Axial piston pumps
variable displacement, mechanical controls

PVPC
Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits. They are characterized by low noise emission, short response time and flexible operation thanks to the wide range of mechanical controls, see section [7] and [8].

For PVPC pumps with electrohydraulic proportional controls, see tech table AS170.

SAE J744 mounting flange and shaft.

<table>
<thead>
<tr>
<th>Max displacement (cm³/rev)</th>
<th>Max pressure working (bar)</th>
<th>Max pressure peak (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29, 46, 73, 140</td>
<td>280</td>
<td>350</td>
</tr>
<tr>
<td>88</td>
<td>250</td>
<td>315</td>
</tr>
</tbody>
</table>

11 MODELS CODE

PVPC - X2E - C - 4046 / 1 D - X - 24DC + /

Variable displacement axial piston pump

Option for pumps with through shaft (1)
XA = intermediate flange SAE A
XB = intermediate flange SAE B
XC = intermediate flange SAE C
(only for size 5073 and 5090)

Additional suffix for double pumps:
X2E = with a fixed displacement pump type PFE (see tech table A005)

Type of control, see section [7]
C = manual pressure compensator
CH = manual pressure compensator, with venting
R = remote pressure compensator (1)
L = load sensing (pressure & flow)
LW = constant power (combined pressure & flow)

For electrohydraulic proportional controls, see tech table AS170

Size and max displacement (2):
3029 = size 3 - displacement 029 cm³/rev
4046 = size 4 - displacement 046 cm³/rev
5073 = size 5 - displacement 073 cm³/rev
5090 = size 5 - displacement 088 cm³/rev
6140 = size 6 - displacement 140 cm³/rev

Shaft, SAE Standard (3):
1 = keyed
5 = splined

Seals material, see section [5]
- = NBR
PE = FKM

Direction of rotation, viewed at the shaft end:
D = clockwise
S = counterclockwise

(1) Not available for PVPC-*-6140
(2) Optional intermediate displacements 35 and 53 cm³/rev are available on request
(3) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request
2 GENERAL CHARACTERISTICS

Assembly position - see section [1] Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line length is 3 m.

Ambient temperature range
Standard = -25°C ÷ +80°C /PE option -15°C ÷ +80°C

Storage temperature
Standard = -40°C ÷ +50°C /PE option -20°C ÷ +50°C

Surface protection (pump body) Black painting RAL9005


3 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size

<table>
<thead>
<tr>
<th>PVPC</th>
<th>3029</th>
<th>4046</th>
<th>5073</th>
<th>5090</th>
<th>6140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max displacement (cm³/rev)</td>
<td>29</td>
<td>46</td>
<td>73</td>
<td>88</td>
<td>140</td>
</tr>
<tr>
<td>Theoretical max flow at 1450 rpm (l/min)</td>
<td>42</td>
<td>66.7</td>
<td>105.8</td>
<td>127.6</td>
<td>203</td>
</tr>
<tr>
<td>Max working pressure / Peak (bar)</td>
<td>280/350</td>
<td>280/350</td>
<td>280/350</td>
<td>250/315</td>
<td>280/350 (1)</td>
</tr>
<tr>
<td>Min/Max inlet pressure (bar abs.)</td>
<td>0.8 / 25</td>
<td>0.8 / 25</td>
<td>0.8 / 25</td>
<td>0.8 / 25</td>
<td>0.8 / 25</td>
</tr>
<tr>
<td>Max pressure on drain port (bar abs.)</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Power consumption at 1450 rpm and at max pressure and displacement (Kw)</td>
<td>19.9</td>
<td>31.6</td>
<td>50.1</td>
<td>54.1</td>
<td>122</td>
</tr>
<tr>
<td>Max torque on the shaft (Nm)</td>
<td>128</td>
<td>203</td>
<td>328</td>
<td>350</td>
<td>780</td>
</tr>
<tr>
<td>Speed rating (rpm)</td>
<td>500 ÷ 3000</td>
<td>500 ≥ 2600</td>
<td>500 ≥ 2600</td>
<td>500 ≥ 2200</td>
<td>500 ≥ 2200</td>
</tr>
<tr>
<td>Body volume (l)</td>
<td>0.7</td>
<td>0.9</td>
<td>1.5</td>
<td>1.5</td>
<td>2.8</td>
</tr>
</tbody>
</table>

(1) The maximum pressure can be increased to 350 bar (working) and 420 (peak) after detailed analysis of the application and of the pump working cycle.

4 ELECTRICAL CHARACTERISTICS - for PVPC-CH

Insulation class H
Connector protection degree IP 65
Relative duty factor 100%
Supply voltage tolerance ± 10%

4.1 COIL VOLTAGE - only for CH version
Average values based ambient/coil temperature of 20°C.

<table>
<thead>
<tr>
<th>External supply nominal voltage ±10%</th>
<th>Voltage code</th>
<th>Power consumption</th>
<th>Nominal current</th>
<th>Coil characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRECT CURRENT</td>
<td>12 DC 24 DC</td>
<td>12DC 24DC</td>
<td>19.2 W</td>
<td>1.61 A 0.80 A</td>
</tr>
</tbody>
</table>

4.2 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - to be ordered separately

<table>
<thead>
<tr>
<th>Code of connector</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-666</td>
<td>Connector IP-65</td>
</tr>
<tr>
<td>SP-667</td>
<td>Connector IP-65 but with built-in signal led</td>
</tr>
</tbody>
</table>

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature
NBR seals (standard) = -25°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C
FKM seals (/PE option) = -20°C ÷ +80°C

Recommended viscosity
15+35 mm²/s - max allowed range: min 10 cSt (at 80°C) - max 1500 cSt at cold startup (-25°C)

Max fluid contamination level
normal operation: ISO4406 class 20/18/13 NAS1638 class 9
longer life: ISO4406 class 18/16/11 NAS1638 class 7
see also filter section at www.atos.com or KTF catalog

<table>
<thead>
<tr>
<th>Hydraulic fluid</th>
<th>Suitable seals type</th>
<th>Classification</th>
<th>Ref. Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral oils</td>
<td>NBR, FKM, HNBR</td>
<td>HL, HLP, HLPD, HVLP, HVLPD</td>
<td>DIN 51524</td>
</tr>
<tr>
<td>Flame resistant without water</td>
<td>FKM</td>
<td>HFDU, HFDR (1)</td>
<td>ISO 12922</td>
</tr>
<tr>
<td>Flame resistant with water</td>
<td>NBR, HNBR</td>
<td>HFC (1)</td>
<td></td>
</tr>
</tbody>
</table>

(1) Max working pressure must be reduced to: 180 bar (working) / 210 bar (peak) for HFC fluid
200 bar (working) / 240 bar (peak) for HFDU and HFDR fluid
6 INSTALLATION POSITION

The pump is supplied with drain D2 open and D1 plugged. Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position. With exception of pump mounted below the oil level, we recommend to interpose a baffle plate between inlet and drain line.

<table>
<thead>
<tr>
<th>INSIDE THE TANK</th>
<th>INSIDE THE TANK</th>
<th>OUTSIDE THE TANK, above oil level</th>
<th>OUTSIDE THE TANK, below oil level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum oil level equal or above the pump mounting surface.</td>
<td>Minimum oil level below the pump mounting surface.</td>
<td>Minimum inlet pressure = 0.8 bar absolute B ≤ 800mm, C= 200mm</td>
<td>C= 200mm</td>
</tr>
<tr>
<td>A ≥ 200mm</td>
<td>Minimum inlet pressure = 0.8 bar absolute B ≤ 800mm, C= 200mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IN: inlet line - D2: drain line - A: minimum distance between inlet and drain line - B+C: permissible suction height - C: inlet line immersion dept

7 MAX PERMISSIBLE LOAD ON DRIVE SHAFT

<table>
<thead>
<tr>
<th>PVPC size</th>
<th>3029</th>
<th>4046</th>
<th>5073</th>
<th>5090</th>
<th>6140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax = axial load</td>
<td>N</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Frad = radial load</td>
<td>N</td>
<td>1500</td>
<td>1500</td>
<td>3000</td>
<td>3000</td>
</tr>
</tbody>
</table>

Notes: For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes. Maximum pressure for all models with water glycol fluid is 160 bar, with option /PE is 190 bar. Max speed with options /PE and for water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

8 VARIATION OF MAX SPEED VS INLET PRESSURE

<table>
<thead>
<tr>
<th>Inlet pressure</th>
<th>Displacement %</th>
<th>% variation of the max. speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar abs.</td>
<td>65 70 80 90 100</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>0,8</td>
<td>120 115 105 97 90</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>0,9</td>
<td>120 120 110 103 95</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>1,0</td>
<td>120 120 115 107 100</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>1,2</td>
<td>120 120 120 113 106</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>1,4</td>
<td>120 120 120 120 112</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>1,6</td>
<td>120 120 120 120 117</td>
<td>% variation of the max. speed</td>
</tr>
<tr>
<td>2,0</td>
<td>120 120 120 120 120</td>
<td>% variation of the max. speed</td>
</tr>
</tbody>
</table>

Example
Displacement: 80% - Inlet pressure: 1,0 bar - Speed: 115%
MAX DISPLACEMENT SETTING

<table>
<thead>
<tr>
<th>PVPC size</th>
<th>3029</th>
<th>4046</th>
<th>5073</th>
<th>5090</th>
<th>6140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max displacement setting range</td>
<td>20,1 ÷ 28,7</td>
<td>31,8 ÷ 45,4</td>
<td>36,8 ÷ 73,6</td>
<td>44,0 ÷ 87,9</td>
<td>70 ÷ 140</td>
</tr>
<tr>
<td>One turn of screw changes pump displacement by approximately</td>
<td>cm³/rev</td>
<td>1,5</td>
<td>2,2</td>
<td>3,2</td>
<td>3,2</td>
</tr>
<tr>
<td>For locking displacement limiter screw</td>
<td>mm</td>
<td>14</td>
<td>14</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>For displacement setting</td>
<td>mm</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>15 ± 1</td>
<td>15 ± 1</td>
<td>15 ± 1</td>
<td>15 ± 1</td>
</tr>
</tbody>
</table>

DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

10.1 Noise level curves
Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics - Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

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10.2 Operating limits

1 = Volumetric efficiency
2 = Overall efficiency
3 = Flow versus pressure curve
4 = Power consumption with full flow
5 = Power consumption at null flow

10.3 Response times

Response times and pressure peack due to variation 0% to 100% and 100% to 0% of the pump displacement, obtained with an instantaneously opening and shut-off of the delivery line.

<table>
<thead>
<tr>
<th>Pump type</th>
<th>T1 (ms)</th>
<th>T2 (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVPC-*-3029</td>
<td>140</td>
<td>36</td>
</tr>
<tr>
<td>PVPC-*-4046</td>
<td>140</td>
<td>42</td>
</tr>
<tr>
<td>PVPC-*-5073</td>
<td>160</td>
<td>44</td>
</tr>
<tr>
<td>PVPC-*-5090</td>
<td>160</td>
<td>44</td>
</tr>
<tr>
<td>PVPC-*-6140</td>
<td>220</td>
<td>150</td>
</tr>
</tbody>
</table>
Manual pressure compensator
The pump displacement is zeroed when the line pressure approaches the setting pressure of the compensator.
Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090
Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090

Manual pressure compensator with venting
As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.
Venting valve solenoid voltage, see section
Venting valve OFF = null displacement
Venting valve ON = max displacement
Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090, 6140
Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090, 6140

Remote pressure compensator
As C, but predisposed with X piloting port for connection of a remote pilot relief valve.
Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090
Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090

Load sensing
The pump displacement is automatically adjusted to maintain a constant (load independent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.
Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.
Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090
Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090
Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

Constant power
In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
For the best regulation, minimum working pressure is 80 bar.
While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).
**Manual pressure compensator**

The pump displacement is zeroed when the line pressure approaches the setting pressure of the compensator.

Compensator setting range: 20 ÷ 280 bar
Compensator standard setting: 280 bar

**Note:** do not modify the setting of differential pressure compensator

**Manual pressure compensator with venting**

As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.

Venting valve solenoid voltage, see section

Venting valve OFF = null displacement
Venting valve ON = max displacement
Compensator setting range: 20 ÷ 280 bar
Compensator standard setting: 280 bar

**Load sensing**

The pump displacement is automatically adjusted to maintain a constant (load independent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.

Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.

Compensator setting range: 20 ÷ 280 bar
Compensator standard setting: 280 bar
Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

**Constant power**

In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.

For the best regulation, minimum working pressure is 80 bar.

While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).
PORTS DIMENSION
IN = Flange SAE 3000 1 1/4”
OUT = Flange SAE 6000 3/4”
D1, D2 = 1/2” BSPP
① = Screw for max displacement setting. In case of double pumps, the screw is not available for version XB

 Mass [kg]
PVPC-*-3029 18

CODE XA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31
screw for max displacement setting not available

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted
PORTS DIMENSION

IN = Flange SAE 3000 1 1/2"
OUT = Flange SAE 6000 1"
D1, D2 = 1/2" BSPP

① = Screw for max displacement setting

| Mass [kg] | PVPC-*-4046 | 24 |

SHAFT TYPE “1”

SHAFT TYPE “5”

CODEXA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31

CODEXB - INTERMEDIATE FLANGE SAE “B” FOR PFE-41

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted.
PORTS DIMENSION

IN = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Screw for max displacement setting.
In case of double pump the screw is not available for version XC

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>SAE Type</th>
<th>Teeth</th>
<th>Pitch</th>
<th>Max Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>XA</td>
<td>CODE XA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31</td>
<td>SAE &quot;A&quot; SPEINED</td>
<td>9</td>
<td>16/32</td>
<td>135 Nm</td>
</tr>
<tr>
<td>XB</td>
<td>CODE XB - INTERMEDIATE FLANGE SAE “B” FOR PFE-41</td>
<td>SAE &quot;B&quot; SPEINED</td>
<td>13</td>
<td>16/32</td>
<td>330 Nm</td>
</tr>
<tr>
<td>XC</td>
<td>CODE XC - INTERMEDIATE FLANGE SAE “C” FOR PFE-51</td>
<td>SAE &quot;C&quot; SPEINED</td>
<td>14</td>
<td>12/24</td>
<td>440 Nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVPC-*-5073</td>
</tr>
<tr>
<td>PVPC-*-5090</td>
</tr>
</tbody>
</table>
PORTS DIMENSION

IN  = Flange SAE 3000 2 1/2”
OUT = Flange SAE 6000 1 1/4”
D1, D2= 3/4” BSPP
➊  = Regulation screw for max
displacement setting.

Mass [kg]

| PVPC-*-6140 | 69 |

SHAFT TYPE “1”

SAE “D” SPLINED
13 TEETH 8/16 PITCH
32° INVOLUTE SPLINE

SHAFT TYPE “5”

1/2” - 13 N.C. - 2B
17.1 PVPC size 3, 4 and 5

① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement.

In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D). Pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups.

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Version</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Mass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVPC-*-3029</td>
<td>CH</td>
<td>144</td>
<td>111</td>
<td>-</td>
<td>-</td>
<td>102</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>L-R</td>
<td>144</td>
<td>111</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>19.2</td>
</tr>
<tr>
<td></td>
<td>LW</td>
<td>144</td>
<td>111</td>
<td>-</td>
<td>211</td>
<td>104</td>
<td>20</td>
</tr>
<tr>
<td>PVPC-*-4046</td>
<td>CH</td>
<td>153</td>
<td>111</td>
<td>-</td>
<td>-</td>
<td>102</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>L-R</td>
<td>153</td>
<td>111</td>
<td>109</td>
<td>-</td>
<td>-</td>
<td>25.2</td>
</tr>
<tr>
<td></td>
<td>LW</td>
<td>153</td>
<td>111</td>
<td>-</td>
<td>235</td>
<td>111</td>
<td>26</td>
</tr>
<tr>
<td>PVPC-*-5073</td>
<td>CH</td>
<td>166</td>
<td>111</td>
<td>-</td>
<td>-</td>
<td>102</td>
<td>36.9</td>
</tr>
<tr>
<td></td>
<td>L-R</td>
<td>166</td>
<td>111</td>
<td>122</td>
<td>-</td>
<td>-</td>
<td>34.2</td>
</tr>
<tr>
<td>PVPC-*-5090</td>
<td>LW</td>
<td>166</td>
<td>111</td>
<td>-</td>
<td>258</td>
<td>120</td>
<td>35</td>
</tr>
</tbody>
</table>
In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups.

1 = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement). 

**Mass [kg]**

<table>
<thead>
<tr>
<th></th>
<th>PVPC-*-6140</th>
<th>PVPC-*-6140</th>
<th>PVPC-*-6140</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>73</td>
<td>70.2</td>
<td>71</td>
</tr>
</tbody>
</table>