
- \( \nu_{\text{max}} = 1600 \text{ mm}^2/\text{s} \) short term, on cold start (\( t_{\text{min}} = -40^\circ\text{C} \))

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

At temperatures of \(-25^\circ\text{C}\) to \(-40^\circ\text{C}\) special measures may be required.

Please contact us for further information.

Notes on the selection of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range \( \nu_{\text{opt}} \) (see shaded section of the selection diagram). We recommend that the higher viscosity grade is selected in each case.

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

Important: The leakage oil temperature is influenced by pressure and speed and is typically higher than the tank temperature. However, maximum temperature at any point in the system must be less than \( 115^\circ\text{C} \).

Please consult Brueninghaus Hydromatik if the above conditions cannot be kept at extreme operating parameters or because of high ambient temperature.

Selection diagram
Filtration
The finer the filtration, the better the achieved purity grade of the hydraulic fluid and the longer the life of the axial piston unit.
To ensure the functioning of the axial piston unit, a minimum purity grade of
9 to NAS 1638
18/15 to ISO/DIS 4406 is necessary.
At very high hydraulic fluid temperatures, a minimum purity grade of
8 to NAS 1638
17/14 to ISO/DIS 4406 is necessary.
If the above mentioned grades cannot be maintained, please consult us.

Input operating pressure range
Absolute pressure at port S (suction port)
Version without charging pump
\[ p_{\text{abs min}} = 0.8 \text{ bar} \]
\[ p_{\text{abs max}} = 30 \text{ bar} \]
Please consult us if the pressure is > 5 bar.
Version with charging pump
\[ p_{\text{abs min}} = 0.6 \text{ bar} \]
\[ p_{\text{abs max}} = 2 \text{ bar} \]

Output operating pressure range
Pressure at port A or B
Nominal pressure \( p_N \)
\[ p_N = 350 \text{ bar} \]
Peak pressure \( p_{\text{max}} \)
\[ p_{\text{max}} = 400 \text{ bar} \]

Case drain pressure
Maximum permissible pressure of the leakage fluid at ports T1 and T2
\[ p_L = 2 \text{ bar abs.} \]
A drain oil line to the tank is necessary.

Flushing the housing
If a variable displacement pump with variable displacement units EP, HD, DR or with stroke limiter (H., U.) is operated for an extended period (t > 10 min) with zero volume flow or operating pressure < 15 bar, the housing should be flushed via one of the ports T1, T2 or R to avoid overheating.

<table>
<thead>
<tr>
<th>NG</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>( q_V ) flush (L/min)</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

It is not necessary to flush the housing on the version with charging pump (A11VLO).
## Technical Data

### Table of values, (theoretical values, regardless of \(\eta_{mh}\) and \(\eta_v\); approximate values)

<table>
<thead>
<tr>
<th>Size</th>
<th>A11VO (with charging pump)</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>(V_g) max (\text{cm}^3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(V_g) min (\text{cm}^3)</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>Max. speed 1) at (V_g) max</td>
<td>(n_{max}) (\text{min}^{-1})</td>
<td>3000</td>
<td>2700</td>
<td>2550</td>
<td>2350</td>
<td>2100</td>
<td>1800</td>
<td>1500</td>
<td>1800</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>Max. speed 3) at (V_g \leq V_{g \text{max}})</td>
<td>(n_{max}) (\text{min}^{-1})</td>
<td>3500</td>
<td>3250</td>
<td>3000</td>
<td>2780</td>
<td>2500</td>
<td>2300</td>
<td>2300</td>
<td>2300</td>
<td>2300</td>
<td>2300</td>
</tr>
<tr>
<td>Flow 4) at (n_{max}) and (V_g \leq V_{g \text{max}})</td>
<td>(q_{V \text{max}}) (\text{L/min})</td>
<td>122</td>
<td>153</td>
<td>183</td>
<td>214</td>
<td>265</td>
<td>393</td>
<td>454</td>
<td>315</td>
<td>467</td>
<td>580</td>
</tr>
<tr>
<td>Power at (q_{V \text{max}}) and (\Delta p = 350) bar</td>
<td>(P_{max}) (\text{kW})</td>
<td>73</td>
<td>92</td>
<td>110</td>
<td>129</td>
<td>159</td>
<td>236</td>
<td>273</td>
<td>190</td>
<td>281</td>
<td>349</td>
</tr>
<tr>
<td>Torque at (V_{g \text{max}}) and (\Delta p = 350) bar</td>
<td>(T_{max}) (\text{Nm})</td>
<td>234</td>
<td>324</td>
<td>412</td>
<td>522</td>
<td>724</td>
<td>1073</td>
<td>1448</td>
<td>724</td>
<td>1073</td>
<td>1448</td>
</tr>
<tr>
<td>Moment of inertia about the drive axis</td>
<td>(J) (\text{kgm}^2)</td>
<td>0,0048</td>
<td>0,0082</td>
<td>0,0115</td>
<td>0,0173</td>
<td>0,0318</td>
<td>0,055</td>
<td>0,0878</td>
<td>0,0337</td>
<td>0,0577</td>
<td>0,0895</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>(m) (\text{kg})</td>
<td>28</td>
<td>36</td>
<td>45</td>
<td>53</td>
<td>66</td>
<td>95</td>
<td>125</td>
<td>69</td>
<td>100</td>
<td>130</td>
</tr>
</tbody>
</table>

1) The values are quoted for an absolute pressure \(p_{abs}\) of 1 bar at suction port \(S\) and mineral fluid.
2) The values are quoted for an absolute pressure \(p_{abs}\) of at least 0.8 bar at suction port \(S\) and mineral operating fluid.
3) The values are quoted for \(V_g \leq V_{g \text{max}}\) or increase of the input pressure \(p_{abs}\) at suction port \(S\) (see graph on page 5).
4) Allows for 3\% displacement loss.

### Determination of size

\[
q_V = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad \text{in L/min}
\]
\[
\Delta p = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad \text{in bar}
\]
\[
\eta_v = \text{volumetric efficiency}
\]
\[
\eta_{mh} = \text{mechanical-hydraulic efficiency}
\]
\[
\eta_t = \text{total efficiency (}\eta_t = \eta_v \cdot \eta_{mh})
\]

### Drive

**Permissible radial and axial loading of drive**

<table>
<thead>
<tr>
<th>Size</th>
<th>40</th>
<th>60</th>
<th>75</th>
<th>95</th>
<th>130</th>
<th>190</th>
<th>260</th>
<th>130</th>
<th>190</th>
<th>260</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance of (F_q) (from shaft collar)</td>
<td>(F_{q a, b, c})</td>
<td>mm</td>
<td>17,5</td>
<td>17,5</td>
<td>20</td>
<td>20</td>
<td>22,5</td>
<td>26</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Max. permissible radial force at</td>
<td>(F_{q \text{max}})</td>
<td>N</td>
<td>3600</td>
<td>5000</td>
<td>6300</td>
<td>8000</td>
<td>11000</td>
<td>16925</td>
<td>22000</td>
<td></td>
</tr>
<tr>
<td>Max. permissible axial force</td>
<td>(F_{ax \text{max}})</td>
<td>N</td>
<td>1500</td>
<td>2200</td>
<td>2750</td>
<td>3500</td>
<td>4800</td>
<td>6000</td>
<td>4150</td>
<td></td>
</tr>
</tbody>
</table>
LR Power Control

Power control regulates the pump displacement as a function of operating pressure so that a preset drive output is not exceeded at constant drive speed.

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

\(V_g = \text{displacement}\)

Precise adjustment according to the hyperbolic characteristic ensures optimum power utilisation.

The operating pressure acts, via a piston, on a fulcrum. This is countered by an externally adjustable spring force which determines the power setting.

If the operating pressure exceeds the set spring force, the pilot valve is actuated via the fulcrum and the pump swivels back (direction \(V_g \text{ min}\)). This shortens the lever length at the fulcrum and the operating pressure can increase in the same proportion as the displacement decreases (\(p_B \cdot V_g = \text{constant}\)).

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

When ordering, please state in clear text:
- Drive power \(P\) in kW
- Drive speed \(n\) in rpm
- Max. flow \(q_v\) max in L/min

Once the details have been clarified, a power graph can be produced on our computers.

Characteristic: LR

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

Circuit diagram: LR
**LRD**  Power Control with Pressure Cut-off

**LRD**  Power control with pressure cut-off
Pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to \(V_g\)\(_{\text{min}}\) when the set pressure signal value is reached.
This function overrides power control, i.e. below the pressure signal value, the power control function is performed.
The valve is integrated into the control housing and is permanently set to a pressure signal value at the factory.
Setting range 50 to 350 bar.

**Characteristic: LRD**

\[
\begin{array}{|c|c|c|}
\hline
\text{Setting range} & 350 & 50 \\
\hline
\end{array}
\]

**Circuit diagram: LRD**

**LRE**  Power control with 2-stage pressure cut-off
Sequencing an external pilot pressure at port Y allows the basic pressure cut-off value to be increased by \(50+20\) bar and a second pressure setting to be implemented. This value is higher than the setting value of the primary pressure relief valve and thus switches off pressure cut-off. The pressure signal at port Y must be between 20 and 50 bar.

**Characteristic: LRE**

\[
\begin{array}{|c|c|c|}
\hline
\text{Increased pressure cut-off} & 390 & 370 \\
\text{Pressure cut-off switched off} & 390 & 370 \\
\text{Primary pressure relief valve} & 350 & 320 \\
\text{Basic pressure cut-off value} & 350 & 320 \\
\hline
\end{array}
\]

**Circuit diagram: LRE**
LRS Power Control with Load Sensing

**LRDS**  Power control with pressure cut-off and load sensing

The load sensing control works as a flow controller controlled by load pressure and co-ordinates the pump displacement to the quantity required by the actuator.

The pump flow depends on the external orifice (control block, throttle valve) switched between the pump and the actuator, but is not affected by the load pressure over the whole range below the pressure signal value.

The valve compares the pressure upstream of the orifice with the downstream pressure and keeps the pressure drop (differential pressure $\Delta p$) occurring here, and hence the flow, constant.

If the differential pressure rises, the pump is swivelled back (direction $V_g_{\text{min}}$). If the differential pressure $\Delta p$ drops, the pump is swivelled out (direction $V_g_{\text{max}}$) until balance is restored in the valve.

$$\Delta p_{\text{orifice}} = p_{\text{pump}} - p_{\text{actuator}}$$

The setting range for $\Delta p$ is between 14 bar and 25 bar.

The standard setting is 18 bar (please state in clear text).

The stand-by pressure in zero stroke mode (orifice closed) is slightly higher than the $\Delta p$-setting.

Power control and pressure cut-off override the load sensing control, i.e. the load sensing function is performed below the set hyperbolic characteristic and below the set pressure signal value.

In a standard LS system, pressure cut-off is integrated into the pump control. In an LUDV system, pressure cut-off is integrated into the LUDV valve block.

(1) The orifice (throttle valve) is not included in the supply.

**Characteristic: LRS**

![Characteristic: LRS](image)
LR... Power control with Stroke Limiter

The stroke limiter enables the pump displacement to be infinitely varied or limited across the whole setting range. The displacement is set once proportionally by the pilot current applied at the proportional solenoid or the pilot pressure ... applied at port Y (max. 40 bar). Direct current at 12V (U1) or 24V (U2) respectively is required to trigger the proportional solenoid (insulation IP 54).

The stroke limiter is overridden by the power control, i.e. below the power control characteristic (hyperbolic characteristic) the displacement is set according to the pilot current or pilot pressure. If the power control characteristic is exceeded by the flow set or the operating pressure, the power control overrides and readjusts the displacement according to the hyperbolic characteristic.

To swivel the pump out of its initial position $V_{g\,\text{max}}$ towards $V_{g\,\text{min}}$, a positioning pressure of 30 bar is needed with the electric stroke limiter LRU1/2 and the hydraulic stroke limiter LRH2/6.

The necessary positioning oil is taken from the high pressure or from the external positioning pressure available at port G ($\geq$ 30 bar).

If the operating pressure is $\geq$ 30 bar and $V_{g\,\text{min}} > 0$, no external positioning pressure is required. In this case the change-over valve should be removed from the pump before commissioning (see note in repair instructions RDE 92500-R) and port G should be closed.

---

**LRU1/2  Power control with electric stroke limiter (positive control)**

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

As the pilot current increases, the pump swivels to a higher displacement.

Start of control at approx.: 400 mA (12 V) 200 mA (24 V)

End of control at approx.: 1200 mA (12 V) 600 mA (24 V)

Starting position in unpressurised state: $V_{g\,\text{max}}$

At operating pressure $> 30$ bar the pump swivels from $V_{g\,\text{max}}$ towards $V_{g\,\text{min}}$ (pilot current $< \text{start of control}$)

The following are available to trigger the proportional solenoid:

- Proportional amplifier PV ________________ (see RE 95023)
- Proportional amplifier VT 2000 ___________ (see RE 29904)
- Chopper amplifier CV ___________________ (see RE 95029)
- Microcontroller MC ____________________ (see RE 95050)

---

**Characteristic: LRU2**

![Characteristic Graph](image)

---

**Circuit diagram: LRU1/2**

![Circuit Diagram](image)
LR... Power Control with Stroke Limiter

**LRH1/5** Hydraulic stroke limiter (negative control)
Control from $V_{g_{\text{max}}}$ to $V_{g_{\text{min}}}$
As the pilot pressure rises, the pump swivels to a smaller displacement.
Start of control (at $V_{g_{\text{max}}}$) adjustable from 4 – 10 bar
Please state start of control in clear text when ordering.
Starting position in unpressurised state: $V_{g_{\text{max}}}$

**LRH2/6** Hydraulic stroke limiter (positive control)
Control from $V_{g_{\text{min}}}$ to $V_{g_{\text{max}}}$
As the pilot pressure rises, the pump swivels to a higher displacement.
Start of control (at $V_{g_{\text{min}}}$) adjustable from 4 – 10 bar
Please state start of control in clear text when ordering.
Starting position in unpressurised state: $V_{g_{\text{max}}}$
At operating pressure > 30 bar the pump swivels from $V_{g_{\text{max}}}$ towards $V_{g_{\text{min}}}$ (pilot pressure < start of control)

**Characteristic: H1**
Pilot pressure rise ($V_{g_{\text{max}}} - V_{g_{\text{min}}}$) $\Delta p = 25$ bar

![Characteristic: H1](image1)

**Characteristic: H5**
Pilot pressure rise ($V_{g_{\text{max}}} - V_{g_{\text{min}}}$) $\Delta p = 10$ bar

![Characteristic: H5](image2)

**Circuit diagram: LRH1, LRH5**

**Characteristic: H2**
Pilot pressure rise ($V_{g_{\text{min}}} - V_{g_{\text{max}}}$) $\Delta p = 25$ bar

![Characteristic: H2](image3)

**Characteristic: H6**
Pilot pressure rise ($V_{g_{\text{min}}} - V_{g_{\text{max}}}$) $\Delta p = 10$ bar

![Characteristic: H6](image4)

**Circuit diagram: LRH2, LRH6**
**LR... Power Control with Override**

**LRC  Override with cross-sensing**
Cross-sensing is a total power control (high pressure dependent) which links two A11VO pumps of equal size with LRC control in power control.

If one pump is running at operating pressures below the set start of control, the drive power not drawn, in a limit case up to 100%, is available to the other pump. Total drive power is thus distributed between two actuators as required.

Power released by pressure cut-off or other overrides is disregarded.

**Semi cross-sensing function**
If LRC control is used on the first pump (A11VO) and another pump mounted on the through drive also with power control without cross-sensing, the power required for the second pump is subtracted from the first pump in its setting. The second pump has priority in the total power setting.

---

**LR3  High pressure dependent override**
High pressure dependent power override is a total power control where the power setting is loaded by the operating pressure of an attached fixed displacement pump (port Z).

The A11VO can thus be set to 100% of the total drive power. The power setting of the A11VO is reduced in proportion to the load-dependent rise in the operating pressure of the fixed displacement pump. The fixed displacement pump has priority in the total power setting.

The measuring area for the power reduction is adapted to the displacement of the fixed displacement pump.

---

**LE1/2  Electric override (negative)**
In this case, in contrast to hydraulic power override, the power setting is loaded by a pilot current. This pilot current acts, via a proportional solenoid, against the power control setting spring.

Higher pilot current = power decrease.

Direct current at 12V (E1) or 24V (E2) respectively is required to trigger the proportional solenoid.

The mechanically set basic power setting can be varied by means of different pilot currents.

If the pilot current signal is variably readjusted via a load limit sensing control, the power decrease of all the actuators is adapted to the possible power output of the diesel engine.
**LR... Power Control with Override**

**LG1/2  Pilot pressure dependent override**

An external pilot pressure acts via port Z on the power control setting spring.

The mechanically set basic power setting can be varied by means of different pilot pressure settings.

If the pilot pressure signal is variably readjusted via a load limit sensing control, the power decrease of all the actuators is adapted to the possible power output of the diesel engine.

The pilot pressure used for power control is generated by an external controller which is not part of the A11VO (see also sheet RE 95072, Electronic load limit sensing control for excavators, GLB).

**LG1 Negative power override**

With negative power override LG1, the force resulting from the pilot pressure acts against the power control setting spring, i.e. higher pilot pressure \(\triangleleft\) power decrease.

**LG2 Positive power override**

With positive power override LG2, the force resulting from the pilot pressure supports the power control setting spring, i.e. higher pilot pressure \(\trianglerightarrow\) power increase.

---

**Controlling the power setting**

Operating pressure \(p_{\text{st}}\) (bar)

Displacement \(V_g\)
**DR Pressure Control**

**DR Pressure control**

The pressure control maintains constant pressure in a hydraulic system within its control range despite fluctuations in the flow required. The variable displacement pump delivers only the amount of hydraulic fluid needed by the actuators. If the operating pressure exceeds the pressure signal value set at the integral valve, the pump is automatically swivelled back and the closed loop error reduced.

Starting position in unpressurised state: $V_g \text{ max}$

Setting range 50 to 350 bar.

**Characteristic: DR**

![Flow vs. Pressure Graph]

**Circuit diagram: DR**

**DRS Pressure control with load sensing**

The load sensing control works as a flow controller controlled by load pressure and co-ordinates the pump displacement to the quantity required by the actuator.

The pump flow depends on the external orifice (control block, throttle valve) switched between the pump and the actuator, but is not affected by the load pressure over the whole range below the pressure signal value.

The valve compares the pressure upstream of the orifice with the downstream pressure and keeps the pressure drop (differential pressure $\Delta p$) occurring here, and hence the flow, constant.

If the differential pressure rises, the pump is swivelled back (direction $V_g \text{ min}$). If the differential pressure $\Delta p$ drops, the pump is swivelled out (direction $V_g \text{ max}$) until balance is restored in the valve.

$\Delta p_{\text{orifice}} = p_{\text{pump}} - p_{\text{actuator}}$

The setting range for $\Delta p$ is between 14 bar and 25 bar.

The standard setting is 18 bar (please state in clear text).

The stand-by pressure in zero stroke mode (orifice closed) is slightly higher than the $\Delta p$ setting.

Pressure control overrides the load sensing control, i.e. the load sensing function is performed below the set pressure signal value.

(1) The orifice (throttle valve) is not included in the supply.

**Characteristic: DRS**

![Operating Pressure vs. Flow Graph]

**Circuit diagram: DRS**

(1)
**DR Pressure Control**

**DRG Pressure remote control**
The pressure remote control enables the pressure control setting to be overridden by means of a separate pressure relief valve (1) and a lower pressure signal value can thus be set. Setting range 50 to 350 bar.

Alternatively, the system can be started at low operating pressures (stand-by pressure) by actuating a 2-2 way valve (2), also separately mounted.

Both functions can be carried out separately or in conjunction (see circuit diagram).

The external valves are not included in the supply.

We recommend that the following is used as the separate pressure relief valve (1):

DBDH 6 (manual), see RE 25402.

**DRL Pressure control for parallel operation**
Pressure control DRL is designed for pressure control of several A11VO axial piston pumps arranged in parallel.

The pressure signal valve for all the pumps connected to the system can be preset by means of an external pressure relief valve (1).

Setting range 50 to 350 bar.

Each pump can be disconnected from the system via a 3-2 way valve (2), also separately mounted.

Check valves (3) should as a rule be provided in the main conduit (port A) or control line (port X).

The external valves are not included in the supply.

We recommend that the following is used as the separate pressure relief valve (1):

DBDH 6 (manual), see RE 25402.

**Circuit diagram: DRG**

![Circuit diagram: DRG](image)

**Characteristics: DRG**

<table>
<thead>
<tr>
<th>Operating pressure</th>
<th>Setting range</th>
<th>Operating range</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>max. 10 bar</td>
<td>pmax</td>
</tr>
<tr>
<td>300</td>
<td></td>
<td>350</td>
</tr>
<tr>
<td>250</td>
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</tr>
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<td></td>
<td>100</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

**Flow q in L/min**

**Circuit diagram: DRL**

![Circuit diagram: DRL](image)
HD Hydraulic Control, Pilot Pressure Dependent

Pilot pressure dependent control allows the pump displacement to be infinitely adjusted in proportion to the pilot pressure applied to port Y (max. 40 bar).

Control from \( V_{g_{\text{min}}} \) to \( V_{g_{\text{max}}} \).

As the pilot pressure rises, the pump swivels to a higher displacement.

Start of control (at \( V_{g_{\text{min}}} \)), adjustable from 4 – 10 bar.

Start of control should be stated in clear text when ordering.

Pump starting position in unpressurised state: \( V_{g_{\text{max}}} \)

To swivel the pump from its starting position \( V_{g_{\text{max}}} \) towards \( V_{g_{\text{min}}} \), a positioning pressure of 30 bar is needed (pilot pressure < start of control).

---

### HD Hydraulic control, pilot pressure dependent

**Characteristic: HD1**

Pilot pressure rise \( V_{g_{\text{min}}} \) to \( V_{g_{\text{max}}} \) \( \Delta p = 10 \text{ bar} \)

![Graph](image1)

**Characteristic: HD2**

Pilot pressure rise \( V_{g_{\text{min}}} \) to \( V_{g_{\text{max}}} \) \( \Delta p = 25 \text{ bar} \)

![Graph](image2)

Circuit diagram: HD1, HD2

---

HD.D Hydraulic control with pressure cut-off

Pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to \( V_{g_{\text{min}}} \) when the set pressure signal value is reached.

This function overrides HD control, i.e. below the pressure signal value, the pilot pressure dependent function is performed.

The valve is integrated into the control housing and is permanently set to a pressure signal value at the factory.

Setting range 50 to 350 bar.

---

Circuit diagram: HD1D, HD2D
**EP Electric Control with Proportional Solenoid**

Electric control with proportional solenoid allows the pump displacement to be infinitely set and programmed in proportion to the solenoid force or current strength. The control force at the control spool is applied by a proportional solenoid.

Direct current at 12V (EP1) or 24V (EP2) respectively is required to trigger the proportional solenoid (insulation IP 54).

Control from \(V_g_{min}\) to \(V_g_{max}\)

As the pilot current increases, the pump swivels to a higher displacement.

Start of control at approx.: 400 mA (12 V) 200 mA (24 V)

End of control at approx.: 1200 mA (12 V) 600 mA (24 V)

Starting position in unpressurised state: \(V_g_{max}\)

To swivel the pump from its starting position \(V_g_{max}\) towards \(V_g_{min}\), a positioning pressure of 30 bar is needed (pilot current < start of control).

The necessary positioning oil is taken from the operating pressure if this is \(\geq 30\) bar. If the operating pressure is \(< 30\) bar, the positioning oil has to be taken from the external positioning pressure available at port G (\(\geq 30\) bar).

If the operating pressure is \(\geq 30\) bar and \(V_g_{min} > 0\), no external positioning pressure is required. In this case the change-over valve should be removed from the pump before commissioning (see note in repair instructions RDE 92500-R) and port G should be closed.

**Important:**

Pump with EP control should be fitted in the tank only if mineral hydraulic fluid is used and the oil temperature in the tank does not exceed 80°C.

The following are available to trigger the proportional solenoid:

- Proportional amplifier **PV** (see RE 95023)
- Proportional amplifier **VT 2000** (see RE 29904)
- Chopper amplifier **CV** (see RE 95029)
- Microcontroller **MC** (see RE 95050)

**EP.D Electric control with pressure cut-off**

Pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to \(V_g_{min}\) when the set pressure signal value is reached.

This function overrides EP control, i.e. below the pressure signal value, the pilot current dependent function is performed.

The valve is integrated into the control housing and is permanently set to a pressure signal value at the factory.

Setting range 50 to 350 bar.

**Characteristic: EP2**

**Circuit diagram: EP**

**Circuit diagram: EP2D**
Unit Dimensions Size 40

Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

Shaft ends
Z Splined shaft DIN 5480 W35x2x30x16x9g
S Splined shaft ANSI B92.1a-1976 1in 1ST 16/32DP ¹
(SAE J744 – 25-4 (B-B))

P Cyl. shaft with key DIN 6885 – AS10x8x56

Ports
A, B Service port SAE 3/4; 420 bar
6000 psi) High pressure series
S Suction port SAE 2; 210 bar
(3000 psi) Standard series
T₁, T₂ Air bleed, tank M22x1,5; 14 deep
R Air bleed, oil drain M22x1,5; 14 deep
M₁ Measuring point, regulating chamber M12x1,5; 12 deep
M Measuring point, service port M12x1,5; 12 deep
X Pilot port for version with load sensing (S) and remote pressure ct-off control (G)
Y Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD
Z Pilot port for version with cross-sensing (C) and power override (LR3, LG1)
G Port for positioning pressure (controller) M14x1,5; 12 deep
1) 30° pressure angle, flat root, side fit, tolerance class 5

¹) 30° pressure angle, flat root, side fit, tolerance class 5
Unit Dimensions Size 40

LRDH1/LRDHS:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ max} \rightarrow V_g \text{ min}$)

LRDH2/LRDH6:
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ min} \rightarrow V_g \text{ max}$)

LG1E:
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

LG2E:
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

Prior to finalising your design, please request certified installation drawing.
Unit Dimensions Size 40

Prior to finalising your design, please request certified installation drawing.

**HD1D/HD2D:**
Hydraulic, pilot pressure dependent control with pressure cut-off

**EP1D/EP2D:**
Electric control (proportional solenoid) with pressure cut-off

**DRS/DRG:**
Pressure control with load sensing
Pressure remote control

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20/48

A11VO
Prior to finalising your design, please request certified installation drawing.

**Unit Dimensions Size 60**

**LRDCS:**
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

---

**Shaft ends**

**Z**
- Splined shaft DIN 5480
- W35x2x30x16x9g

**S**
- Splined shaft ANSI B92.1a-1976
  - 1 1/4in – 14T 12/24DP 1)
  - (SAE J744 – 32-4 (C))

**P**
- Cyl. shaft with key DIN 6885 – AS10x8x56

**T**
- Splined shaft ANSI B92.1a-1976
  - 3/8in – 21T 16/32DP 1)

---

**Ports**

**A, B** Service port
- SAE 3/4; 420 bar (6000 psi) High pressure series

**S** Suction port
- SAE 2; 210 bar (3000 psi) Standard series

**T₁, T₂** Air bleed, tank
- M22x1,5; 14 deep

**R** Air bleed, oil drain
- M22x1,5; 14 deep

**M₁** Measuring point, regulating chamber
- M12x1,5; 12 deep

**M** Measuring point, service port
- M12x1,5; 12 deep

**X** Pilot port
- for version with load sensing (S) and remote pressure cut-off control (G)
- M14x1,5; 12 deep

**Y** Pilot port
- for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD
- M14x1,5; 12 deep

**Z** Pilot port
- for version with cross-sensing (C) and power override (LR3, LG1)
- M14x1,5; 12 deep

**G** Port for positioning pressure (controller)
- M14x1,5; 12 deep
- for version with stroke limiter (H...), HD and EP with screwed fitting GE10 - PLM
- (otherwise port G closed)

---

1) 30° pressure angle, flat root, side fit, tolerance class 5
Unit Dimensions Size 60

**LRDH1/LRDH5:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\text{ max}}$ to $V_{g\text{ min}}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\text{ min}}$ to $V_{g\text{ max}}$)

**LRDU1/LRDU2:**
Power control with pressure cut-off and electric stroke limiter (function: $V_{g\text{ min}}$ to $V_{g\text{ max}}$)

**LRDH1/LRDH5:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\text{ max}}$ to $V_{g\text{ min}}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\text{ min}}$ to $V_{g\text{ max}}$)

**Prior to finalising your design, please request certified installation drawing.**

**LG1E:**
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

**LG2E:**
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off
Unit Dimensions Size 60

Prior to finalising your design, please request certified installation drawing.

**HD1D/HD2D:**
Hydraulic, pilot pressure dependent control with pressure cut-off

**EP1D/EP2D:**
Electric control (proportional solenoid) with pressure cut-off

**DRS/DRG:**
Pressure control with load sensing
Pressure remote control
Unit Dimensions Size 75

**LRDCS:**
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

**Ports**

- **A, B** Service port
  - SAE 1; 420 bar (6000 psi) High pressure series

- **S** Suction port
  - SAE 2 1/2; 210 bar (3000 psi) Standard series

- **T1, T2** Air bleed, tank
  - M22x1,5; 14 deep

- **R** Air bleed, oil drain
  - M22x1,5; 14 deep

- **M1** Measuring point, regulating chamber
  - M12x1,5; 12 deep

- **M** Measuring point, service port
  - M12x1,5; 12 deep

- **X** Pilot port
  - for version with load sensing (S) and remote pressure cut-off control (G)
  - M14x1,5; 12 deep

- **Y** Pilot port
  - for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD
  - M14x1,5; 12 deep

- **Z** Pilot port
  - for version with cross-sensing (C) and power override (LR3, LG1)
  - M14x1,5; 12 deep

- **G** Port for positioning pressure (controller)
  - M14x1,5; 12 deep

  for version with stroke limiter (H..., U2), HD and EP with screwed fitting GE10 - PLM
  (otherwise port G closed)

---

**Shaft ends**

- **Z** Splined shaft DIN 5480
  - W40x2x30x18x9g

- **S** Splined shaft ANSI B92.1a-1976
  - 1 1/4in 14T 12/24DP ¹)
  - (SAE J744 – 32-4 (C))

- **P** Cyl. shaft with key
  - DIN 6885 – AS12x8x80

- **T** Splined shaft ANSI B92.1a-1976
  - 1 3/8in 21T 16/32DP ¹)

1) 30° pressure angle, flat root, side fit, tolerance class S

---

Prior to finalising your design, please request certified installation drawing.
Prior to finalising your design, please request certified installation drawing.

**LRDH1/LRDHS:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ max}$ to $V_g \text{ min}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ min}$ to $V_g \text{ max}$)

**LRDU1/LRDU2:**
Power control with pressure cut-off and electric stroke limiter (function: $V_g \text{ min}$ to $V_g \text{ max}$)

**LRDH1/LRDH5:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ max}$ to $V_g \text{ min}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ min}$ to $V_g \text{ max}$)

**LRDU1/LRDU2:**
Power control with pressure cut-off and electric stroke limiter (function: $V_g \text{ min}$ to $V_g \text{ max}$)

**LR3DS:**
Power control with high pressure dependent override, pressure cut-off and load sensing control

**LG1E:**
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

**LG2E:**
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off

**LG1:**
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off
Unit Dimensions Size 75

**HD1D/HD2D:**
Hydraulic, pilot pressure dependent control with pressure cut-off

**EP1D/EP2D:**
Electric control (proportional solenoid) with pressure cut-off

**DRS/DRG:**
Pressure control with load sensing
Pressure remote control

Prior to finalising your design, please request certified installation drawing.
Unit Dimensions Size 95

Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

Ports

- A, B  Service ports  SAE 1; 420 bar (6000 psi) High pressure series
- S  Suction port  SAE 3; 140 bar (2000 psi) Standard series
- T1, T2  Air bleed, tank  M26x1,5; 16 deep
- R  Air bleed, oil drain  M26x1,5; 16 deep
- M1  Measuring point, regulating chamber  M12x1,5; 12 deep
- M  Measuring point, service port  M12x1,5; 12 deep
- X  Pilot port  M14x1,5; 12 deep for version with load sensing (S), DRL and remote pressure cut-off control (G)
- Y  Pilot port  M14x1,5; 12 deep for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD
- Z  Pilot port  M14x1,5; 12 deep for version with cross-sensing (C) and power override (LR3, LG1)
- G  Port for positioning pressure (controller)  M14x1,5; 12 deep for version with stroke limiter (H...), U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)

Shaft ends

- Z  Splined shaft DIN 5480
  W45x2x30x21x9g
- S  Splined shaft ANSI B92.1a-1976
  1 3/4in 13T 8/16DP 1)
  (SAE J744 – 44-4 (D))

1) 30° pressure angle, flat root, side fit, tolerance class 5
Unit Dimensions Size 95

**LRDH1/LRDH5:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ max} \to V_g \text{ min}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ min} \to V_g \text{ max}$)

**LRDU1/LRDU2:**
Power control with pressure cut-off and electric stroke limiter (function: $V_g \text{ min} \to V_g \text{ max}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g \text{ min} \to V_g \text{ max}$)

**Prior to finalising your design, please request certified installation drawing.**

**LG1E:**
Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off

**LG2E:**
Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off
LE1S/LE2S:
Power control with electric override (negative) and load sensing control

HD1D/HD2D:
Hydraulic, pilot pressure dependent control with pressure cut-off

EP1D/EP2D:
Electric control (proportional solenoid) with pressure cut-off

DRS/DRG:
Pressure control with load sensing
Pressure remote control

DRL:
Pressure control for parallel operation

Prior to finalising your design, please request certified installation drawing.
Unit Dimensions Size 130

Prior to finalising your design, please request certified installation drawing.

**LRDCS:**

Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

Ports:

- **A, B** Service port (without charging pump) SAE 1; 420 bar (6000 psi) High pressure series
- **S** Suction port (without charging pump) SAE 3; 140 bar (2000 psi) Standard series
- **T1, T2** Air bleed, tank M26x1.5; 16 deep
- **R** Air bleed, oil drain M26x1.5; 16 deep
- **M1** Measuring point, regulating chamber M12x1.5; 12 deep
- **M** Measuring point, service port M12x1.5; 12 deep
- **X** Pilot port M14x1.5; 12 deep for version with load sensing (S), DRL and remote pressure cut-off control (G)
- **Y** Pilot port M14x1.5; 12 deep for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD
- **Z** Pilot port M14x1.5; 12 deep or version with cross-sensing (C) and power override (LR3, LG1)
- **G** Port for positioning pressure (controller) M14x1.5; 12 deep for version with stroke limiter (H...), U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)

Shaft ends:

- **Z** Splined shaft DIN 5480 W50x2x30x24x9g
- **S** Splined shaft ANSI B92.1a-1976 1 3/4in 13T 8/16DP 1) (SAE J744 – 44-4 (D))

View Y
Clockwise rotation
(Anti-clockwise rotation)

1) 30° pressure angle, flat root, side fit, tolerance class S
### Unit Dimensions Size 130

<table>
<thead>
<tr>
<th>LRDU1/LRDU2:</th>
<th>LR3DS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power control with pressure cut-off and electric stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)</td>
<td>Power control with high pressure dependent override, pressure cut-off and load sensing control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LG1E:</th>
<th>LG2E:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off</td>
<td>Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off</td>
</tr>
</tbody>
</table>

Prior to finalising your design, please request certified installation drawing.
Unit Dimensions Size 130

**LE1S/LE2S:**
Power control with electric override (negative) and load sensing control

**HD1D/HD2D:**
Hydraulic, pilot pressure dependent control with pressure cut-off

**EP1D/EP2D:**
Electric control (proportional solenoid) with pressure cut-off

**LE2:**

**HD1/2:**

**D:**

**Y:**

**DR:**

**S/G:**

**DRS/DRG:**
Pressure control with load sensing
Pressure remote control

**DRL:**
Pressure control for parallel operation

Prior to finalising your design, please request certified installation drawing.
Prior to finalising your design, please request certified installation drawing.

**Unit Dimensions Size 130**

**Version with charging pump A11VLO130LRDS:**

Power control LR with pressure cut-off D and load sensing control S

---

**Ports**

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service port (with charging pump)</td>
<td>SAE 1 1/4; 420 bar (6000 psi) High pressure series</td>
</tr>
<tr>
<td>S</td>
<td>Suction port (with charging pump)</td>
<td>SAE 3; 140 bar (2000 psi) Standard series</td>
</tr>
<tr>
<td>T₁, T₂</td>
<td>Air bleed, tank</td>
<td>M26x1.5; 16 deep</td>
</tr>
<tr>
<td>R</td>
<td>Air bleed, oil drain</td>
<td>M26x1.5; 16 deep</td>
</tr>
<tr>
<td>M₁</td>
<td>Measuring point, regulating chamber</td>
<td>M12x1.5; 12 deep</td>
</tr>
<tr>
<td>M</td>
<td>Measuring point, service port</td>
<td>M12x1.5; 12 deep</td>
</tr>
<tr>
<td>X</td>
<td>Pilot port</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td></td>
<td>for version with load sensing (S), DRL and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>remote pressure cut-off control (G)</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Pilot port</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td></td>
<td>for version with stroke limiter (H...),</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-stage pressure cut-off (E) and HD</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>Pilot port</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td></td>
<td>or version with cross-sensing (C) and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>power override (LR3, LG1)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Port for positioning pressure (controller)</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td></td>
<td>for version with stroke limiter (H, U2),</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HD and EP with screwed fitting GE10 - PLM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(otherwise port G closed)</td>
<td></td>
</tr>
</tbody>
</table>
Unit Dimensions Size 190

Prior to finalising your design, please request certified installation drawing.

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

Ports

- **A, B**: Service port (without charging pump) SAE 1 1/2; 420 bar (6000 psi) High pressure series
- **S**: Suction port (without charging pump) SAE 3 1/2; 35 bar (500 psi) Standard series
- **T1, T2**: Air bleed, tank M33x2; 16 deep
- **R**: Air bleed, oil drain M33x2; 16 deep
- **M1**: Measuring point, regulating chamber M12x1,5; 12 deep
- **M**: Measuring point, service port M12x1,5; 12 deep
- **X**: Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G) M14x1,5; 12 deep
- **Y**: Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD M14x1,5; 12 deep
- **Z**: Pilot port or version with cross-sensing (C) and power override (LR3, LG1) M14x1,5; 12 deep
- **G**: Port for positioning pressure (controller) M14x1,5; 12 deep
  for version with stroke limiter (H...), U2, HD and EP with screwed fitting GE10 - PLM
  (otherwise port G closed)

Shaft ends

- **Z**: Splined shaft DIN 5480 W50x2x30x24x9g
- **S**: Splined shaft ANSI B92.1a-1976 1 3/4in 13T 8/16DP
  (SAE J744 – 44-4 (D))
- **T**: Splined shaft ANSI B92.1a-1976 2in 15T 8/16DP
  (SAE J744 – 50-4 (F))

1) 30° pressure angle, flat root, side fit, tolerance class 5
Unit Dimensions Size 190

**LRDH1/LRDH5:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g_{\text{max}}$ to $V_g_{\text{min}}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g_{\text{min}}$ to $V_g_{\text{max}}$)

**LRDU1/LRDU2:**
Power control with pressure cut-off and electric stroke limiter (function: $V_g_{\text{min}}$ to $V_g_{\text{max}}$)

**LRDH2/LRDH6:**
Power control with pressure cut-off and hydraulic stroke limiter (function: $V_g_{\text{min}}$ to $V_g_{\text{max}}$)

Prior to finalising your design, please request certified installation drawing.
**Unit Dimensions Size 190**

**LE1S/LE2S:**
Power control with electric override (negative) and load sensing control

**HD1D/HD2D:**
Hydraulic, pilot pressure dependent control with pressure cut-off

**EP1D/EP2D:**
Electric control (proportional solenoid) with pressure cut-off

**DRS/DRG:**
Pressure control with load sensing
Pressure remote control

**DRL:**
Pressure control for parallel operation

Prior to finalising your design, please request certified installation drawing.
Unit Dimensions Size 190

Version with charging pump A11VLO190LRDS:
Power control LR with pressure cut-off D and Load sensing control S

Prior to finalising your design, please request certified installation drawing.

Ports

A, B  Service port (with charging pump)  SAE 1 1/2; 420 bar (6000 psi) High pressure series

S  Suction port (with charging pump)  SAE 3 1/2; 35 bar (500 psi) Standard series

T1, T2  Air bleed, tank  M33x2; 16 deep

R  Air bleed, oil drain  M33x2; 16 deep

M1  Measuring point, regulating chamber  M12x1,5; 12 deep

M  Measuring point, service port  M12x1,5; 12 deep

X  Pilot port
for version with load sensing (S), DRL and remote pressure cut-off control (G)

Y  Pilot port
for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD

Z  Pilot port
or version with cross-sensing (C) and power override (LR3, LG1)

G  Port for positioning pressure (controller)  M14x1,5; 12 deep

Flange SAE J744 165-4 (E)

View Y
Clockwise rotation
(Anti-clockwise rotation)

Detail W
Unit Dimensions Size 260

LRDCS:
Power control LR with pressure cut-off D, cross-sensing control C and load sensing control S

Prior to finalising your design, please request certified installation drawing.

Ports
A, B Service port (without charging pump) SAE 1 1/2; 420 bar (6000 psi) High pressure series
S Suction port (without charging pump) SAE 3 1/2; 35 bar (500 psi) Standard series
T1, T2 Air bleed, tank M33x2; 16 deep
R Air bleed, oil drain M33x2; 16 deep
M1 Measuring point, regulating chamber M12x1,5; 12 deep
M Measuring point, service port M12x1,5; 12 deep
X Pilot port M14x1,5; 12 deep for version with load sensing (S), DRL and remote pressure cut-off control (G)
Y Pilot port M14x1,5; 12 deep for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD
Z Pilot port M14x1,5; 12 deep or version with cross-sensing (C) and power override (LR3, LG1)
G Port for positioning pressure (controller) M14x1,5; 12 deep for version with stroke limiter (H...), U2, HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)

Shaft ends
Z Splined shaft DIN 5480 W60x2x30x28x9g
S Splined shaft ANSI B92.1a-1976 1 3/4in 13T 8/16DP ¹)
(SAE J744 – 44-4 (D))
T Splined shaft ANSI B92.1a-1976 2 1/4in 17T 8/16DP ¹)

¹) 30° pressure angle, flat root, side fit, tolerance class 5
**Unit Dimensions Size 260**

<table>
<thead>
<tr>
<th>LRDH1/LRDH5:</th>
<th>LRDH2/LRDH6:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ max}$ to $V_{g\ min}$)</td>
<td>Power control with pressure cut-off and hydraulic stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)</td>
</tr>
</tbody>
</table>

![LRDH1/LRDH5 Diagram]

Prior to finalising your design, please request certified installation drawing.

<table>
<thead>
<tr>
<th>LRDU1/LRDU2:</th>
<th>LR3DS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power control with pressure cut-off and electric stroke limiter (function: $V_{g\ min}$ to $V_{g\ max}$)</td>
<td>Power control with high pressure dependent override, pressure cut-off and load sensing control</td>
</tr>
</tbody>
</table>

![LRDU1/LRDU2 Diagram]

<table>
<thead>
<tr>
<th>LG1E:</th>
<th>LG2E:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power control with pilot pressure dependent override (negative) and 2-stage pressure cut-off</td>
<td>Power control with pilot pressure dependent override (positive) and 2-stage pressure cut-off</td>
</tr>
</tbody>
</table>

![LG1E Diagram]

![LG2E Diagram]
**Unit Dimensions Size 260**

**LE1S/LE2S:**
Power control with electric override (negative) and load sensing control

**HD1D/HD2D:**
Hydraulic, pilot pressure dependent control with pressure cut-off

**EP1D/EP2D:**
Electric control (proportional solenoid) with pressure cut-off

**DRS/DRG:**
Pressure control with load sensing
Pressure remote control

**DRL:**
Pressure control for parallel operation

Prior to finalising your design, please request certified installation drawing.
**Unit Dimensions Size 260**

**Version with charging pump A11VLO260LRDS:**
Power control LR with pressure cut-off D and Load sensing control S

Prior to finalising your design, please request certified installation drawing.

**Ports**

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service port (with charging pump)</td>
<td>SAE 1 1/2; 420 bar (6000 psi) High pressure series</td>
</tr>
<tr>
<td>S</td>
<td>Suction port (with charging pump)</td>
<td>SAE 4; 35 bar (500 psi) Standard series</td>
</tr>
<tr>
<td>T₁, T₂</td>
<td>Air bleed, tank</td>
<td>M33x2; 16 deep</td>
</tr>
<tr>
<td>R</td>
<td>Air bleed, oil drain</td>
<td>M33x2; 16 deep</td>
</tr>
<tr>
<td>M₁</td>
<td>Measuring point, regulating chamber</td>
<td>M12x1.5; 12 deep</td>
</tr>
<tr>
<td>M</td>
<td>Measuring point, service port</td>
<td>M12x1.5; 12 deep</td>
</tr>
<tr>
<td>X</td>
<td>Pilot port for version with load sensing (S), DRL and remote pressure cut-off control (G)</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td>Y</td>
<td>Pilot port for version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td>Z</td>
<td>Pilot port or version with cross-sensing (C) and power override (LR3, LG1)</td>
<td>M14x1.5; 12 deep</td>
</tr>
<tr>
<td>G</td>
<td>Port for positioning pressure (controller) for version with stroke limiter (H.., U2), HD and EP with screwed fitting GE10 - PLM (otherwise port G closed)</td>
<td>M14x1.5; 12 deep</td>
</tr>
</tbody>
</table>
Through Drive Dimensions

Flange SAE J744 – 82-2 (A) Hub for splined shaft to ANSI B92.1a-1976

Flange SAE J744 – 101-2 (B) Hub for splined shaft to ANSI B92.1a-1976

Flange SAE J744 – 127-2 (C) Hub for splined shaft to ANSI B92.1a-1976

Note: The mounting flange can also be turned 90°. If required, please state in clear text.

Prior to finalising your design, please request certified installation drawing.

Note: *) Version with charging pump

1) 30° pressure angle, flat root, side fit, tolerance class 5
**Through Drive Dimensions**

**Flange** SAE J744 – 152-4 (D) **Hub** for splined shaft to ANSI B92.1a-1976

<table>
<thead>
<tr>
<th>Overall length A1</th>
<th>Size</th>
<th>K86</th>
<th>K17</th>
<th>K81</th>
<th>K82</th>
<th>K83</th>
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<tbody>
<tr>
<td>75</td>
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<tr>
<td>130*</td>
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<td>260*</td>
<td>459</td>
<td>459</td>
<td>459</td>
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</tbody>
</table>

*) Version with charging pump

1) 30° pressure angle, flat root, side fit, tolerance class 5

**Flange** SAE J744 – 165-4 (E) **Hub** for splined shaft to ANSI B92.1a-1976

<table>
<thead>
<tr>
<th>Overall length A1</th>
<th>Size</th>
<th>K72</th>
<th>K84</th>
<th>K67</th>
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<tbody>
<tr>
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<td>260</td>
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<td>400</td>
<td>400</td>
<td>400</td>
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<tr>
<td>260*</td>
<td>459</td>
<td>442,5</td>
<td>442,5</td>
<td>442,5</td>
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</tbody>
</table>

*) Version with charging pump
Overview of A11VO Attachments

<table>
<thead>
<tr>
<th>Through drive - A11VO</th>
<th>Attachment for 2nd pump</th>
<th>Through drive available for size</th>
</tr>
</thead>
<tbody>
<tr>
<td>flange hub for splined shaft</td>
<td>A11VO size (shaft)</td>
<td>A10V(S)/O/31 size (shaft)</td>
</tr>
<tr>
<td>82-2 (A) 5/8in</td>
<td>K01</td>
<td>—</td>
</tr>
<tr>
<td>82-2 (A) 3/4in</td>
<td>K02</td>
<td>—</td>
</tr>
<tr>
<td>101-2 (B) 7/8in</td>
<td>K03</td>
<td>—</td>
</tr>
<tr>
<td>101-2 (B) 1in</td>
<td>K04</td>
<td>40 (S)</td>
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<tr>
<td>101-2 (B) W35</td>
<td>K05</td>
<td>40 (Z)</td>
</tr>
<tr>
<td>127-2 (C) 1 1/4in</td>
<td>K06</td>
<td>60 (S)</td>
</tr>
<tr>
<td>127-2 (C) 1 1/2in</td>
<td>K07</td>
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</tr>
<tr>
<td>127-2 (C) W30</td>
<td>K08</td>
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</tr>
<tr>
<td>127-2 (C) W35</td>
<td>K09</td>
<td>60 (Z)</td>
</tr>
<tr>
<td>152-4 (D) 1 1/4in</td>
<td>K10</td>
<td>75 (S)</td>
</tr>
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<td>152-4 (D) 1 3/4in</td>
<td>K11</td>
<td>95 (S), 130 (S)</td>
</tr>
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<td>152-4 (D) W40</td>
<td>K12</td>
<td>75 (Z)</td>
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<tr>
<td>152-4 (D) W45</td>
<td>K13</td>
<td>95 (Z)</td>
</tr>
<tr>
<td>152-4 (D) W50</td>
<td>K14</td>
<td>130 (Z)</td>
</tr>
<tr>
<td>165-4 (E) 1 3/4in</td>
<td>K15</td>
<td>90 (S), 260 (S)</td>
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<tr>
<td>165-4 (E) W50</td>
<td>K16</td>
<td>190 (Z)</td>
</tr>
<tr>
<td>165-4 (E) W60</td>
<td>K17</td>
<td>260 (Z)</td>
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</tbody>
</table>

Pump Combinations A11VO + A11VO

<table>
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1) When using the Z shaft (splined shaft DIN 5480) for the mounted pump (2nd pump)
2) Version with charging pump

When ordering pump combinations the type designations for the 1st and 2nd pumps should be joined by “+”
ordering code for 1st pump + ordering code for 2nd pump
Example order:
A11VO130LRDS/10R-NZD12K61 + A11VO60LRDS/10R-NZC12N00
### Permissible Input or Through Drive Torque

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Max permissible input torque $^2$)

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<td>(ANSI B92.1a-1976)</td>
<td>(1 1/4in)</td>
<td>(1 3/8in)</td>
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<td>—</td>
<td>—</td>
<td>(2in)</td>
<td>(2 1/4in)</td>
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Max perm. through drive torque $^3$) $T_{D \text{ zul.}}$ Nm | 314 | 521 | 660 | 822 | 1110 | 1760 | 2065 |

$^1$) disregarding efficiency  
$^2$) for drive shafts not subject to radial stress  
$^3$) Note max. perm. input torque for shaft $S$

### Key to symbols

- $T_{D \text{ zul.}}$: Max. perm. through drive torque in Nm
- $T_{E \text{ zul.}}$: Max. perm. input torque at drive shaft in Nm

\[
T_1 = \frac{1.59 \cdot V_{g1} \cdot \Delta p_1}{100 \cdot \eta_{mh}} \quad \text{in Nm}
\]

\[
T_2 = \frac{1.59 \cdot V_{g2} \cdot \Delta p_2}{100 \cdot \eta_{mh}} \quad \text{in Nm}
\]

- $V_{g1}$: Displacement per revolution, 1st pump in cm$^3$
- $V_{g2}$: Displacement per revolution, 2nd pump in cm$^3$
- $\Delta p_1$: Differential pressure, 1st pump in bar
- $\Delta p_2$: Differential pressure, 2nd pump in bar
- $\eta_{mh}$: Mechanical-hydraulic efficiency

### Torque distribution

**Single pump**

![Single pump diagram](image)

**Pump combination**

![Pump combination diagram](image)
Swivel Angle Display

**Optical swivel angle display (V)**
With the optical swivel angle display, the pump swivel position is shown by a mechanical indicator at the side of the housing.

**Electric swivel angle display (R)**
With the electric swivel angle display, the pump swivel position is reported by a position sensor. This sensor converts the swivel position into an electrical signal.

Supply voltage: 5V
Output signal $U_\alpha$: \[
\begin{align*}
V_{g_{\text{min}}} : & \quad 2,5V \\
V_{g_{\text{max}}} : & \quad 4,5V
\end{align*}
\]

The 6-pin AMP-MQS connector comprising:
- 6-pin MQS connector, code A 1-0967616-1
- 6 connector contacts 0-0963727-2
- 6 single-conductor seals 0-0967067-1
- 3 blind plugs 0-0967056-1

is not included in the supply.
Available from Brueninghaus Hydromatik on request.

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Installation and Commissioning Notes

General
The pump housing must be filled with fluid during commissioning and remain full when operating (housing space filled). Commissioning should be carried out at low speed and with no load until all air has been bled from the system. If the pump is idle for extended periods, the housing may drain via the service lines. It is important to refill the housing sufficiently before putting it back into operation.

Leakage fluid in the housing space should be sent to the tank via the highest leakage oil port. The minimum suction pressure at port $S$ of 0.8 bar abs. (without charging pump) or 0.6 bar (with charging pump) must be observed.

Mounting below the tank
Pumping below minimum oil level in tank (standard).
➔ Installation position is optional.
➔ Installation position "shaft end upwards":
   It is important to ensure that the pump housing is completely full when commissioning. An air bubble in the bearing area will cause damage to the axial piston unit.

Steps:
➔ Before commissioning, fill axial piston pump via the highest leakage oil port $T_1$, $T_2$, $R$.
➔ Recommendation: fill the suction lines.
➔ Run pump at low speed (starter speed) until pump system is completely filled.
➔ Minimum immersion depth of suction or leakage oil line in tank: 200 mm (in relation to min. oil level in tank).

Mounting above the tank
Pumping above minimum oil level in tank.
➔ Installation position "shaft horizontal" and "shaft end upwards".
➔ Installation position "shaft end upwards":
   If the pump is idle for extended periods, the housing space may drain via the service lines (air enters via the shaft seal). The bearings are thus insufficiently lubricated when the pump is started up again. It is important to refill the axial piston pump via the highest leakage oil port before putting it back into operation (air bleed via port $R$). A check valve in the leakage oil line (opening pressure 0.5 bar) can prevent draining via the leakage oil line. Draining via the service ports can be reduced via a special control plate design.
➔ Version A11VLO (with charging pump) is not designed for mounting above the tank.

For steps, refer to mounting below the tank.

In addition please note the following:
➔ max. perm. suction height $h_{max} = 800$ mm
➔ min. perm. pressure at port $S$ (min. suction pressure)
➔ when adjusting with pressure control, stroke limiter, HD and EP adjustment, set residual flow $V_g \geq 5\% V_{g\ max}$.
➔ Recommendation: use "swan neck" suction line.
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When ordering, please quote type and ID number