Axial piston pumps
variable displacement, mechanical controls

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 [1].

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

SAE J744 mounting flange and shaft.

### PVPC

<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>

#### MODEL CODE

<table>
<thead>
<tr>
<th>PVPC</th>
<th>X2E</th>
<th>C</th>
<th>4046</th>
<th>/</th>
<th>1</th>
<th>D</th>
<th>X</th>
<th>24DC</th>
<th>+</th>
<th>/</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 [2]

- C = manual pressure compensator
- CH = manual pressure compensator, with venting
- R = remote pressure compensator
- L = load sensing (pressure & flow)
- LW = constant power (combined pressure & flow)

For electrohydraulic proportional controls, see tech table AS170

#### Seals material, see section [3]

- NBR
- FKM

Series number

Coil voltage, see section [4]

- X = without connector (only for CH version)
  See section [4] for available connectors, to be ordered separately

Direction of rotation, viewed at the shaft end:

- D = clockwise
- S = counterclockwise

### 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 090 cm³/rev
- 6140 = size 6 - displacement 140 cm³/rev

#### Shaft, SAE Standard (3):

- 1 = keyed
- S = splined

(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 6

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 RAL 9005

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

PVPC size | 3029 | 4046 | 5073 | 5090 | 6140
---|---|---|---|---|---
Max displacement (cm³/rev) | 29 | 46 | 73 | 88 | 140
Theoretical max flow at 1450 rpm (l/min) | 42 | 66.7 | 105.8 | 127.6 | 203
Max working pressure / Peak (bar) | 280/350 | 280/350 | 280/350 | 250/315 | 280/350
MiniMax inlet pressure (bar abs.) | 0.8 / 25 | 0.8 / 25 | 0.8 / 25 | 0.8 / 25 | 0.8 / 25
Max pressure on drain port (bar abs.) | 1.5 | 1.5 | 1.5 | 1.5 | 1.5
Power consumption at 1450 rpm and at max pressure and displacement (Kw) | 19.9 | 31.6 | 50.1 | 54.1 | 122
Max torque on the shaft (Nm) | Type 1: 210 | Type 5: 270 | Type 1: 350 | Type 5: 440 | Type 1: 670 | Type 5: 810 | Type 1: 1000 | Type 5: 2340
Max torque at max working pressure (Nm) | 128 | 203 | 328 | 350 | 780
Speed rating (rpm) | 500 ÷ 3000 | 500 ÷ 2600 | 500 ÷ 2600 | 500 ÷ 2200 | 500 ÷ 2200
Body volume (l) | 0.7 | 0.9 | 1.5 | 1.5 | 2.8

(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% (short time)

Supply voltage tolerance | ±10% (short time)

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</td>
<td>12DC</td>
<td>19.2 W</td>
<td>1.61 A</td>
</tr>
<tr>
<td></td>
<td>24 DC</td>
<td>24DC</td>
<td>19.2 W</td>
<td>0.80 A</td>
</tr>
<tr>
<td>ALTERNATE CURRENT</td>
<td>24 / 50 / 60 AC</td>
<td>24/50/60AC</td>
<td>19.0 W</td>
<td>0.89 A</td>
</tr>
<tr>
<td></td>
<td>110 / 50 / 60 AC</td>
<td>110/50/60AC</td>
<td>19.0 W</td>
<td>0.19 A</td>
</tr>
<tr>
<td></td>
<td>220 / 50 / 60 AC</td>
<td>220/50/60AC</td>
<td>19.0 W</td>
<td>0.09 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

<table>
<thead>
<tr>
<th>Seals, recommended fluid temperature</th>
<th>NBR seals (standard) = -25°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKM seals (PE option) = -20°C ÷ +80°C</td>
<td></td>
</tr>
<tr>
<td>Recommended viscosity</td>
<td>15÷35 mm²/s - max allowed range: min 10 cSt (at 80°C) - max 1500 cSt at cold startup (-25°C)</td>
</tr>
<tr>
<td>Max fluid contamination level</td>
<td>ISO4406 class 20/18/13 NAS1638 class 9</td>
</tr>
<tr>
<td>- normal operation</td>
<td>see also filter section at <a href="http://www.atos.com">www.atos.com</a> or KTF catalog</td>
</tr>
<tr>
<td>- longer life</td>
<td>ISO4406 class 18/16/11 NAS1638 class 7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydraulic fluid</th>
<th>Classification</th>
<th>Ref. Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral oils</td>
<td>NBR, FKM, HNBR</td>
<td>HLP, HLPD, HLV, HLVLP, HLVLPD</td>
</tr>
<tr>
<td>Flame resistant without water</td>
<td>FKM</td>
<td>HFDU, HFDR</td>
</tr>
<tr>
<td>Flame resistant with water</td>
<td>NBR, HNBR</td>
<td>HFC</td>
</tr>
</tbody>
</table>

ISO 12922
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>Vertical Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSIDE THE TANK</td>
</tr>
<tr>
<td>Minimum oil level equal or above the pump mounting surface. A ≥ 200mm</td>
</tr>
<tr>
<td>OUTSIDE THE TANK, above oil level</td>
</tr>
<tr>
<td>Minimum inlet pressure = 0,8 bar (absolute) B ≤ 800mm, C= 200mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horizontal Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSIDE THE TANK</td>
</tr>
<tr>
<td>Minimum oil level equal or above the pump mounting surface. A ≥ 200mm</td>
</tr>
<tr>
<td>OUTSIDE THE TANK, above oil level</td>
</tr>
<tr>
<td>Minimum inlet pressure = 0,8 bar (absolute) B ≤ 800mm, C= 200mm</td>
</tr>
</tbody>
</table>

IN: inlet line - D1: 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</td>
<td>70</td>
</tr>
<tr>
<td>0,8</td>
<td>120</td>
<td>115</td>
</tr>
<tr>
<td>0,9</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>1,0</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>1,2</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>1,4</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>1,6</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>2,0</td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>

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

![Diagram of a pump with labels 1 and 2, and notes indicating locking displacement limiter screw and displacement setting.

PVPC size

<table>
<thead>
<tr>
<th>Max displacement setting range</th>
<th>3029</th>
<th>4046</th>
<th>5073</th>
<th>5090</th>
<th>6140</th>
</tr>
</thead>
<tbody>
<tr>
<td>from ÷ to</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>
</tbody>
</table>

One turn of screw changes pump displacement by approximately

| cm³/rev | 1.5 | 2.2 | 3.2 | 3.2 | 6.0 |

For locking displacement limiter screw

| mm | 14 | 14 | 17 | 17 | 19 |

For displacement setting

| mm | 4 | 4 | 5 | 5 | 6 |

Tightening torque

| Nm | 15 ± 1 | 15 ± 1 | 15 ± 1 | 15 ± 1 | 20 ± 1 |

10 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.

--- = Qmax

----- = Qmin

![Graphs showing noise level curves for PVPC-3029, PVPC-4046, PVPC-5073 and PVPC-5090, and PVPC-6140. The graphs illustrate the noise level in dB as a function of operating pressure in bar.]
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, 6140
- 20 ÷ 250 bar for 5090

Compensator standard setting:
- 280 bar for 3029, 4046, 5073, 6140
- 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, 6140

Compensator standard setting:
- 280 bar for 3029, 4046, 5073
- 250 bar for 5090, 6140

---

**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, 6140

Compensator standard setting:
- 280 bar for 3029, 4046, 5073
- 250 bar for 5090, 6140

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).
INSTALLATION DIMENSIONS OF PVPC-*-3029: BASIC VERSION “C” CONTROL

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

| Mass [kg] | PVPC-*-3029 | 18 |

SHAFT TYPE “1”
SAE “B” SPUNED
13 TEETH 16/32 PITCH
30˚ INVOLUTE SPLINE

SHAFT TYPE “5”

INTERMEDIATE FLANGE SAE “A” FOR PFE-31
SAE “A” SPUNED
9 TEETH 16/32 PITCH
100 Nm MAX

INTERMEDIATE FLANGE SAE “B” FOR PFE-41
SAE “B” SPUNED
13 TEETH 16/32 PITCH
135 Nm MAX

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted.
INSTALLATION DIMENSIONS OF PVPC-*-4046: BASIC VERSION “C” CONTROL

**Shaft Type “1”**
- SAE “BB” splined
- 15 teeth 16/32 pitch
- 30° involute spline

**Shaft Type “5”**
- SAE “BB” splined
- 13 teeth 16/32 pitch
- 30° involute spline

**Ports Dimension**
- **IN** = Flange SAE 3000 1 1/2"
- **OUT** = Flange SAE 6000 1"
- **D1, D2** = 1/2" BSPP screws for max displacement setting

**Intermediate Flange “A” for PFE-31**
- SAE “A” splined
- 9 teeth 16/32 pitch
- 150 Nm max

**Intermediate Flange “B” for PFE-41**
- SAE “B” splined
- 13 teeth 16/32 pitch
- 250 Nm max

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

| Mass [kg] | PVPC-*-4046 | 24 |
PORTS DIMENSION
IN  = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Regulation screw for max displacement setting

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

Mass [kg]
PVPC-*-5073  33
PVPC-*-5090

INTERMEDIATE FLANGE SAE “A” FOR PFE-31

INTERMEDIATE FLANGE SAE “B” FOR PFE-41

INTERMEDIATE FLANGE SAE “C” FOR PFE-51

Drawing show pumps with clockwise rotation (option D); pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted.
INSTALLATION DIMENSIONS OF PVPC-*-6140: BASIC VERSION “C” CONTROL

PORTS DIMENSION

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

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

| Mass [kg] | PVPC-*-6140 | 69 |

SHAFT TYPE “1”

SAE “D” SPLINED
13 TEETH 8/16 PITCH
30° INVOLUTE SPLINE

SHAFT TYPE “5”

1/2"-13UNC - 2B
16.1 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>
Version CH

Version L, R

Version LW

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.

17 RELATED DOCUMENTATION

A900  Operating and maintenance information for pumps

K800  Electric and electronic connectors