

DOWNHOLE APPLICATIONS



Pumps to process

PCM, THE ORIGINAL INVENTOR



In 1930, the world's very first Progressing Cavity Pump (PCP) was designed by René Moineau, the founder of PCM.

Today, PCM MOINEAU OILFIELD

Division offers the largest range of progressing cavity oilwell pumps. PCM produces its own elastomers, and

it has the expertise and facilities to continuously research and develop the products of tomorrow's oilfield requirements.

For many years, PCM has operated and maintained a sound quality-control policy. Our ISO 9001 standard remains a guarantee of reliability and quality.

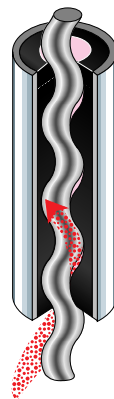
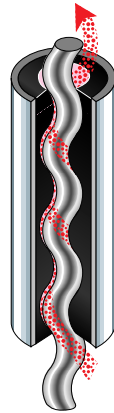
PCP PRINCIPLE

A PCP consists of a single helical rotor which rotates inside a double internal helical stator. The rotor is precisely machined from high strength steel ; the stator is molded of resilient elastomer. This makes the PC Pump the best pump for viscous fluids.

Completion : For oil production, the stator is fixed to the tubing and the rotor is attached to a sucker rod string. The pump is driven by rotation of the sucker rod string.

Large particle handling : The rotors are plated with a hard material to resist abrasion. Abrasive particles which are caught between the rotor and the stator are pressed into the elastic wall of the stator and then expelled into the next cavity when the rotor has passed.

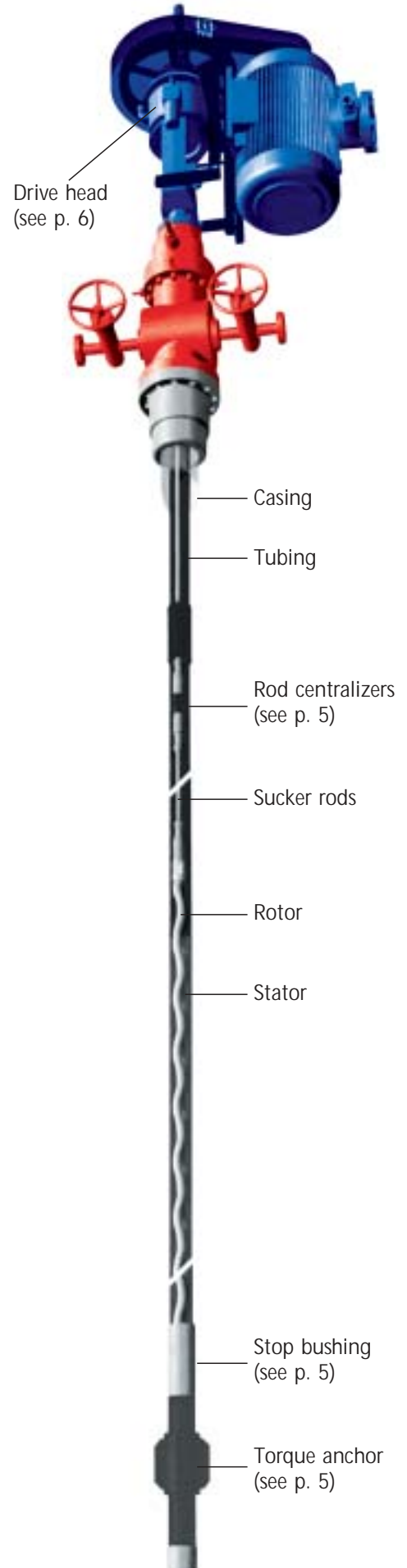
Flow rate proportional to pump speed : As the PCP is a volumetric pump, the flow rate depends only on the rotor speed. Therefore the pump can be exactly matched to the well inflow rate for optimum production.



Principle of the operation of a PCP



Cutaway PCP



PCP BENEFITS

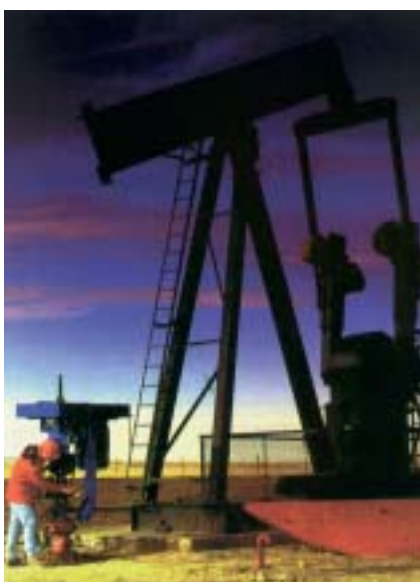
When compared to other artificial lift methods the PC pump has many benefits for the user.

Lower capital costs : The lack of expensive foundations, the simple construction and the compact surface drive unit minimises start-up costs or allows more pumps to be installed (and so more oil recovered) for the same capital outlay.

Lower running costs : In most applications, typically a PC pump has a significantly higher overall mechanical efficiency than that available from alternative artificial lift methods such as Electric Submersible Centrifugal Pumps or Rod Pumps. The unit cost of fluid recovered is therefore reduced.

Reliability : The simple construction has no standing or travelling valves to block and only one moving part downhole. The pump handles gas and solids without blocking and is more resistant to abrasive wear.

More environmentally acceptable : The low unobtrusive profile of the quiet running surface drivehead makes the PC pump more acceptable in environmentally sensitive areas.



PCP drive system VS beam unit

Low transportation costs : The complete system can be delivered in a pick-up truck.

Installation cost is minimal : The complete system can be installed by the service rig crew.

Absence of pulsations in the formation near the bore hole will generate less sand production from unconsolidated sand reservoirs. Constant flow production makes instrumentation easier.

Constant stress on rod string with minimal stress fluctuation decreases the risk of fatigue failure and rod fall.

Sand is handled efficiently due to the resilience of the stator material and the pumping mechanism.

Gas presence will not gas lock the pump.

Positive displacement rate is controlled by speed and is not a function of pressure, although pressure affects efficiency.

Wide production range for each model (3 : 1 range in production rates). This range can be achieved without any change of equipment, using a Variable Speed Drive.

Operating Safety : The compact drive systems can easily be caged or set bellow grade, out of the reach of people and animals, for maximum operating safety. All moving parts are enclosed in metal guards or housings, and the drive heads are equipped with anti back spin devices to protect maintenance personnel during operation.

Long Life : Pumping systems are built to last. All above-ground moving mechanical components are suspended in place by heavy-duty lubricated bearings, ensuring smooth vibration-free performance.



Installation of the PCP.
Running in the rotor

Easy adjustment : Belt drive mechanisms or hydraulic controls make it easy to change the speed of PC pumps for varying well production rates. Variable speed devices and gear reducers can be installed to make speed adjustments easier and to extend the range of pumping speeds.

Simple maintenance : PCP systems are easy to maintain in the field. The surface drivehead contains only one set of lubricated bearings and other easily maintained components that do not require special tools or procedures. The drivehead packing is easily adjusted for extended packing and drive shaft life. Only one moving part down hole for reduced maintenance and workovers.

PCM MOINEAU PCP UNIQUE FEATURES

Longest PCP Experience : Since 1932, PCM has produced Progressing Cavity Pumps.

Largest Range : With flow rates up to 1000 m³/day (6280 bfpd) and head capabilities up to 3000 m (9850 ft) PCM offers a wide range of performance.

Drivehead Choice : Depending upon load and mounting, 8 basic types of driveheads are offered. They can use all types of acceptable oilfield movers, and options like torque controller, brakes, etc. are available. (see page 6)

Elastomer Choice : PCM is its own elastomer manufacturer with a R & D lab, formulation, mixing and injection facilities. This enables PCM to provide the elastomer you need. Compatibility tests are routinely performed by each distributor in its own laboratory.

Specific Rotor Geometry : Minimizes abrasion, increases lifetime and de-creases starting torque.

Rotor Material : Stainless steel rotors are available upon request for corrosive environments.



Rotor turning

PUMP RANGE

Series*	Pump Model**	ISO Code	Flow at 500 RPM		Head Capability	
			m ³ /d	bfpd	m	ft
2 3/8" EUE	15 TP 1200	15/12	16	100	1200	4000
	30 TP 600	30/6	27	168	600	2000
	30 TP 1300	30/13	27	168	1300	4250
	30 TP 2000	30/20	27	168	2000	6600
	80 TP 1200	80/12	85	536	1200	4000
	80 TP 1600	80/16	85	536	1600	5250
2 7/8" EUE	60 TP 1300	60/13	66	417	1300	4250
	60 TP 2000	60/20	66	417	2000	6600
	60 TP 2600	60/26	66	417	2600	8500
	100 TP 1200	100/12	109	684	1200	4000
	100 TP 1800	100/18	109	684	1800	5900
	240 TP 900	240/9	238	1494	900	2950
3 1/2" EUE	120 TP 2000	120/20	122	770	2000	6600
	120 TP 2600	120/26	122	770	2600	8500
	200 TP 600	200/6	196	1232	600	2000
	200 TP 1200	200/12	196	1232	1200	4000
	200 TP 1800	200/18	196	1232	1800	5900
	300 TP 800	300/8	300	1885	800	2600
4" NU	225 TP 1600	225/16	225	1410	1600	5300
	225 TP 2400	225/24	225	1410	2400	7900
	300 TP 1200	300/12	300	1885	1200	4000
	300 TP 1800	300/18	300	1885	1800	5900
	400 TP 900	400/9	400	2515	900	2950
	400 TP 1350	400/13.5	400	2515	1350	4450
	600 TP 600	600/6	600	3770	600	2000
	600 TP 900	600/9	600	3770	900	2950
5" CSG	430 TP 2000	430/20	430	2703	2000	6600
	750 TP 1200	750/12	750	4710	1200	4000
	1000 TP 600	1000/6	1050	6600	600	2000
	1000 TP 860	1000/8.6	1000	6280	860	2800
6 5/8" BUT	900 TP 1500	900/15	920	5660	1500	5000

*Series are designated by the size of the API stator thread.

**Models are designated by two numbers. The first one is an approximation of the capacity in m³/d at 500 rpm and zero head, the second one indicates the nominal head capability in meters.

ELASTOMERS

The elastomer selection is a critical step in the PCP design. It influences the pump lifetime and performance. The right selection requires a good knowledge of well conditions and fluid composition.

PCM has developed a wide range of elastomers. These elastomers are

mainly made up of "nitrile" (copolymer made up of butadiene and acrylonitrile). The butadiene contributes to mechanical properties, as acrylonitrile contributes to chemical properties.

In addition, PCM develops an hydrogenated nitrile elastomer to achieve

better H₂S and temperature resistance, and a butadiene fluorocarbon elastomer to achieve greater resistance to aromatics and CO₂.

The figures below should be used as a reference only. PCM's specialists must be consulted for each specific application.

OVERVIEW ELASTOMER SELECTION GUIDE

Characteristic	PCM Code	Mechanical Properties	Resistance to Abrasives	Resistance to Aromatics	Resistance to H ₂ S	Resistance to CO ₂	Temperature Limit
Standard Nitrile	159	Excellent	Good	Medium	Good	Good	120 °C
Soft Nitrile	194	Good	Excellent	Poor	Good	Poor	80 °C
High Acrylonitrile	199	Good	Medium	Good	Good	Medium	100 °C
Hydrogenated Nitrile	198	Good	Excellent	Medium	Excellent	Medium	140 °C
Fluorocarbon	204	Medium	Poor	Very Good	Good	Excellent	130 °C

PUMP ACCESSORIES

PCM/KUDU offer a large range of downhole and surface accessories.

Rod Centralizers : Rotational wear of the tubing by the rods can be prevented with non rotating centralizers.

PCM will calculate rod/tubing side loading if a directional survey is supplied and will recommend centralizer placement in deviated or horizontal wells. (photo 1)

Stop Bushing : It is mounted at the lower end of the stator to space out the rotor during pump installation.

Back-Spin Brakes : A selection of brakes can be fitted on the drive-head :

- Hydraulically controlled disk brake
- Manually controlled mechanical brakes (photo 2)

Torque Anchor : Prevents the PCP stator and/or tubing from backing off due to rotational torque.

Others : PCM will supply gas anchors, tubing centralizers, tubing drains, pup joints, collars, pony rods, couplings, sucker rods, polished rods, wellhead components, etc. upon request.



Elastomer press



1 - Sucker rod centralizers



2 - Drive head with back spin brake (Kudu)

PCM/KUDU DRIVE SYSTEMS

The drive system includes a motor, a speed reducer and a drivehead.

All types of acceptable oilfield prime movers can be used : electric motors, internal combustion engines or hydraulic motors.

A full range of speed reducers is available, which provide fixed speed or variable speed, including : direct belt/pulley drive, gear reducer, mechanical, electronic or hydraulic variable speed drive.

Driveheads can be of either the vertical shaft, bearing box type or right angle drive gear box type.

The drive-heads can be driven by electric or hydraulic motors with belts



Drive head RH 100 HP (Kudu)

and pulleys or through in-line gear reducers. The right angle drive-head can also be driven by an internal combustion engine through belts and pulleys to the horizontal input shaft.



PCM drive system in Sudan
(Kudu drive head VH 100 HP)

DRIVE-HEAD MODELS AND MAIN SPECIFICATIONS

Model designations provide the following information :

Type : V means Vertical drive
R means Right angle
S means Solid shaft
H means Hollow shaft

Power : Maximum Horse Power

Load : Maximum thrust load (tons) based upon L10 lifetime of 25000 hours at 500 rpm.

Example : VS-60HP-9.9T is a solid shaft drivehead with vertical mounting ; its maximum power is 60 Horse Power, and its maximum load is 9.9 tons.



PCM RH 25 HP

DRIVEHEADS

A total of 8 driveheads can be selected according to the type and the load.

The 3 types are :

- Solid shaft which is recommended for in line direct mounting of the gear reducer.
- Hollow shaft mounted in line which allows easy flush by of the pump and is recommended for belt and pulley mounting with vertical rotation axis.
- Hollow shaft with right angle which allows easy flush by of the pump and is recommended for belt and pulley mounting with horizontal rotation axis.

DRIVE-HEAD CHART

	Solid shaft in line			Hollow shaft in line			Right angle		
	Type	Power	Load	Type	Power	Load	Type	Power	Load
Heavy duty	-	-	-	VH	100HP	18T	RH	100HP	18T
High duty	VS	60HP	9.9T	VH	100HP	11.6T	RH	100HP	11.6T
Standard duty	VS	25HP	4T	VH	25HP	4T	RH	25HP	4T

EXAMPLES OF APPLICATIONS

Water as readily as oil

PCM MOINEAU Pumps will pump water as readily as oil and can be used in water source wells, to de-water gas wells, or coal bed methane recovery wells.

Corrosive conditions

PCM MOINEAU Pumps can be used to combat corrosive conditions. Pumps have been used successfully in high water cut (99%) wells with 180,000 ppm salt, and 12 % CO₂ + 3% H₂S in the gas.

High efficiency

PCM MOINEAU Pumps are the simplest and most efficient high volume pumps up to 1000 m³/day (6280 bfpd). Abrasives have very little effect on the pump.

High viscosity and sand

PCM MOINEAU Pumps are ideal for pumping high viscosity crudes, with or without high sand content, because PC Pumps are the best sludge pumps. In one extreme case, a 15,000 cPo. crude was pumped with 61 % sand content.

Suitable for unstable soil

PCM MOINEAU Pumps are a solution to unstable soil conditions which plague pump jacks because the PC drivehead is mounted on the wellhead.

Small footprint

PCM MOINEAU Pumps are used on offshore platforms, on crowded production pads, in irrigated fields and in urban areas, because of the small size of the drivehead and quiet operation.

Dramatic energy savings

PCM MOINEAU Pumps often replace other pumping systems because of the dramatic power savings. In many areas, the power supply companies offer incentives to change to more power efficient PC Pump Systems.

PCM PRODUCT RANGE

In addition to oil well pumps, PCM Moineau Oilfield designs and manufactures Progressing Cavity and Hose pumps for any transfer application. Particularly, these pumps can be used for drain vessels, sump caissons, drilling mud disposal or oily water treatment onshore as well as offshore.

WORLDWIDE DISTRIBUTION

PCM is rapidly expanding its overseas network.

Thousands of PCM MOINEAU Pumps are operating from Patagonia to Sakhalin islands.

PCM's affiliate KUDU Industries covers North America.

PCM's office in Kuala Lumpur covers South East Asia.

PCM covers the rest of the world through distributors in most oil producing areas.

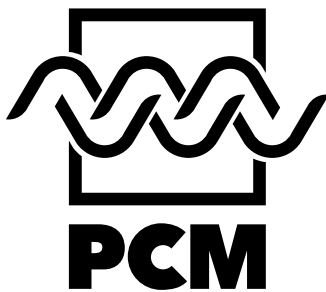


Commissioning a PCP in Libya
(Drivehead VS 60 HP with moto-reducer)

REFERENCES

PCM pumps are used in more than 20 countries, by more than 100 companies including :

AMAX PETROLEUM OF CANADA INC.
AGIP CANADA LTD.
AMOCO CANADA PETROLEUM CO. LTD.
ANDERSON OIL & GAS INC.
BP ALASKA
BOHAI OIL CORP.
CANADA NORTHWEST ENERGY LTD/CUPET
CHEVRON CANADA RESOURCES LTD.
CNPC
CONOCO CANADA LTD.
ELAN ENERGY INC.
EXXON EXPLORATION AND PRODUCTION GEOSERVICES
GNPOC SUDAN
HALLIBURTON
KUWAIT OIL COMPANY
LIRIK PETROLEUM
LUKOIL
LUNDIN OIL
MAXUS ENERGY
MEGIONNEFTEGAS
MOBIL OIL CANADA
MORRISON PETROLEUMS LTD.
MURPHY OIL COMPANY LTD.
NAM (SHELL GROUP)
NOBLE DRILLING (CANADA) LTD.
O.N.G.C.
PANCANADIAN PETROLEUM LIMITED
PETROLEUM DEVELOPMENT OF OMAN
PETROLEOS DE VENEZUELA
PG & E RESOURCES
RANCHMEN'S RESOURCES LTD.
RENAISSANCE ENERGY LTD.
REPSOL
RIGEL
SCHLUMBERGER
SHELL CANADA LIMITED
SHENGLI OIL FIELD
SINCOR
SYRIAN PETROLEUM COMPANY
TALISMAN ENERGY INC.
TOTALFINAELF
T.P.A.O.
UNOCAL CALIFORNIA



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