Description of the Operation of a Progressing Cavity Pump

The PC pump is a very simple pump. There are only 2 parts. A stationary part, the stator and a rotating part, the rotor. It is a positive displacement pump without valves, and it delivers a constant flow.

The PC pump is actually a special case of the gear pump. It is a spiral gear pump with an external-tooth gear running in an internal-tooth gear. The internal gear (with external teeth) is called the rotor, and the external gear (with internal teeth) is called the stator. PC pumps are usually made in the most basic expression of this principle. The rotor is a gear with 1 tooth, so it becomes a single threaded helix. The stator is a gear with 2 valleys so it becomes a double threaded helical cavity. The stator has twice the pitch length of the rotor.

Refer to **Fig. 1** the stator is shown in cross section on the right side. The rotor is in the centre. When the rotor is inserted in the stator as shown on the left side, it will be located on the periphery of the stator cavity so that the gears are fully meshed. When the rotor is rotated to the right, it will describe a circle to the left as it is forced around the periphery of the stator.

Consider the cross-sections:

At cross-section A, there is a fully developed cavity to the left of the rotor. The cavity on the right is squeezed off (point x). In other works, a cavity has been terminated and another is about to begin.

At cross-section B, the stator cavity has rotated 90º to the right and point x is now at the bottom of the cross-section. The cavity which was sealed off in cross-section A is now 1/ 2 developed. The rotor has rotated 180º. At this point, it is obvious that there are cavities on both sides of the rotor. Therefore, when the rotor was inserted in the stator, 2 chains of spiral, lenticular on-lapping cavities were formed.

At cross-section C, the stator cavity has rotated 180º and the cavity, which we are following, is at its fullest development. The cavity on the other side of the rotor has reached its end and is sealed off. The rotor has rotated 360º.

At cross-section D, the stator has rotated 270º and the cavity is beginning to disappear. The rotator has rotated 540º.

At Cross section E, we are back where we started. The cavity is sealed off, the stator has rotated 360º and the rotor has rotated 720º.

Therefore, a cavity is 1 pitch length of the stator, which are 2 pitch lengths of the rotor. The cavities are sealed because the stator is usually molded in an elastomer and there is an interference fit with the metal rotor.

When the rotor is turned to the right, the cavities spiral up the barrel of the pump without changing size or shape. This is why the PC pump is an excellent sludge pump. If a particle is caught between the rotor and the stator wall, it is pressed into the wall as the rotor passes, then it is expelled into the next cavity.

Each cavity in the chain boosts the pressure by an equal amount. Therefore, each cavity is a stage.

The pressure rating of a progressing cavity pump is the pressure at which the pump is the most efficient. Below that rating, the pump is less efficient because of internal friction. Above that rating, the pump is less efficient because of increased slippage. PC pumps will work at pressures higher than the pressure rating, but the life is shortened. It is recommended that PC pumps be run at 75% of the rated head for long life in non-abrasive conditions; and 50% of the rated head in abrasive conditions, if possible. The pressure rating of a progressing cavity pump is usually close to 500 kPa per stage, but that varies with the hardness of the elastomer and the geometry of the pump (i.e., short pitch vs. long pitch)..