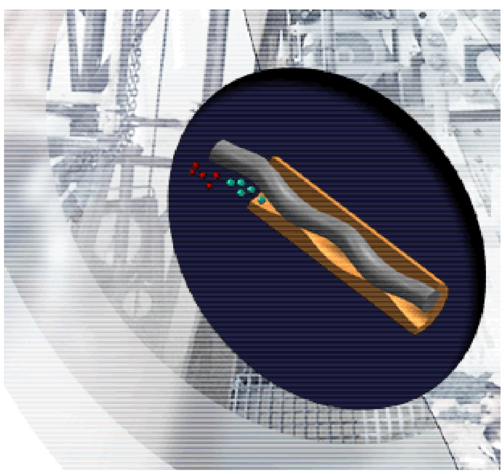
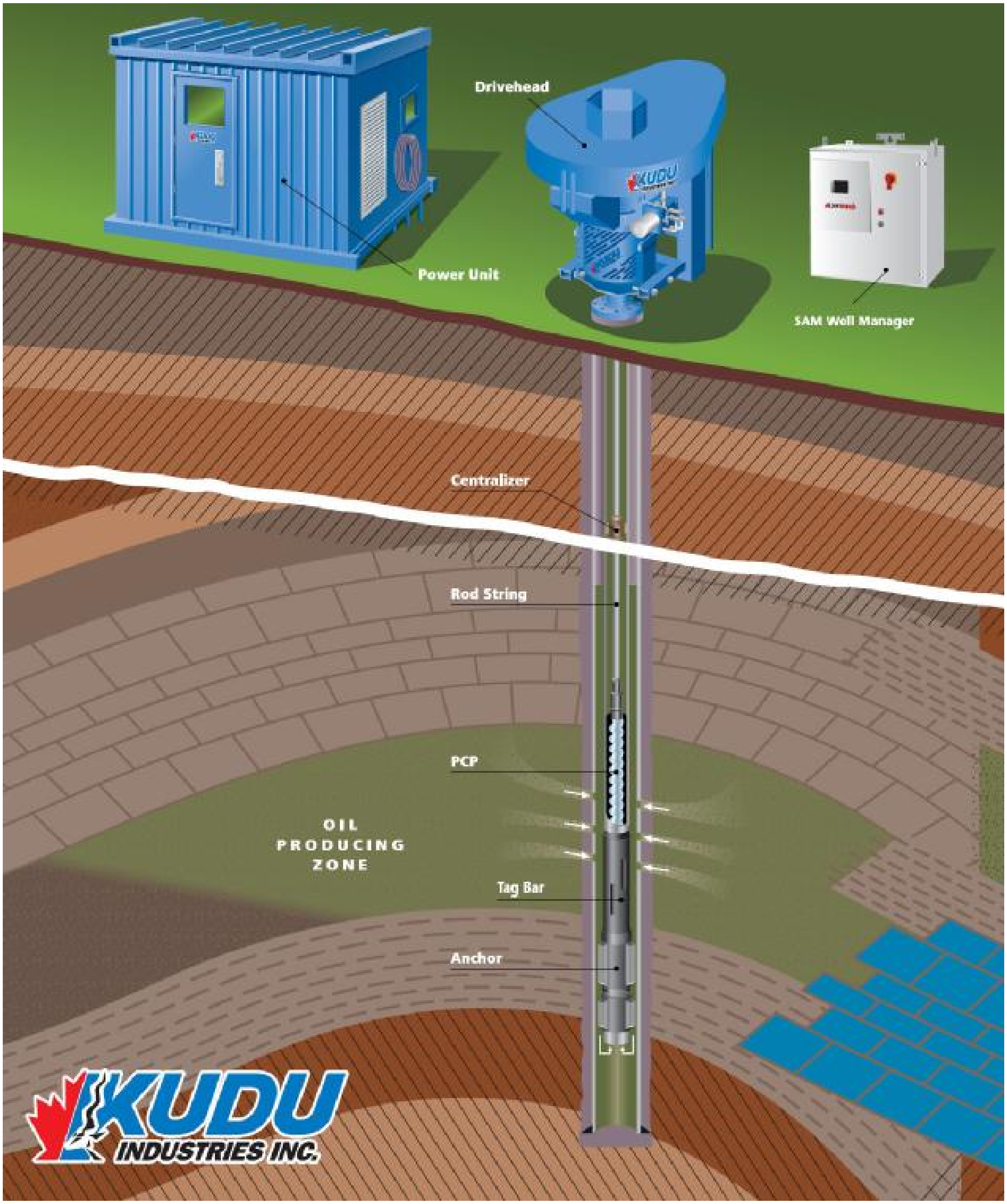
PRINCIPLES OF OPERATIONS

PCP's are positive displacement pumps, which consist of two key parts, the stator and the rotor. The stator remains stationary and the rotor rotates. The PCP is described as a gear pump with a single helical rotor, which rotates inside a double internal helical elastomer lined stator. The stator is run into the well on the bottom of the production tubing, while the rotor is connected to the end of the rod string. The rotor turns eccentrically in the stator forming cavities from the intake, beginning of the flow, to the discharge at the end of the pump. The PCP delivers a constant flow that is proportional to the size of the cavity and rotational speed of the rotor. Rotation of the rod string at surface is powered by a hydraulic or direct drive system, which causes the rotor to spin within the fixed stator, resulting in fluid production at surface. There are different surface drive configurations, auxiliary equipment components as well as pump types and sizes for various applications. The PCP system also offers the following key operational benefits:

- Produces in high viscosity fluids and large sand concentrations
- Low internal shear rates (limits fluid emulsification through agitation)
- Continuous power demand (prime mover capacity fully utilized)
- No valves or reciprocating parts to clog, gas lock or wear
- Tolerates high percentages of free gas
- Decreased capital and power cost
- Simple installation and operation
- Good abrasion resistance
- Limited noise levels
- Low maintenance
- Small footprint



PCP COMPONENTS

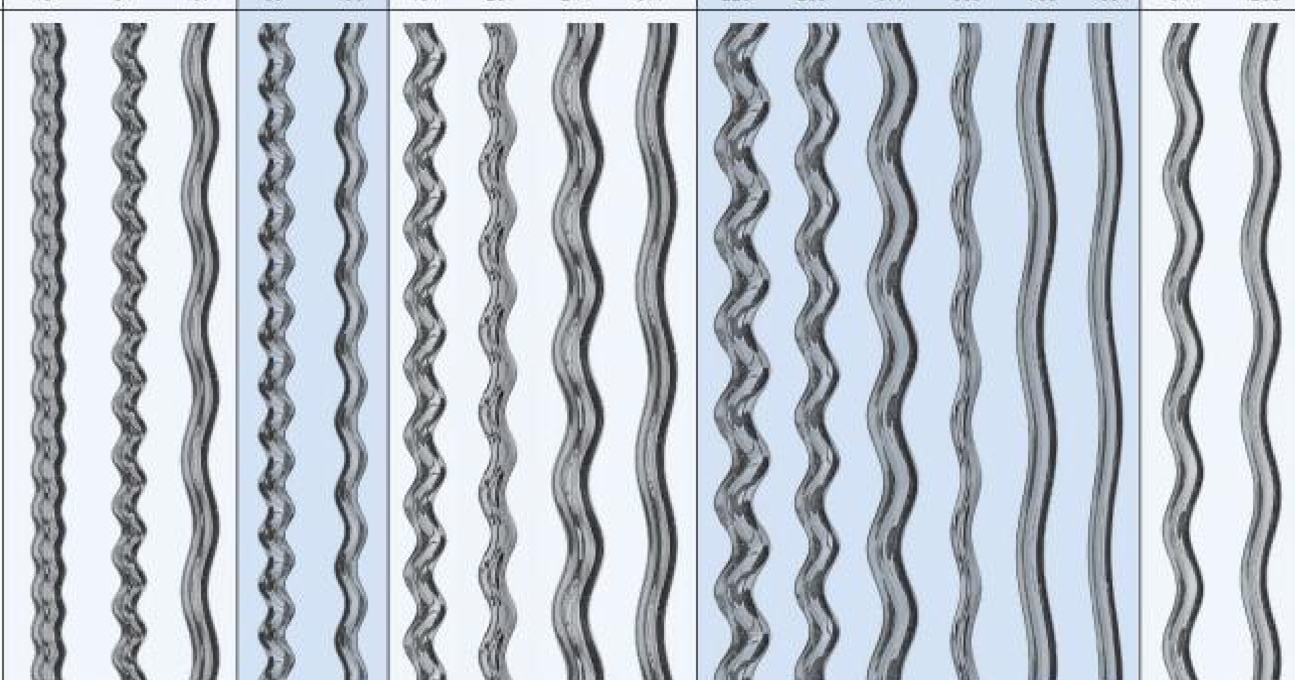


ROTOR

The rotor is the moving (rotating) component of the PCP and is held from the surface by the drive string, which is typically a conventional or continuous sucker rod. The rotor has contact with the stator elastomer along the seal line. The amount or degree of interference fit is critical to the efficiency and life expectancy of the pump.

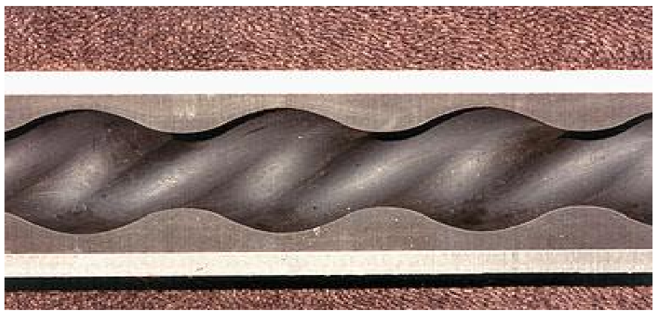
The rotor is machined to exacting tolerances and plated with chrome or chrome alternatives such as KUDU's Tough Coat™. The chrome provides a protective coating that minimizes abrasion, friction and corrosion damage. For each rotation of the rotor, fluid will move one pitch length of the stator. A different type of rotor pitch determines the ideal usage for a particular application. For example, the aggressive pitch of the 60TP pump is ideal for large sand concentrations and the 80TP pump is for lower clearance applications.

PUMP MODEL	15	30	80	60	100	120	160	200	300	180	225	300	400	600	800	750**	1000**	PUMP MODEL
m^3/day @ 100 rpm	3.1	5.4	17	13.2	21.6	24	32	38.8	60	36	45	60	80	120	174	150	200	m^3/day @ 100 rpm
bbl/day @ 100 rpm	19	34	107	83	136	151	201	244	377	226	283	377	503	755	1094	944	1258	bbl/day @ 100 rpm
ROTOR OPTIONS																		ROTOR OPTIONS
SERIES	2 3/8"			2 7/8"		3 1/2"				4"						5"		SERIES



STATOR

The stator consists of a steel tube, which encases an elastomer mould designed to achieve a specific geometric configuration. The fabrication of the stator begins with machining a reusable metal core in the male configuration of the stator's double internal helix. The metal core is positioned in the center of the stator casing, which has been cleaned and coated internally with a metal bonding agent to the elastomer. In an application, the stator is attached to the end of the tubing string and run into the well prior to the rotor or rods. An exception to this configuration is if an insert-able PCP system is used.



ELASTOMER

The elastomer is the heart of the PCP pump. Elastomer selection is a critical step in the PCP design as it influences pump run life and performance. Proper selection requires good knowledge of the well's operating conditions and fluid composition. Elastomer compatibility tests maybe required to measure the effect of the wellbore fluid on the material. To do these tests, a sample of the elastomer is immersed into the wellbore fluid (oil or water). The test will determine volume increases or decreases and hardness or softness changes of the elastomer. These tests are typically conducted at bottomhole pressure and temperature, over a 72 to 240 hour period.

Most elastomers are primarily made up of nitrile, a copolymer of butadiene and acrylonitrile. The butadiene contributes to mechanical properties, such as tear resistance. Acrylonitrile contributes to chemical properties, such as the resistance to aromatics. In addition, KUDU offers hydrogenerated nitrile elastomer (198) to achieve better H2S and temperature resistance, as well as a fluorocarbon elastomer (204) for greater resistance to aromatics and H2S. It is important to note that each manufacturer supplies its own formulation of elastomers, references and descriptions.

	Elastomer Description	Hardness	Abrasive Resistance	Tear Strength 20°C	Tear Strength 61°C	Explosive Decompression	Aromatics 21°C	Hydrolysis 50°C	CO_2 Resistance	H_2S Resistance
159	Synthetic	75	6	9	6	8	5	5	9	4
194	Synthetic	58	8	7	5	6	4	5	7	6
198	HNBR	76	5	8	5	5	4	9	5	9
199	Synthetic	73	5	10	6	9	5	3	9	3
204	Flourocarton Copolymer	77	3	5	5	5	10	7	6	9
205	Synthetic	53	9	7	5	6	4	4	6	6