HOSE VS PROGRESSIVE CAVITY PUMP

THE SURPRISINGLY EXPENSIVE LOW PRICED PUMPS

A WHITEPAPER

VERDER
passion for pumps

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Progressing cavity pumps are the traditional choice to dose lime and transfer sludges in water treatment and industrial process plants. With a relatively low initial purchase price, you would expect their long term ownership costs to be similarly beneficial, especially when compared to hose pumps with double the initial outlay. However, there are many factors that produce significant ownership cost differences and can make the low priced pump an expensive choice.

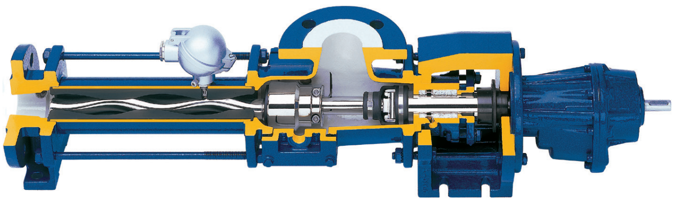
Ownership Cost Factor 1: Abrasive Wear

Lime or Kalkmilch is probably the most widely used chemical in water treatment, industrial waste remediation and process acidity control, finding many uses to neutralise acidic streams, correct or optimise pH levels. Lime and similar pH adjustment chemicals, such as Soda Ash, and waste water sludges with high grit contents, have a common pumping challenge : the pumped fluids are abrasive and can result in significant wear on contact parts.

As indicated earlier, the traditional solution, progressing cavity pumps rely on precision tolerances between the stator and rotor to maintain optimum pump efficiency and as wear increases the stator-rotor gap then flow rates fall because of increasing product slip. Slip is the difference between the fluid being provided to the pump's input and what is delivered at its output, any "lost flow" is caused by product slipping back through the pump and indicates less than perfect volumetric efficiency.

When pumps wear, users increase pump speeds to maintain chemical delivery rates but the wear rate is proportional to speed then this further accelerates wear rates in a downward spiral. One solution that attempts to negate increasing "lost flow" is to adjust the stator position but even the most sophisticated systems require physical maintenance interventions to minimise the effects of reducing efficiencies and prolong stator life.

Similarly, manufacturers can suggest over-sizing a pump and running it slowly to reduce wear rates but this simply increases the initial investment and the cheap pump becomes more expensive.



Principle of Operation : Progressing Cavity Pump

Progressing cavity pumps use a metallic helix shaped rotor, conventionally solid though some hollow metal versions are produced, rotating inside a double helixed stator, usually made from an elastomeric material such as natural rubber, as a pumping mechanism. As the rotor turns, the helixes create a liquid pocket that moves through the pump, hence the technology's name: progressing cavity. For optimum pump efficiency, there is a close tolerance fit between the rotor and stator and each pump depends on the pumped fluid to lubricate these rotor-stator sliding contact surfaces.

Principle of Operation : Hose Pump

Hose pumps work on the principle of peristalsis : by alternating compression and relaxation of a hose or tube, drawing fluid in and propelling it away from the pump. A rotating shoe or roller sits on a hose or tube's contact path creating a seal between the suction and discharge sides of the pump at one or more points, depending on the number of shoes or rollers in contact at any time.
As the pump's rotor turns this sealing point moves along the tube or hose displacing product into the discharge line. The hose or tube recovers after the pressure has been released, creating a vacuum. This is the priming mechanism, which draws the product into the suction side of the pump. Combining these suction and discharge principles results in a powerful self-priming positive displacement action.

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In contrast, hose pumps run at slow speeds by design, normally at less than 50 rpm minimising abrasive wear rates to near zero and correctly configured have no slip or have perfect volumetric efficiency. Such capabilities are well proven in many industries and with many diverse fluids from pumping cement to filter presses to delivering high SG mining slurries to concentrators, even evacuating radioactive leachates. Their pumping element, the hose is designed for maximum fatigue strength and delivers hose service lives that can be measured in thousands of hours. With such extended routine maintenance intervals, they are almost fit and forget pumping .

Clearly, choosing the cheap solution is surprising when you consider how vulnerable they are to the damaging effects of abrasion caused by the solid particles in the lime, grit and similar harsh solids in suspension and the consequences on pumping operations.

Ownership Cost Factor 2 : dry running (and its consequences)

Any progressing cavity pump depends on a continuous liquid stream to lubricate the close tolerance fit in the stator – rotor region.

Interrupting the liquid stream has disastrous consequences, even for just a few seconds – without the pumped liquid flowing through the pump to lubricate the stator results in severe friction heating resulting in stator expansion which further reduces the rotor-stator clearances, often changing precise clearances to an interference fit and ultimately, a burnt stator.

The user can smell the consequences as the elastomeric stator overheats: burnt rubber!
Replacing a burnt stator requires:

- Removal of the pump to workshop facilities;
- Use of specialist tools and equipment to release the trapped, burnt stator;
- A new stator must be fitted and any damaged seals replaced;
- Re-installation of the repaired pump.

Keyfacts Peristaltic Pumps:

- Dry self-priming
- Can run dry without damage
- Abrasion resistant - pumps up to 80% solids in suspension
- Pumps long and stringy solids - up to 85% of the pump's ID
- Accurately doses off-gassing liquids over the full 100% of flow range
- Reversible – pumps in both directions to clear blockages
- The hose is the only spare part and can be replaced in-situ
- Max. flow rate 90 m^3/h
- Max. discharge pressure: 16 bar

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In contrast, hose pumps use hoses in a permanent lubricant bath, for high pressure duties, or for low pressure applications a hose compressed by low friction, long life PTFE rollers. These pumps not only remove the impact of such failures but provide assurance against minor liquid flow interruptions such as feed tanks emptying, blocked feed lines and choked valves.

Ownership Cost Factor 3: Parts Costs

Progressing cavity pumps are precision assemblies and have significant replacement parts costs -
A worn stator can cost 40 to 50% of the original pump cost plus it is generally accepted that the rotor is also replaced every second or third stator change, another costly part before additional rebuild incidentals such as seals and coupling rods are considered resulting in maintenance event costs closer to 70% of the original pump cost.
In contrast, the hose pump has a much lower parts cost requiring nothing more than a hose and depending on the duty, some food grade lubricant totalling less than 10% of the original pump price.

Ownership Cost Factor 4: Servicing Costs

The burnt stator illustration highlights the complexity of the stator replacement procedure : the pump must be removed to a workshop, specialist equipment used to remove the damaged stator, the associated assemblies stripped down, the replacement stator fitted, the pump rebuilt with new seals etc : a process that can easily take many hours and requires costly skilled tradesmen.

For hose pumps, the only service part is the easy to change long life hose, a procedure that is normally carried out where the pump is installed and one that takes minutes not hours. Additionally, semi-skilled staff regularly carry out on site hose changeovers, lowering the servicing costs even further.

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Ownership Cost Factor 5 : Hidden Servicing Costs

Water companies are increasingly adopting unmanned or semi-skilled plant operation that places a premium on service interventions and availability of skilled maintenance staff, who are often located in a remote central engineering resource pool. Any pump or system issue results in a call out with the associated time-consuming journey to get to the plant before starting work. Consequently, the impact of issues such as clogged pumps, worn parts needing adjustment, dry running burnt outs and routine component changes are much more than the simple on site time to resolve the issue, there is the oft-neglected “travel to site” time which can be a significant as globally, traffic congestion increases around major conurbations and is often a hidden cost of ownership.

Ownership Cost Factor 6 : Clogging and Blockages

All hose pumps are truly reversible, being able to run backward or forwards at the same flow rates. Often, hose pumps are reversed for a short period to clear system blockages simply by a sending a remote signal to the pump’s inverter, clearing such problems without even needing a site visit.

The Bottom Line

Theory is great but let’s run some real numbers

The Initial Investment

A typical lime dosing situation requires a pump to move $4m^3$ of lime per hour – a typical progressing cavity pump will cost around €2,500 and the corresponding hose pump cost will be around €5,500.

So, the hose pump will require an extra €3,000 initial investment or €2.50 per day over a 5 year period.

Maintenance Event Costs

Every time we change a stator, the cost will be around €1,750 for a spare stator, seals, etc and takes around 6 hours. In contrast the hose pump spares will cost €500 and 2 hours to change and let’s presume they a common labour rate of € 50 per hour. For all maintenance events, we’ve allowed 1 hour to travel to and return from site.

ADDITIONAL INFORMATION

Hose change on a Verderflex Dura:
www.youtube.com/watch?v=c2e__EmSgMs

Hose change on a Verderflex Rollit:
www.youtube.com/watch?v=LpPyOFJArQM

Stator change on a Eccentric screw pump:
https://www.youtube.com/watch?v=Bpk4nAbElos

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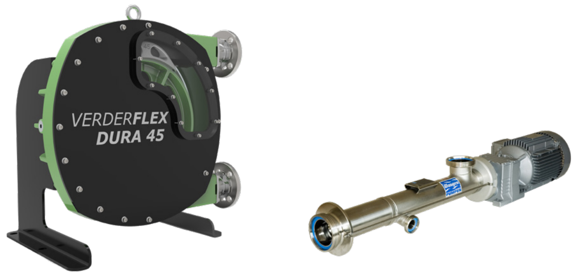
Maintenance Frequency
We could pick a really stark, not so common scenario that empowers the argument but that isn't really representative of the real world plus we don't need such a scenario to illustrate our argument. Let's use a situation where there are 4 stator changes and 3 hose changes per year and with no unplanned burnt stators. Combining the event costs and frequencies result in annual maintenance costs of € 8400 for the progressing cavity pump and a much lower €1950 for the hose pump.



Combining this data into a simple analysis as below:

TCO Calculator	*Hose Pump*	*Progressing Cavity Pump*
Cost per year	***Dura 45***	
Purchase cost price	*€ 5.500*	*€ 2.500*
# of pumps required	*1*	*1*
Total purchase cost pumps	*€ 5.500*	*€ 2.500*
Differential Cost	*€ 3.000*	
Differential Cost / month	*€ 50*	
Differential Cost / day	*€ 2,50*	
Attributable expenses		
Labour Cost / Hour	*€ 50*	
Annual Maintenance costs	***€ 1.950***	***€ 8.400***
# of maintenance visits per year	*3*	*4*
Labour Hours / Mtce Event	*2*	*6*
Labour Cost / Hour	*€ 50*	*€ 50*
maintenance cost per event	*€ 100*	*€ 300*
travel costs per event (1 hour)	*€ 50*	*€ 50*
spares costs per event	*€ 500*	*€ 1.750*
Annual Breakdown Repair costs	**-**	**-**
# of Dry Running Burn Outs p.a.	*0*	*0*
Workshop Labour Hours / Mtce Event		*6,0*
Workshop rebuilt costs / Event	**-**	***€ 300***
On Site Labour Hours / Mtce Event		*2,0*
spares costs per event	*€ 500*	*€ 1.750*
travel costs per event (1 hour)	*€ 50*	*€ 50*
On site Repair cost / Event	-	*€ 100*
Cost per Event	*€ 550*	*€ 2.200*
Total Annual cost of ownership	***€ 1.950***	***€ 8.400***
Annual Saving	*€ 6.450*	
Payback Time on Hose Pump Cost	*10 months*	
5 Years Savings	*€ 32.250*	
5 year savings as % of difference in pump cost	*1075%*	
Lifetime hose / stator (days)	*120*	*90*
# Changes per year	*3*	*4*

Produces these results:
- An annual saving of € 6450 or
- A payback of 10 months of the hose pump initial investment or
- A 5 year saving of over €32,000

All for an extra €2.50 per day

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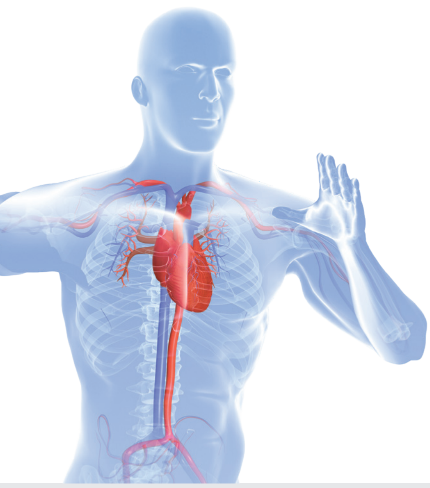
Conclusion

This clearly demonstrates that the low priced pump is actually very expensive. If our labour hourly rate increases, the plant experiences dry running problems, the abrasion issues are even more significant, the travel to site time increases the argument strengthens even more.

Contact us:
PM Peristaltics

More information:
www.verderliquids.com



About Verder Liquids
In 1959, André Verder opened an industrial pump trading company, closely focussed on customers' needs. Today, this customer-oriented philosophy continues: it remains the group's core passion to offer you the right pump for your individual application. In line with that goal, the Verder product portfolio encompasses a multitude of different pumping technologies enabling us to offer you the best pump for your process.

Today, Verder has evolved from a trading company into Verder Liquids, an international manufacturer with worldwide production facilities, complementing our own portfolio with innovative technologies from our long-term distribution partners.

More information can be found at **www.verderliquids.com**

Whitepaper_10 Ways to kill your Centrifugal pump_2019

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