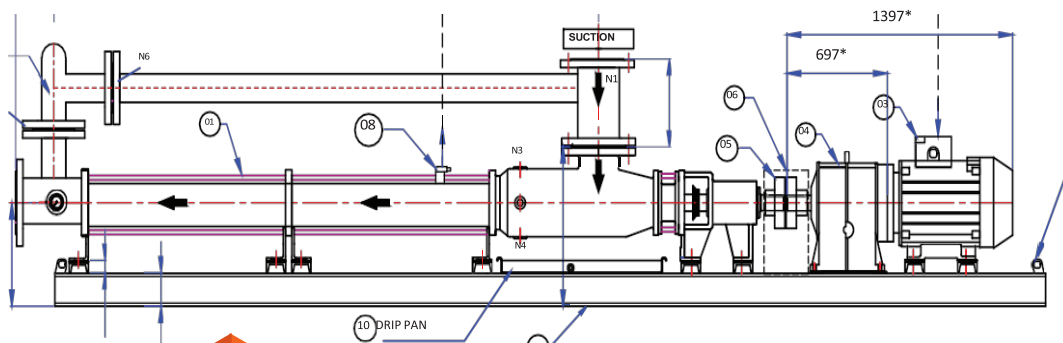


MULTIPHASE SURFACE PROGRESSIVE CAVITY PUMP



NOVA PETROLEUM
S E R V I C E S

WWW.NOVAPSERVICES.COM

alavia6@proton.me



TECHNOLOGIES

Multiphase Surface Progressive Cavity Pump

Multiphase pumping has become a critical component in many production schemes. Far from being a niche technology, it is fast becoming a standard component of the modern oil and gas production system. Multiphase pumps provide cost savings and operation flexibility in applications as diverse as onshore heavy oil and subsea/offshore conventional oil.

PCP is a positive displacement pump; PCP consists of two components: a single winding rotor with a round cross-section and a stationary element called the stator. We at NOVA Petroleum Services provide a complete solution for the design and supply of all components for Multiphase Applications.

We supply all equipment, including Skid Mounted, Pump (Pump, consistent stator, Rotor), Fixed Speed or Variable Speed Drive, Gearbox, Electric Motor, Junction Box, surface electrical, and unique control system. We have established alliances with leading manufacturers to produce PCP at a very robust and very affordable price compared to others. Stator Elastomers.

At NOVA Petroleum Services, we understand that elastomers are a critical component in PCP operational situations. Our commitment to selecting the best materials for H₂S, CO₂, and high-temperature conditions is a key factor in ensuring the reliability and longevity of our equipment, giving our customers peace of mind.

We have developed a series of elastomer formulas under different conditions, showcasing our adaptability and problem-solving skills in meeting diverse operational challenges.



MULTIPHASE PROGRESSIVE CAVITY PUMP

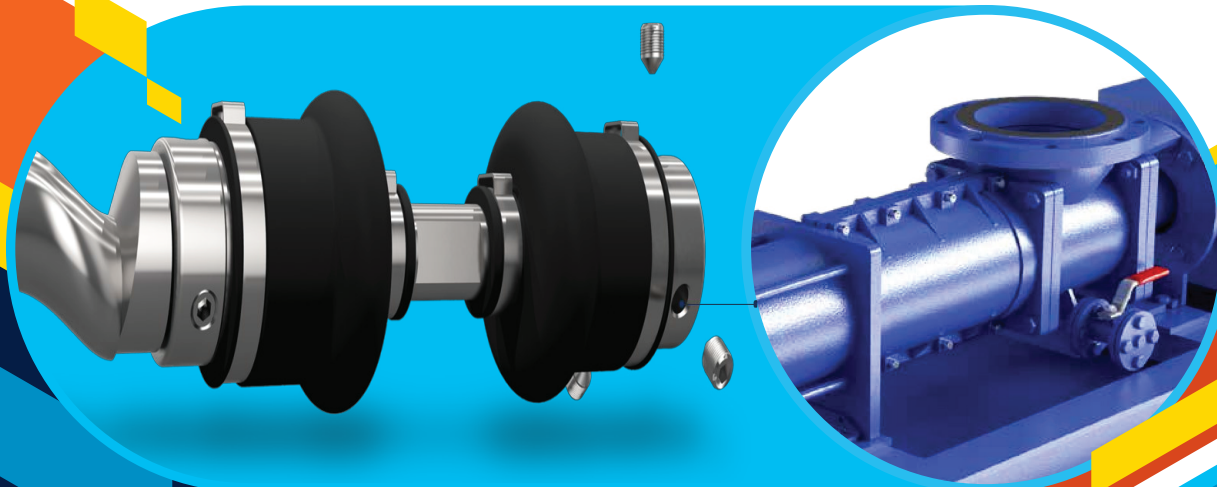
NOVA PETROLEUM SERVICES offers a full suite of application-specific equipment to meet your Multiphase Surface PCP needs. With continuous research and development, we strive to develop innovative tools that create more value for oil and gas production companies.

Boosting Wells into High-Pressure Gathering System

Multiphase Surface PCPs have all been used in different countries to boost production from low-pressure wells into higher-pressure gathering systems. As an alternative to installing vessels and conventional gas compression. Below is recommended API Standard.

ITEM	COMPONENT	API STANDARD
1	PUMP	API 676, Material and construction to suit application
2	Mechanical Seal	API 676, Single or double cartridge based on API 682 category 1
3	Seal Support System	API seal support system option (API plan 53B for illustration). Cooling system
4	Coupling with Spacer	Spacer type to AGMA 9000 class 9
5	Guard	Bearing design only. Flexible coupling to API 610/ AGMA 6009/6010
6	Gear Box	Helical gear reducer, minimum service factor 1.5, to AGMA 6009/6010
7	Shaft Seal	Single or double cartridge mechanical seal. API 682 (cat 1) complaints and seal support system options
8	Stator:	Available in nitrile (NBR), HNBR, or fluoroelastomer (FKM)
9	Piping	Connections to ANSI/ASME B16.5.
10	Motor	Safe or Hazardous area
11	Vent/Drain valve	Flange ANSI/ASME B16.5
12	Baseplate	Long coupled, cold service, mild steel extended base c/w drip tray API 676
13	Protection	NORSOK M50
14	Optional for Coupling and Spacer	API 671 corrosion-resistant, metallic, flexible coupling and spacer.

Multiphase Surface PCP Components



The NOVA Multiphase progressing cavity pump technology brings multiple benefits:

- Up to 90% GVF involving solids, low NPSH, or viscous fluid.
- Max flow rate – up to 75,000 bfpd [2,200 US gpm].
- Max differential pressure – up to 750 psi, 48 Bar.
- Max motor HP – up to 200 HP (150 kW) (for special applications, please inquire with NOVA).
- Maximum fluid temperature – up to 265°F [130°C].
- Ability to produce highly viscous fluids (up to 1000,000 cp).
- High system energy efficiency (between 55% and 70%).
- Lower power consumption.
- System simplicity, with fewer components.
- No valves, no gas lock. **NO CHANGES ON FLOW WHEN YOU HAVE BACKPRESSURE.**
- Handles fluids with free gas
- Relatively low capital and operating costs.
- Low maintenance.
- Simple installation and operation. Plug and Play.
- It can be used in remote locations without power.
- Steady energy demand.

NOVA multiphase booster pump system can provide incremental oil production to naturally flowing or gas-lifted, ESP wells, improve efficiency, and reduce operating costs.

Seal System

Seal Plan to suit application requirements.

Mechanical Seal

Single or double to API 682 Category 1

Pump

To API 676 Third Edition.
Materials of construction to suit application.

Baseplate

Long coupled, cold service mild steel extended base, c/w drip tray to API 676.

Motor

Safe or hazardous area.

Gearbox

To AGMA 6009/6010.

Coupling

Spacer type to AGMA 9000 Class 9.

Vent / Drain Valves

Ball valves flanged ASME B16.5.



API 676

The American Petroleum Institute (API) is an association for the USA oil and Gas industry and sets standards for a wide range of criteria, including materials of construction, operating procedures and safe practice.

NOVA API 676 pump has been designed to comply with positive displacement pumps-rotary third edition standard and specification is available, outlining the design and materials of construction requirements for pump selections.

Flow up to 225 m³/h / 990 gpm/33,942 bbls/d up to 48 bars/750 psi differential pressure.

OVER PRESSURE PROTECTION

Pressure relief valves to API 520/526

DRY RUN PROTECTION

PT 100 sensor with control relay, supplied with IS barrier for hazardous area applications.

SURFACE PROTECTION

NOVA standard high build two pack epoxy to 12944 C5-M or contract specification such as NORSOK M501.

INSPECTION AND TEST

Mechanical run, including performance, noise, and vibration, NPSH, and hydraulic test and material certification to contract requirements.

Pressure Transmitter overpressure protection with option for hazardous area.

Additional Protection Strategies

Chemical Inhibitors:

- H₂S Scavengers (e.g., Triazine) to neutralize H₂S.
- CO₂ Corrosion Inhibitors (e.g., amine-based compounds) to reduce Acid.



NOVA PETROLEUM
S E R V I C E S

Effect of H₂S and CO₂ on PCP Materials

Hydrogen Sulfide (H₂S) Effect

Sulfide Stress Cracking (SSC): High strength steels are susceptible to brittle fracture due to H₂S exposure.

Hydrogen Embrittlement: H₂S can diffuse into metals, causing loss of ductility and cracking.

Elastomer Degradation: H₂S can Chemically Degrade rubber components used in stators.

Carbon Dioxide (CO₂) Effects:

Carbonic Acid Corrosion: CO₂ reacts with water to form H₂CO₃ (Carbonic Acid), which aggressively corrodes metals.

Localized pitting and crevice corrosion: CO₂ accelerates metal degradation, especially in presence of chlorides.

Based on H₂S Concentration (NACE MR0175 / ISO 15156)

H ₂ S Concentration (ppm)	Environment Type	Material Consideration
< 0.05 ppm	Non-sour	No special materials required.
0.05 – 50 ppm	Low H ₂ S	Carbon steels can be used with inhibitors.
50 – 500 ppm	Moderately sour	Corrosion-resistant alloys (CRA) recommended (DuplexSS, 13Cr).
> 500 ppm	Highly sour	Nickel-based alloys, super duplex SS, and coatings required.

Recommended Materials for PCP Components in H₂S and CO₂ Environments

Component	Low H ₂ S & CO ₂ (<50 ppm, <0.5 psi CO ₂)	Moderate H ₂ S & CO ₂ (50-500 ppm H ₂ S, 0.5-30 psi CO ₂)	High H ₂ S & CO ₂ (>500 ppm H ₂ S, >30 psi CO ₂)
Pump Body & Housing	Carbon Steel (API 5L X52)	13Cr, Duplex SS (S31803)	Super Duplex SS (S32750), Inconel 625
Rotor	AISI 4140 (Coated)	Duplex SS (S31803)	Inconel 625 with Tungsten Carbide Coating
Stator Lining	NBR	HNBR	FKM, FFKM
Seals & O-rings	NBR	HNBR, FKM	FFKM (Kalrez®)
Tubing & Drive Shaft	Carbon Steel	13Cr Stainless Steel	Duplex SS, Inconel 625

Sand Problem: NOVA suggests for oil and gas application with Moderate content, at fluid temperature of 60°C, and gas fluctuations, Hydrogenated Nitrile Butadiene Rubber (HNBR) is an excellent choice for the PCP stator. Due to its robust resistance to oils, and abrasive conditions.

General Knowledge:

WEAR

Wear is proportional to speed, minimize speed to minimize wear.

De-rate pressure per stage to limit slip amount 6 Bar for no Abrasion, 3 Bar for heavy abrasion.

ABRAISON RESISTANCE

Oversize Rotor to increase run life. Use abrasion resistant stator material or softer elastomers for better run life. High standard chrome Rotor for additional Rotor base metal protection or Tungsten Carbide coated rotors for high abrasion resistance.

VISCOSITY

The more viscous a fluid, the slower the pump will have to run in order to permit the fluid to flow into cavity. At reduced speeds, the pump may not develop 100% volumetric efficiency and has to be considered for the selection process.

As a rule of thumb, the PC Pump is an efficient selection when the pressure required is higher than the flow rate (PSI > GPM). It is prudent to address the major concerns in the selection process: abrasion, temperature, the viscosity. Wear is proportional to speed, more so in a PC pump than in a centrifugal pump.

Below shown some Viscosity Indications:

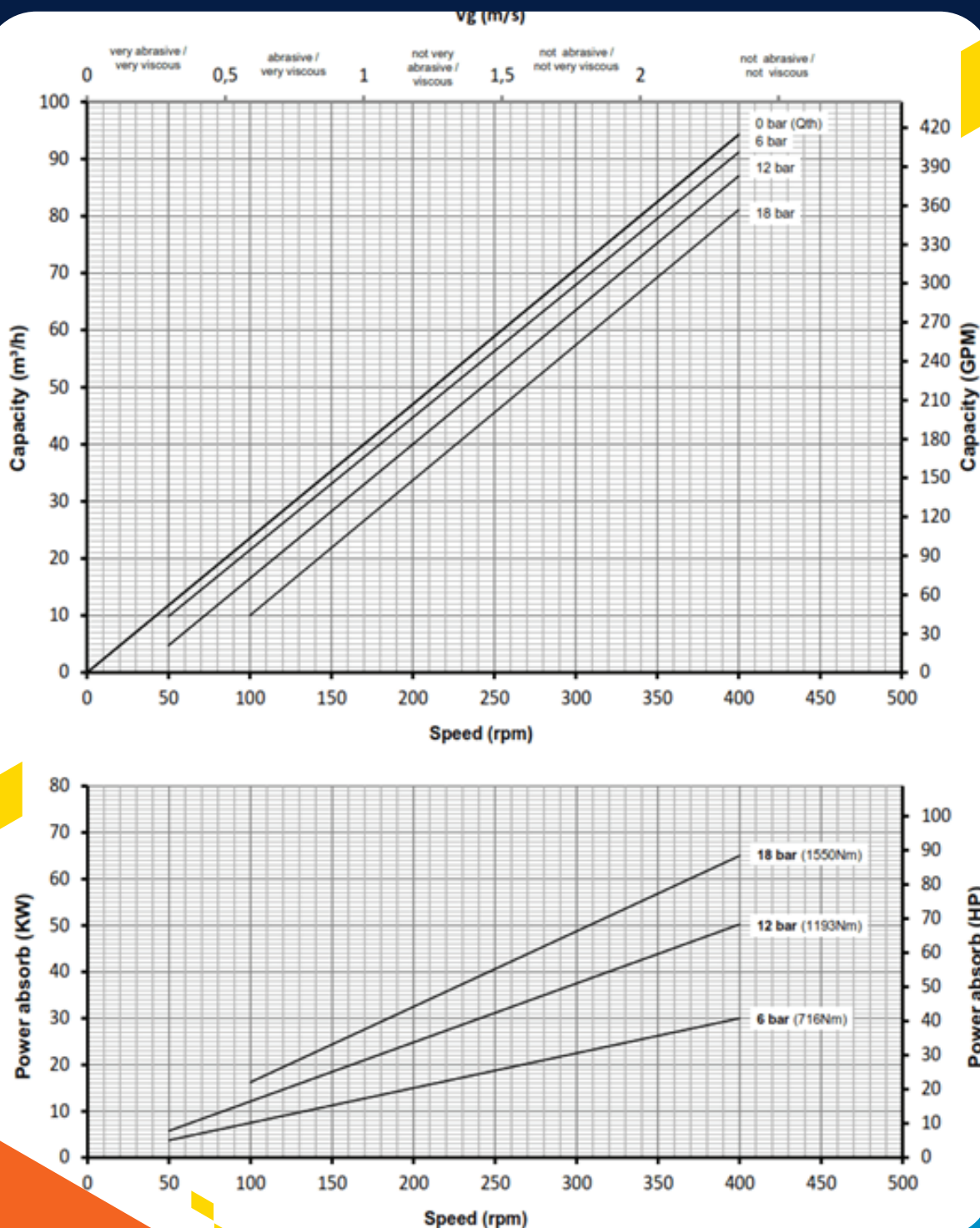
Fluid	Viscosity (cP)
Water	1
Motor Oil SAE 40	200
Glycerin	1,400
Honey	10,000
Ketchup	50,000

Pump Curve:

Multiphase Progressive cavity pump curves are different from centrifugal curves, as they are linear.

This demonstrates the unit's ability to handle liquids of varying viscosities with little impact on pump performance.

The bottom axis is speed rather than flow, as flow is proportional to speed. Unit speed is much lower than centrifugal, operating from as little as 50 RPM.



Not Recommended:

- Carbon Steel (AISI 1020, 1045) Highly susceptible to CO₂ corrosion.
- Standard Stainless Steels (304, 316)
 - Prone to pitting and cracking in H₂S.

Request Date:

**Multiphase Progressive
Cavity Pump Data**

AT SURFACE CONDITION	COMPANY
Site Name / Location:	
Data	Value
Suction pressure [psig]- Bar	
Discharge Pressure [psig]- Bar	
Suction temperature [F] / C	
Oil flow rate [b/d] - m ³ /Day - GPM	
Gas flow rate [mmsft ³ /d]	
Water flow Rate [b/d] - m ³ /Day	
Gas specific gravity	
water specific grav.	
Tempreture	
Oil API degree	
GOR	
Crude Viscosity Cp	
Available Voltage At site Volts 380/420	
Frequesncy HZ	
Indoor/Outdoor	
Sand	
H ₂ S	
CO ₂	
Offshore/Onshore	