# AXIAL PISTON PUMPS
# GENERAL INFORMATION

## PRODUCT DESCRIPTION

PWG offers variable-displacement axial piston pumps for closed-loop circuits. Displacement is continuously variable by tilting a swashplate; moving it beyond the neutral position reverses the flow. Various controls are available, including manual, lever-operated servo and electrical controls.

All pumps include a charge pump that replenishes leakage losses, maintains pressure in the main circuit and supplies oil to the control system. The pumps incorporate high-pressure relief valves and are available in single or tandem versions. Various mounting options for auxiliary pumps and accessories, including bypass valves and filters, are available.

The identification plate carries the technical data, traceability number and marking valid for the warranty period. It is an integral part of the product; if it is missing, the warranty is void.

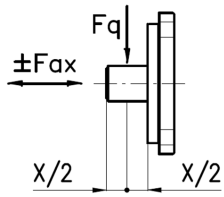
Any modification to our products without the manufacturer's authorisation constitutes tampering and will invalidate warranty coverage.

All PWG products undergo final functional and design-conformity checks. The mark shown below certifies that these checks have been passed. Where available and upon explicit request, PWG can provide declarations concerning inspections, tests and trials performed on the product.

# TECHNICAL FEATURES

## SHAFT LOAD CAPACITY

The shaft can withstand both radial and axial loads. The maximum permissible loads in the table ensure a bearing life greater than 80% of the life obtained without external loads.

| Displacement | | | | 14/18 | 21/28 | 46/50/64 |
|---|---|---|---|---|---|---|
|  | **Radial load** | $F_{q\ max}$ | N (lbf) | 600 (135) | 1200 (270) | 3000 (675) |
| | **Axial load** | $F_{ax\ max}$ | N (lbf) | 400 (90) | 950 (213) | 1500 (337) |

## INSTALLATION

PWG pumps may be installed in any orientation or position. For further details, contact PWG S.r.l.

# TECHNICAL FEATURES

## FLUIDS

Use mineral-based fluids with anticorrosion, antioxidant (ageing resistance) and antiwear additives (to prevent seizure in the mixed-friction region), and additives that improve viscosity-temperature behaviour, in accordance with DIN 51524-1/2/3 as appropriate for the severity of the application.

Optimum viscosity at operating temperature is 15-60 cSt. A maximum viscosity of 800 cSt is permissible for short periods during cold starting. Viscosities below 10 cSt are not permitted. Values of 10-15 cSt are tolerated only exceptionally and for short periods.

## OPERATING TEMPERATURE

During operation of the piston unit, hydraulic fluid temperature should remain between -25°C (-13°F) and 80°C (176°F); the limits specified for the fluid must also be observed.

## FILTRATION

For correct operation, the maximum permitted circuit contamination level is 20/18/15 to ISO 4406:1999 [class 9 to NAS 1638]. If the circuit includes a gear pump, installation of a WF filter (page 215) is recommended, with a microfibre element rated at 22 microns absolute (10 nominal). It can be connected directly to the piston pump suction and used as a manifold for all returns from the actuators.

## SUCTION PRESSURE

Minimum absolute pressure at the charge pump inlet is 0.8 bar [11.6 psi]. At start-up, an absolute pressure of 0.5 bar [7.25 psi] is tolerated briefly. Inlet pressure must never fall below this value.

## CASE PRESSURE

Maximum case pressure is 2 bar [29 psi]. A maximum pressure of 6 bar [87 psi] is permitted briefly when starting the machine. Higher pressure may impair the service life and operation of the shaft seal.

## SEALS

Standard seals in C and W series pumps are NBR. Contact PWG S.r.l. when using special fluids.

## DISPLACEMENT LIMITING

The pump has a mechanical displacement limiter. Two set screws limit the travel of the control piston.

# INSTALLATION AND COMMISSIONING

## GENERAL RULES

The following installation and commissioning instructions apply to C and W series medium-pressure axial piston pumps for closed-loop circuits. Compliance has a decisive effect on unit service life.

These instructions refer to standard units fitted with standard components and used with common hydraulic fluids. Read them carefully before installation and start-up. Refer to the product catalogue for pump port identification.

Before initial start-up, the pump case must be completely filled with pre-filtered hydraulic oil and must remain full during operation. Starting the unit without filling the case may damage or immediately destroy the rotating group.

The following distinguishes between installation position (pump relative to reservoir) and installation orientation (vertical shaft, horizontal shaft, etc.).

The ideal filling procedure is described below. Complete filling can only be ensured by following these instructions. The original mounting position must be maintained after every overhaul.

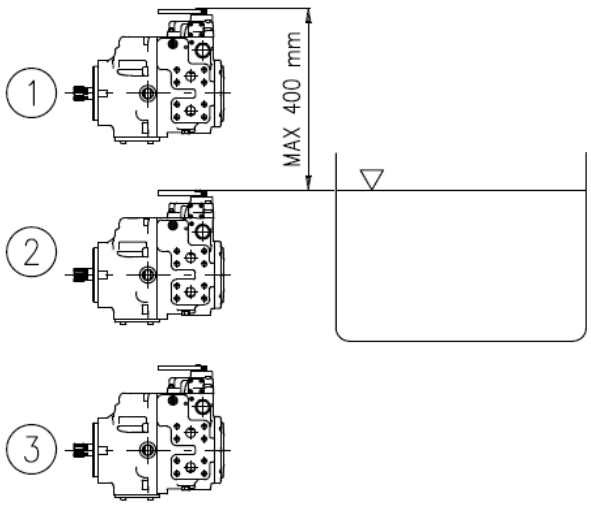
## INSTALLATION POSITION

The following installation positions are possible (see figure 1):

1. Pump above the reservoir, above the minimum oil level. Possible, but not recommended.

2. Pump beside the reservoir, below the minimum oil level, or with the highest point of the pump at the minimum oil level.

3. Pump under positive suction head, completely below the minimum oil level.



# INSTALLATION AND COMMISSIONING

## LINE SIZING

Absolute suction pressure must not fall below 0.8 bar (absolute). Oil velocity in the lines must therefore be kept as low as possible.

Velocity in drain and pressure lines must also be limited to avoid excessive pressure losses. Recommended velocity ranges for the different line types are shown in the table below.

The lower the oil velocity in the lines, the higher the efficiency and safety of the system. Cost and practical considerations set the limits on line sizing.

| Service | Fluid velocity (m/sec) |
|---|---|
| Suction | 0.6 - 1.2 |
| Drain line | 1.5 - 4 |
| Pressure lines | 2 - 8 |

## FLOW VELOCITY CALCULATION

To calculate flow velocity, use the following formula (see also the nomogram on the next page):

$$V = \frac{Q \times 21.23}{D^2}$$

V = velocity in m/sec
Q = flow rate in l/min
D = internal line diameter in mm

## EXAMPLE

Consider a C3 64 pump with the standard charge pump (13 cc) and a maximum speed of 3600 rpm. Under these conditions the charge pump delivers 46 l/min.

To avoid cavitation and prevent pressure falling below 0.8 bar (absolute), a velocity of 1 m/s is acceptable. A line with an internal diameter of 31 mm (equivalent to 1” G) is required. Always avoid elbows and sharp bends.

With the pump in neutral, charge pump flow must pass through the case drain. Under load, drain flow may increase because of leakage.

Assuming a 5% efficiency reduction under peak load, the drain lines must handle a maximum of 46 + (64 x 3.6 x 0.05) = 57.5 l/min. At a drain line velocity of 3.0 m/s, a 3/4” G line is required.

# INSTALLATION AND COMMISSIONING

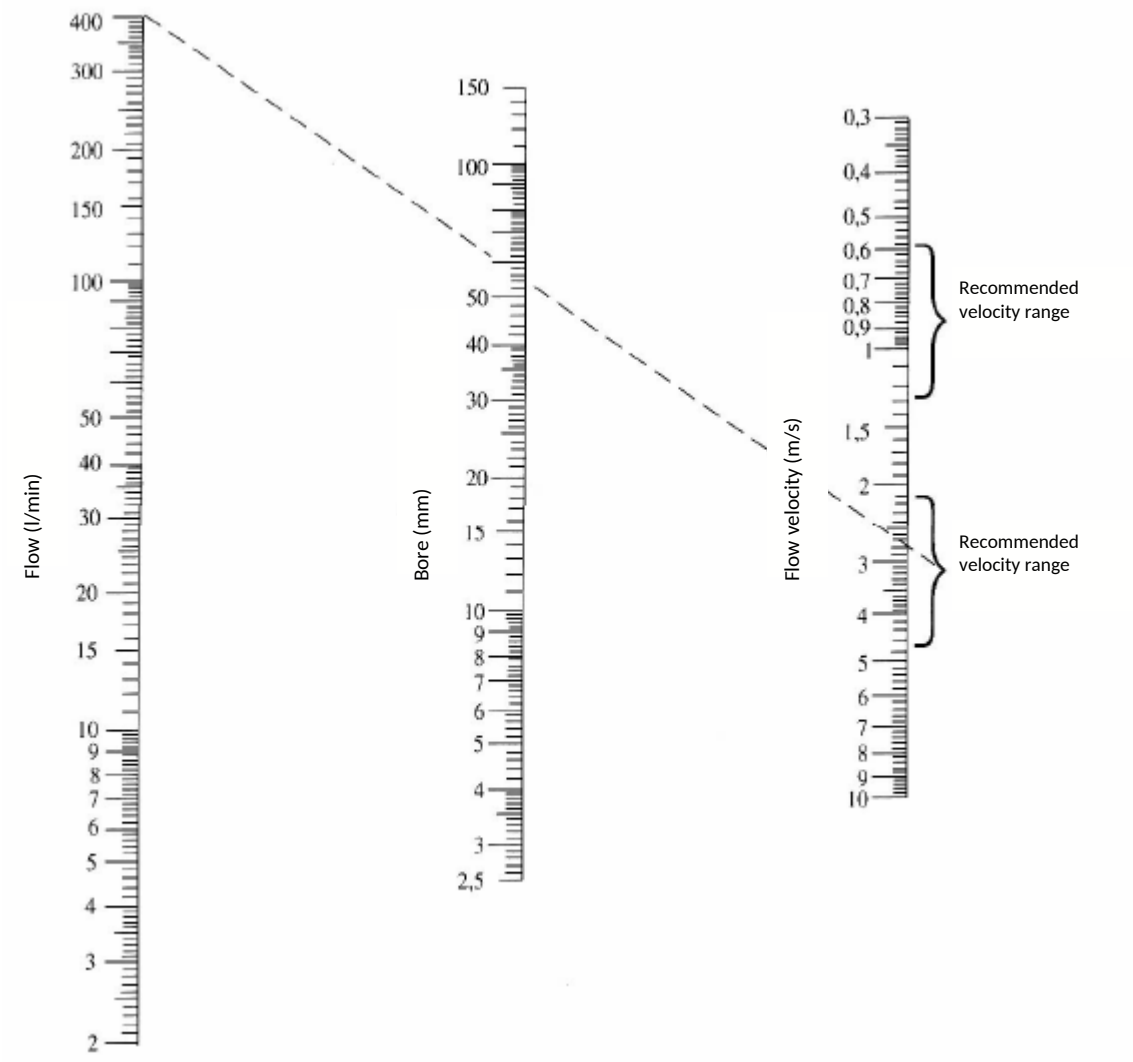
## PRESSURE LINES

For the pressure lines, maximum flow from a C3 64 at 3600 rpm is 230 l/min. With a maximum velocity of 4.5 m/s, the required line diameter is 32 mm, approximately equivalent to a 1 1/4” BSP line.

## WARNING

Regardless of the theoretical calculation results, NEVER use lines or fittings with a diameter smaller than the corresponding ports on the unit. Larger diameters are acceptable.

## FLOW - VELOCITY NOMOGRAM



# INSTALLATION AND COMMISSIONING

## INITIAL START-UP OR RESTART

Before initial start-up or restart, all system lines must be pre-flushed and the reservoir filled to its maximum level with pre-filtered oil. For line flushing and reservoir filling, use filter elements rated at 10 µm absolute or finer; 4 µm absolute is recommended.

After completing pump installation, connections and case filling in accordance with the preceding instructions, proceed as follows:

1) Connect two pressure gauges with a full-scale range of 600 bar to ports “MA” and “MB” (available only on displacements 50 and 64).

2) Connect a pressure gauge with a full-scale range of 60 bar to port “P”.

3) Ensure that the suction line, including the filter, is completely filled with oil. Otherwise, fill it and bleed the air. If this is not done, the charge pump may run without priming and be damaged.

4) Jog the pump by starting the prime mover and immediately stopping it, so that the pump rotates only briefly each time. Repeat until the gauge at port “P” reads 20 - 23 bar.

## IMPORTANT

Do not operate the flow control during this stage or the following stages!

5) Start the prime mover and leave it running. Check that pressure at “P” stabilises at the specified value:
W1-C1-C2-C3: 22 - 23 bar (*)
W0: 7-10 bar
(*) Standard values; these may vary in some cases.

6) Stop the prime mover and flush the closed circuit between pump and motor (see the relevant procedure).

7) Check lines and fittings for oil leaks, then carry out the load test, any required adjustments and the final machine acceptance test.

## MAINTENANCE

Change the oil for the first time after approximately 500 hours. Replace the filter cartridge first after 50 hours to clean the circuit initially, then every 500 hours. Subsequently change the oil every 2000 hours.

Reduce these intervals if the filter clogging indicator signals a blocked cartridge or if the system operates in a highly contaminated environment.

# INSTALLATION AND COMMISSIONING

## CLOSED-LOOP FLUSHING

After the initial start-up procedure, flush the closed circuit on new systems, after any pump or motor maintenance, or whenever either pressure line between pump and motor has been replaced and/or disconnected.

This precaution is essential to remove contaminants introduced during assembly and those in lines and fittings. The pump and motor will operate without closed-loop flushing, but their service life may be seriously reduced.

Flushing requires an in-line filter with nominal operating pressure and flow capacity suitable for the pump. Use an element rated at 10 µm absolute or finer; 4 µm absolute is recommended.

Because the filter has a specified flow direction, operate the pump control to obtain the required delivery direction. If in doubt, the higher-pressure branch, A or B, is the delivery branch.

Two in-line filter arrangements are possible:
1. Connect the filter in place of the motor.
2. Connect the filter in the return branch before it reaches the pump and bypass the motor with a temporary connection (preferred arrangement).

Flushing is satisfactory when oil cleanliness in the closed circuit reaches ISO 4406 code 18/16/13 or cleaner. The maximum acceptable contamination level of 20/18/15 applies to the entire system.

## WARNING

If several motors are connected in parallel, each circuit branch must be flushed correctly, including the lines connecting each motor to the flow-splitting point.

For this purpose, fit a high-pressure shut-off ball valve in series with each motor bypass line (arrangement 2 above). Flush the corresponding branch with its valve open and all other valves closed. Repeat for every branch to flush the entire circuit.

When flushing is complete, remove the filter and any temporary lines and restore the system to its normal operating configuration. The machine may then be tested under load and any necessary adjustments made.