TECHNICAL BULLETIN

PROGRESSING CAVITY PUMPS | LS-TB-021

LIFTING SOLUTIONS

BULLETIN	TOPIC	ISSUE DATE	ISSUED BY
LS-TB-021 V1	PC PUMP CHOPS OVERVIEW	FEBRUARY 11, 2021	ENGINEERING

BACKGROUND

Cold Heavy Oil Production with Sand (CHOPS) applications are particularly challenging. They require Progressing Cavity Pump (PCP) selection for operation at low speed, increased lift capacity and improved inflow performance. The use of soft elastomers in these applications results in a more forgiving sealine surface for abrasive wear. When combined with the aggressive geometry this allows for easier passing of solids without causing damage to the elastomer. A higher compression sets results in more interference between the rotor and stator which allows for extended wearability.

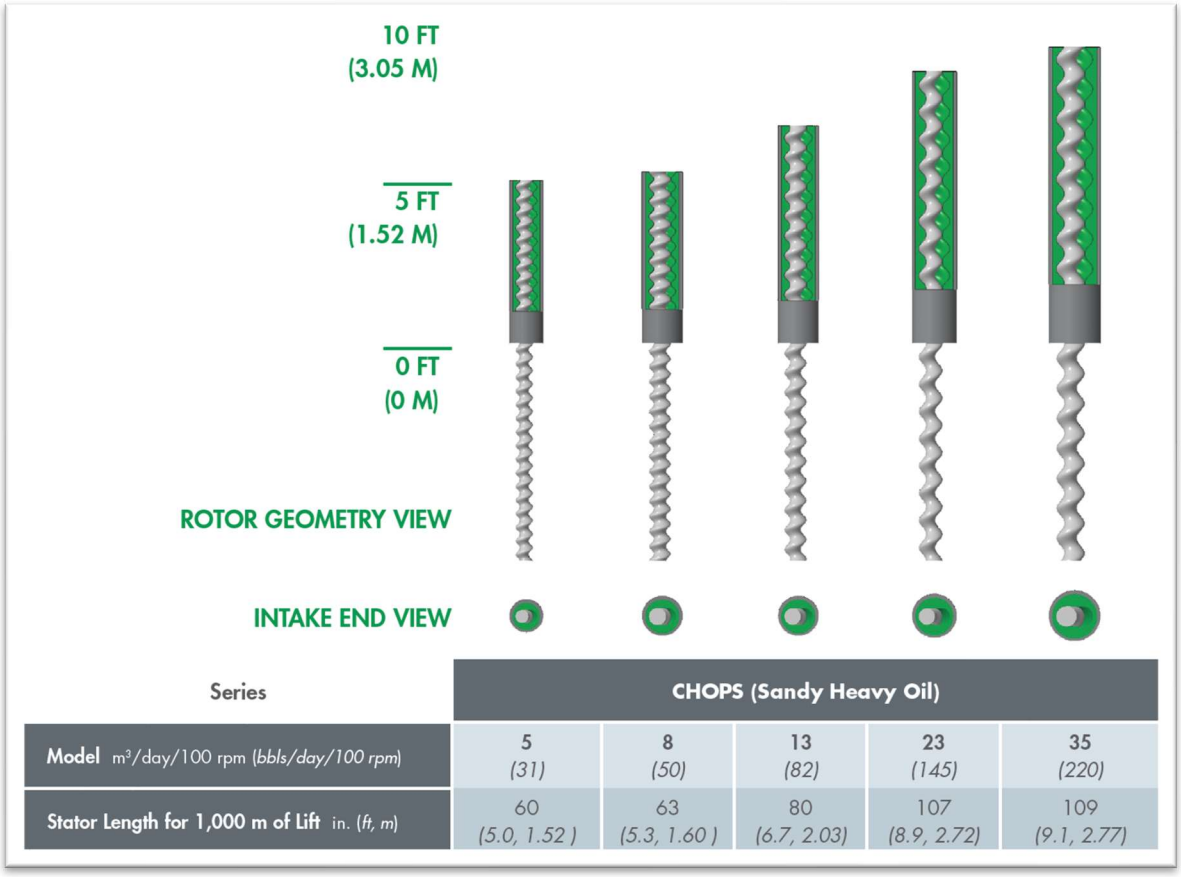
DESIGN OPTIMIZATION

PCP geometries for CHOPS applications are specifically designed for viscous fluids with high concentrations of sand. Fundamental design optimizations include.

Design Variable	Advantages
Cavity Inflow Area	The cavity inflow area is maximized to provide the largest possible opening at the intake of the pump while still considering rotor profile strength. This is important to increase pump inflow performance as less intake pressure is required to fill the cavity.
Cavity Length	Viscous, sand laden fluid is drawn into the cavity via the inflow area described above. The shorter the overall length of the cavity the easier it is to fill the cavity with fluid. This results in lower a rotor swept angle and more aggressive overall geometry.
Pump Length	Because of the increased cavity inflow area and decreased cavity length, the overall pump assembly is shorter with a larger flow area from intake to discharge. This results in less viscous flow losses when pumping higher viscosity fluids with entrained solids.
Pump Speed	CHOPS PCP's are designed to operate at low speed (typically less than 100rpm). At 60rpm the cavities in a PCP open and close one time per second – this is fast. Speed is an important factor contributing to inflow performance and pump longevity through a reduction in cycles
Soft Elastomer	Soft elastomer is more resilient. It is resistant to abrasive wear and tear. More compression/interference fit is required to seal between the rotor and stator of an aggressive geometry in a softer elastomer. This is beneficial in CHOPS applications as there is a deeper seal between the rotor and stator which takes longer to wear away.
Paddled Rotor	The rotor typically is flattened for 12-16 inches a short distance from the bottom. By increasing the contact area, you increase the resistance between the rotor and fluid being pumped by creating agitation at the intake to help dissipate sand.

AVAILABLE MODELS

Current availability of aggressive CHOPS pump geometries is illustrated below with the approximate stator lengths shown in graphical form and as called out in the table for 1000m of equivalent pump lift.



Series	CHOPS (Sandy Heavy Oil)				
Model m^3/day/100 rpm (*bbls/day/100 rpm*)	5 *(31)*	8 *(50)*	13 *(82)*	23 *(145)*	35 *(220)*
Stator Length for 1,000 m of Lift in. (*ft, m*)	60 *(5.0, 1.52)*	63 *(5.3, 1.60)*	80 *(6.7, 2.03)*	107 *(8.9, 2.72)*	109 *(9.1, 2.77)*

APPLICATION ADVANTAGES

CHOPS PCP's are typically employed where maximum inflow performance is required. By optimizing the inflow characteristics of the PCP and agitating the intake, sand will move through the PCP. This helps to prevent bridging at the intake that results in intake restrictions. Soft elastomer is beneficial to provide improved sealability and resistance to abrasive wear. Rotor/Stator cycle time is reduced through a reduction in overall pumping speed which in turn extends the overall useful life of the pump.

CONCLUSION

The CHOPS PCP geometry is adequate for moving viscous sand laden fluids. The aggressive geometry and general design intent enable production of sand, abrasives, and other solids. Failure modes are typical of these harsh production environments; however, the longevity is a function of the total sand produced if a premature failure is avoided.