Closed Loop pump

Function:

Closed circuit pumps have a variable displacement and two flow directions. They are associated with a charge pump.
The pumps transform the engine's horsepower into torque and supply one or more motors with hydraulic fluid.
The charge pump guarantees a minimum level of pressure in all the circuit lines and compensates for the main pump's leaks.

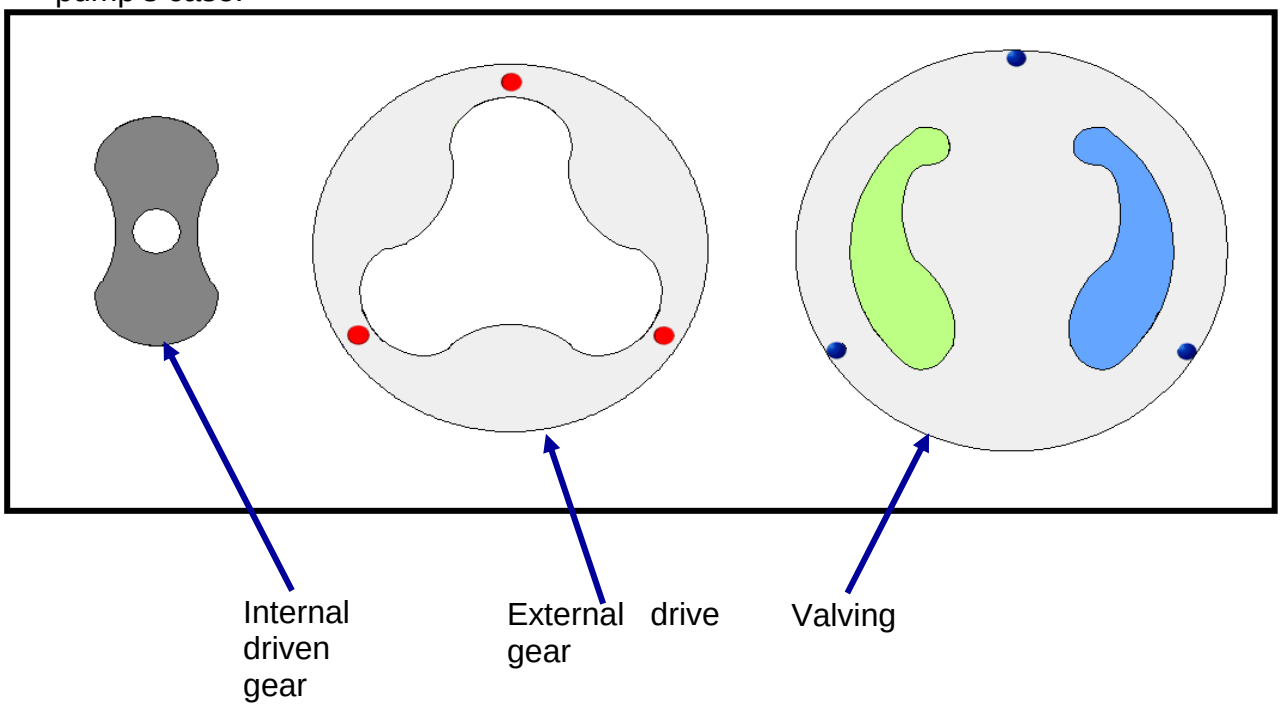
Principle of operation:

The PVA pumps consist of:

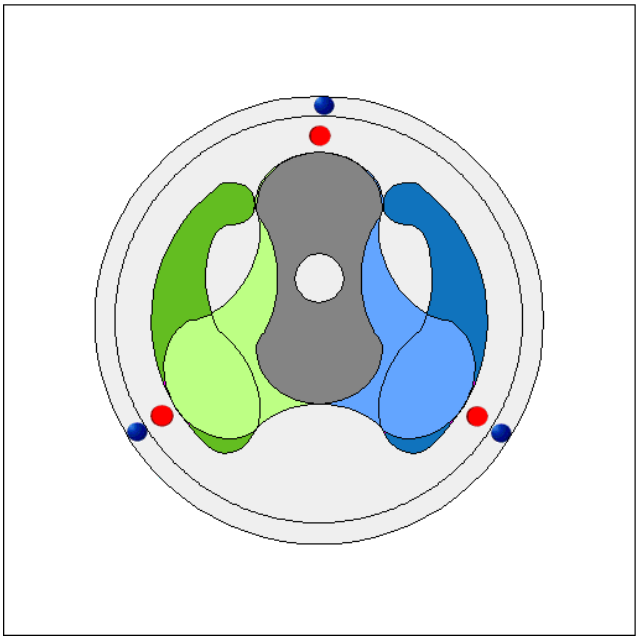
- An axial piston, variable displacement main pump
- A fixed displacement gerotor or internal gear charge pump

Charge pump principle of operation:

The charge pump is based on the gerotor technology and integrated into the main pump's case.



A gerotor pump consists of three main elements: the external drive gear, the internal driven gear and the valving. The latter is partly connected to the suction (in green in the drawing), partly to the charge pressure line (in blue in the drawing).
The missing tooth on the internal gear creates a void which allows it to suck fluid into the pump. The spaces between the gear teeth transport the fluid to the discharge side, and then the gears re-mesh to discharge the fluid.

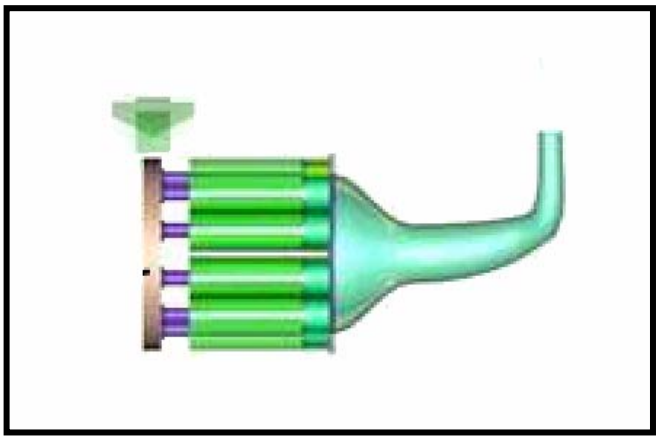


Charge pressure

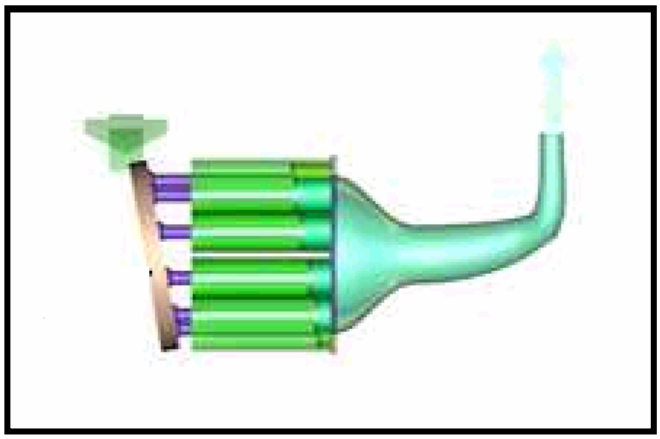
Suction

Main pump principle of operation:

The variable displacement, double flow direction pump consists of axial pistons that rest on a variable angle swashplate. Its angle determines the pump's displacement.



Zero degree angle (Neutral):
➡ No piston stroke
➡ No output flow



Forward angle:
➡ The pistons move back and forth
➡ The pump discharges hydraulic fluid

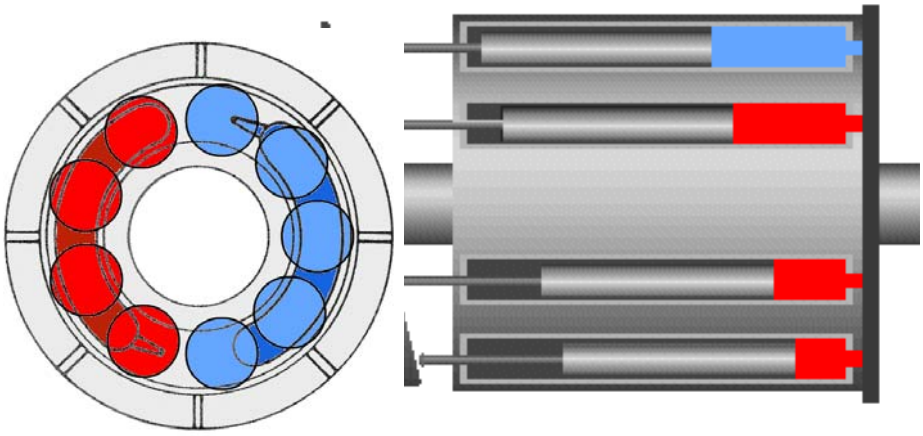
The pistons are guided in cylinders as they move back and forth; the barrel to which they are mounted makes them rotate; the

other end of the pistons rests on the swashplate.
When the swashplate is in neutral position (0 degree angle) the pistons cannot move back and forth inside the cylinders. No hydraulic flow is generated in the closed loop circuit and the pump is in neutral (0 displacement).

When the swashplate is tilted the pistons move back and forth inside the cylinders. By sucking and discharging oil they generate flow in the closed loop circuit.

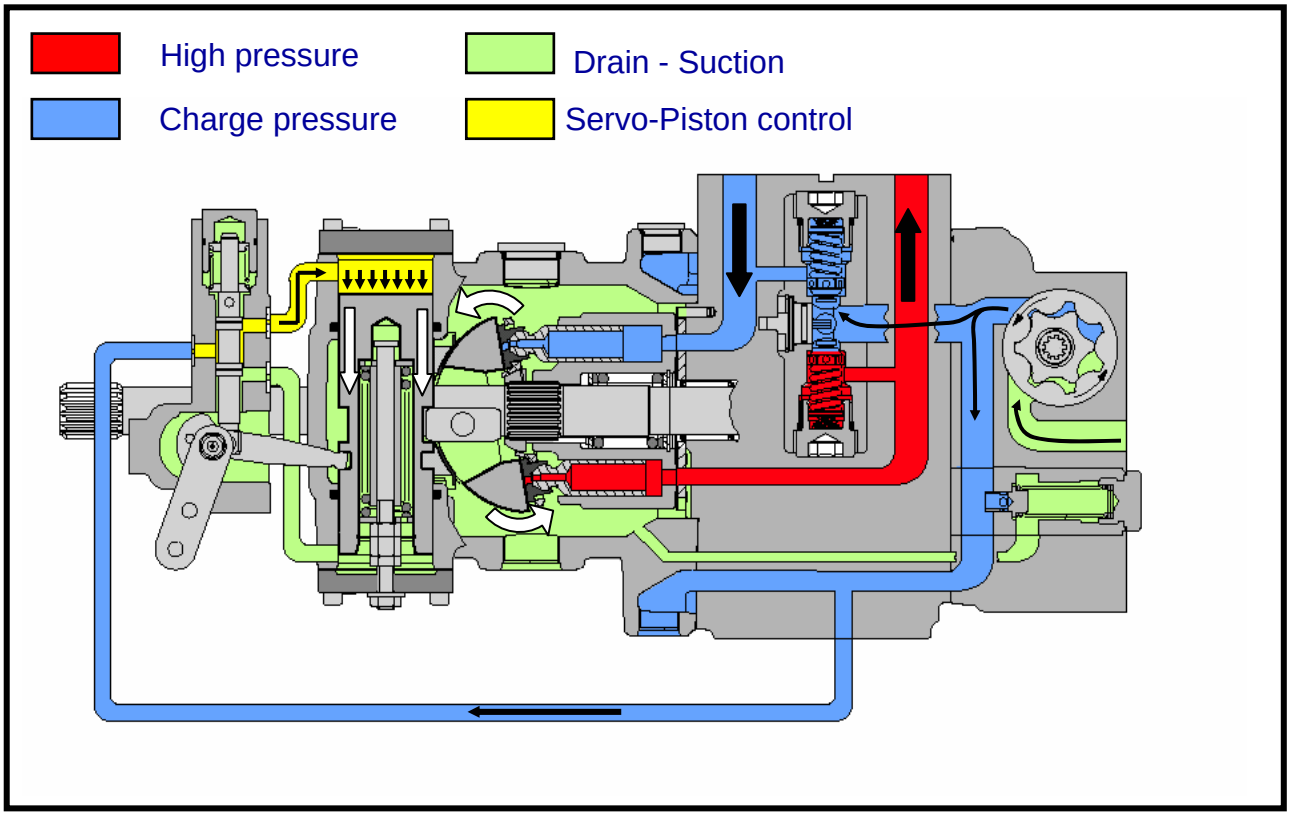
Charge pressure

High pressure



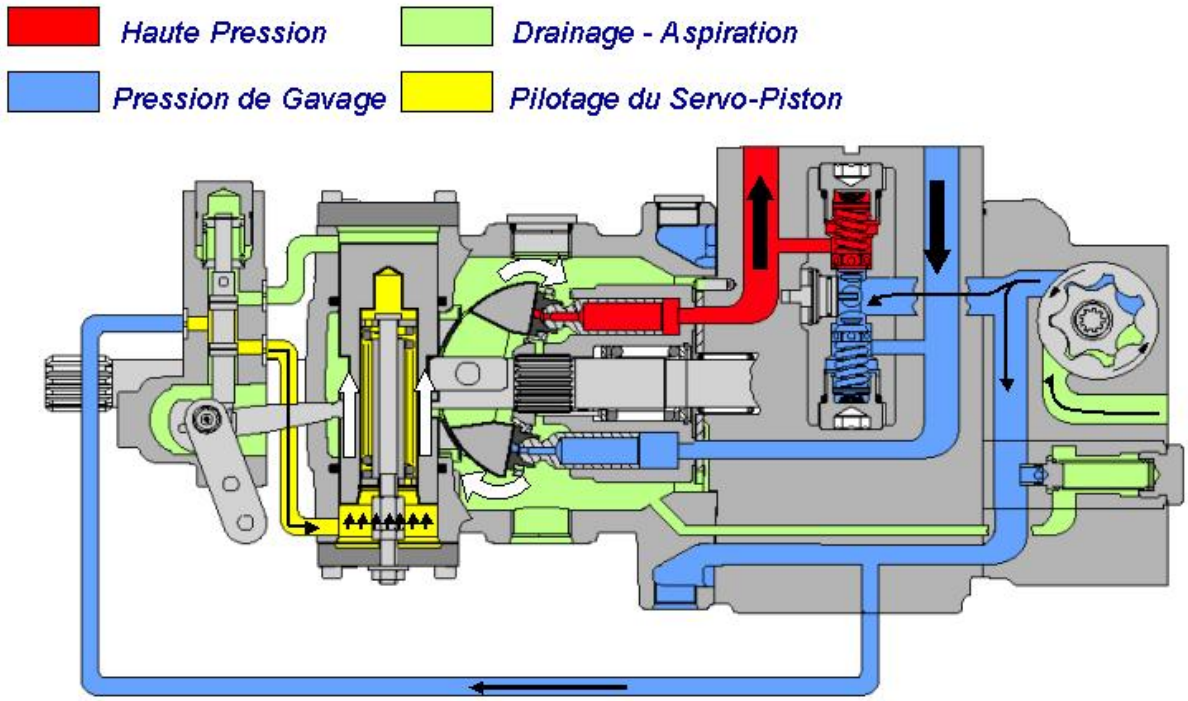
Infinitely variable displacement:
Changing the swashplate's angle can change the pump's displacement but also reverse the oil flow that passes through it. The swashplate angle is servo-controlled.

Manually actuating the pump lever makes the servo-piston move; the servo-piston pushes against the swashplate, causing it to tilt to a position out of neutral.
In order to increase the vehicle's speed, the operator pulls the servo-control's lever further and allows the charge pressure to communicate with the upper part of the servo-piston. The pressure increase pushes the servo-piston towards the bottom and increases the swashplate angle.



The higher the swashplate angle, the longer the pistons' stroke. The volume of oil sucked and discharged will therefore increase. The hydraulic motor receiving the oil will increase its rotating speed to deal with the additional volume and the wheel will turn faster.

To reverse the flow the pump's swashplate must be tilted the other way. Although the barrel rotates in the same direction, sucking and discharging are reversed. As a result the motor receiving the flow reverses its direction of rotation.



Benefits:

This pump technology enables the vehicle to drive in forward and reverse with the utmost precision. Furthermore the secondary (charge) pump maintains the charge pressure level in the closed loop's return line.

Limits:

These pumps can only generate a limited flow level. Changing motor displacement may be needed on certain vehicles to reach the desired travel speed.

Find out more :

Training Closed Loop