AXIAL PISTON PUMPS

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Axial Piston Pumps are highly efficient pumping units capable of high pressures and flows.

An axial piston pump with load sense offers flow on demand and with a closed center control valve, little heat is generated when the pump is destroked because no fluid is moved.

Fixed displacement pumps must continually pump fluid back to tank through an open center valve. The heat generated even when no load is on the pump represents power loss and higher operating costs for fixed displacement pumps.

Because of their superior efficiency, small size and weight, and because of today's increased costs of fuel and energy; axial piston pumps are being more frequently specified in applications once filled by fixed displacement vane or gear pumps.

Once axial piston pumps were found primarily in aerospace applications, today these efficient pumps are found everywhere...

in large presses, in hydrostatic drives, steering assemblies - all sorts of stationary and mobile applications.

LARGE PRESSES
HYDROSTATIC DRIVES
STEERING ASSEMBLIES
Because of the closely fitted parts and finely machined surfaces on an axial piston pump, special care must be taken when service is required. But first, the basics.

In the Axial Piston Pump the pistons reciprocate parallel to the drive shaft.

The pistons are fitted into a round cylinder block, much like bullets in a revolver - and, like a revolver, the cylinder block turns.

Displacement in any piston pump is determined by the size and number of pistons as well as the length of stroke. This variable displacement piston pump changes the length of the stroke continuously to match the changing flow requirements of the hydraulic system.
A “swash plate” or cam is mounted on pivots at the drive end of the pump.

Each piston is fitted with a ball joint shoe and each shoe has a flange.

The return plate with nine holes in it fits over the shoes and holds them against the wear surface of the cam.

If the cam is tipped, the pistons will be forced into and out of their respective bores as the cylinder block rotates.
If the cam is not tipped, the pistons remain stationary in their bores as the cylinder block is turned and no oil is pumped.

To reduce friction between the rotating shoes and the wear plate, a small hole permits hydraulic oil to flow from the hollow piston, through the ball joint to the back of the shoe, creating a hydrostatic bearing. Because of hydrostatic balance very little of the fluid escapes the cavity.

The shoes and the ball joint are also separated by an oil film.

Looking at the cover end of the pump, we see the valve plate.

There are two kidney shaped holes in the valve plate, the larger of the two is the intake port.

The smaller kidney shaped opening is the discharge port.
As the bores in the rotating cylinder block turn past the valve plate intake port, the pistons are being pulled from their bores, drawing oil in at the intake.

As the bores in the rotating cylinder block turn past the discharge port, the pistons are being pushed into their bores, forcing oil out.

The small round holes at either side of the discharge port allow oil to be released into the port gradually, reducing vibration and noise.

The very small hole near the intake port allows any fluid trapped in the bore to escape into the case as the piston fully bottoms in the cylinder block.
As you can imagine, firm contact between the valve plate and the rotating cylinder block is critical for efficient pump operation.

Also, the return plate, which holds the shoes against the cam surface must have a firm, constant contact to do its job.

One large spring provides firm contact for both the valve plate and the return plate.

This large spring is fitted into the center of the cylinder block and the pump shaft passes through it.

The spring is seated against a large snap ring (at the valve plate end of the cylinder block).
Three small steel pins pushed by the spring hold the return plate tightly against the shoes...

but at the same time, the spring is pushed against the snap ring forcing the entire cylinder block toward the valve plate.

The cam is tipped to change the displacement according to system demand. The cam has several forces acting upon it.

The purpose of that spring is to push the cam full tilt and make sure the pump is on full stroke when first starting up.
A small piston within the spring is pushed by discharge pressure, providing still more force to keep the pump at maximum displacement after it picks up pressure.

At the bottom of the pump is the control sleeve - a single acting device which can move the cam fully off stroke to zero pump displacement.

So when oil is directed to the control sleeve, the cam moves the pump off stroke and compresses the spring.

Oil to this control sleeve is directed by a pressure compensated control - a spool valve directs oil to the control sleeve when a predetermined pressure is reached.

See Controls 10-210-x for control operation.