Eccentric Rolling Design Peristaltic Pump Increases Pump Reliability Exponentially

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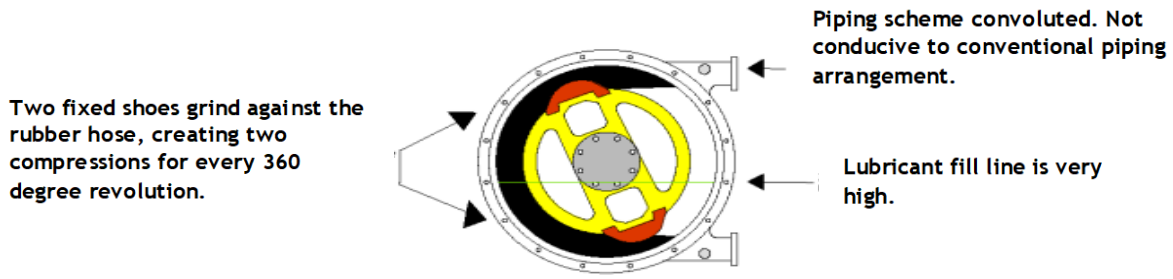
Flowrox Rolling Design Peristaltic Pumps significantly reduces total annual cost.

When comparing many pump styles from one brand or design to another there may be only minor advantages from one design to another. However, the basis of the design of the peristaltic pump can produce incredibly different performance and operational cost savings. Early peristaltic pumps utilized metal bumps or shoes to compress the rubber hose. There were typically two metal shoes that were located 180 degrees opposite of each other. These shoes rub against the rubber hose to compress it. The rubbing action of the shoes generate heat and limit the pump's speed or RPM in continuous duty applications. The pump can be run at higher RPMs but not continuously because there will be too much heat generated, which will be destructive to the rubber hose and pump bearings. One of the remedies to help reduce the heat in a shoe design pump is to utilize a large amount of glycerin inside the pump hosing to help dissipate the heat. This glycerin also becomes a significant replacement cost for owners of shoe design hose pumps.

Figure 1. Below a metal shoe pump with the reed area depicting the metal shoes compressing the rubber hose.



As mentioned above, this design cannot run much more than 70 rpm continuously due to the heat that will be generated, which will have adverse effects on pump lifetime. It can be run periodically for short durations up to 120 rpm, but if run continuously at high RPM then the hose and bearings will deteriorate rapidly.

Some of the newer peristaltic designs now use an eccentric shaft and heavy-duty roller that roll over the hose only once per revolution. Many individuals think that the number one determinant of how long a hose lasts is based on the medium going through the pump. This is true in very few cases, in reality, the number one determinant is how many times the rubber hose is compressed.

So by simply compressing the rubber hose half as many times as a shoe design or multiple roller design, the single roller design can improve pump availability and reduce operating costs. Because there is no heat generation found in single roller designs, the single roller design can achieve hose life 2 – 5 times longer than shoe designs. If you compare the maintenance costs of the two designs, the savings can be staggering when using the rolling design. Manufacturers of the shoe design pumps push owners to purchase larger diameter pumps to keep the RPM lower. This is a sound practice, but in many cases a much smaller rolling design can be used, which costs much less and takes up much less space.

Figure 2. Above depicts a Flowrox eccentric rolling design peristaltic pump. This pump can be run 24/7 at a full 120 revolutions per minute and not generate any significant heat or damage to the hose or bearings of the pump.

At the City of Hamilton, OH, the municipal power plant was utilizing (2) shoe design pumps to deliver lime slurry. The plant complained that they were spending nearly $30,000 annually per pump to keep these two pumps running. For this reason, they sought out replacement pumps to reduce this extreme operating cost. This plant first purchased a 2.5” (65mm) Flowrox pump to replace one 4” (100mm) peristaltic shoe pump.

The results of that replacement were as follows:

	Flowrox	**Shoe Peristaltic Pump**
Hose Lifetime in Revolutions	2,721,600	518,400
Operating RPM of pumps	21	6
Revolutions annually	10,485,720	2,995,920
Annual Glycerin Consumption	$348	$9,101
Annual Hose Consumption	$4,800	$13,800
Annual Electrical Consumption	$3,572	$5,792
Annual Labor	$350	$525
Total Annual Costs	$9,070	$29,218

***** The above data was provided directly from the customer.**

In the above financial information provided by the City of Hamilton, OH, the Flowrox rolling design saved the city more than $20,000 per pump per year in operating cost. The Flowrox pumps provided were 2.5” (65mm) compared to the 4” (100mm) shoe design pumps. These 2.5” Flowrox pumps were significantly less costly to purchase than 4” shoe design pumps.

Greater Pumping Capacity Dramatically Increases the Financial Impact of One Design Versus the Other

If the pump discharge flow rates required were much higher, the operating cost scenario can be much more exaggerated. The below case is a mining application involving a mineral slurry with sulfuric acid. The Flowrox pumps are 4” pumps. The shoe pumps are what are commonly referred to as duplex pumps. This means there are two pump heads on one motor. Each pump head will have one hose. These pumps will consume two hoses every time the hoses need changing. The shoe pumps require two pump heads to keep the revolutions per minute low to limit the heat generated by the pumps. The total required flow rate is 660 gallons per minute. In this case, there are two Flowrox 4” pumps delivering 330 gallons per minute each. Conversely, the requirement will be minimum two duplex 4” peristaltic pumps.

	Flowrox	**Duplex Shoe Peristaltic Pump**
Hose Lifetime in Revolutions	4,998,248	518,400
Operating RPM of pumps	39.5	32
Number of Hose per Year	8.3	65.77
Annual Glycerin Consumption	$1,300	$12,527
Annual Hose Consumption	$49,352	$385,806
Total Annual Costs	$50,652	$398,333

*****The above is based data supplied by users of shoe and rolling design peristaltic pumps.**

As you can see from the above, the operating cost savings from Flowrox rolling design compared to the shoe design is a difference of $347,681 annually in operating expenses. Customers have grown accustomed to frequent hose changes. This article attempts to bring to light that there are new options available that significantly reduce operating costs in the peristaltic pump design. By only compressing the rubber hose once per revolution, it almost guarantees more than double the hose life over multiple compression peristaltic pumps. Eliminating the heat destruction further extends the hose lifetime and reduces costs dramatically.

IIoT Monitoring Can Further Enhance Pump Performance

Monitored and connected pumps can provide an additional level of diagnostics that can help to minimize pump operating costs and downtime. IIoT monitoring of any pump or any industrial asset allows for early warning of signs of fatigue. An example would be slight changes in main bearing vibration. This change indicates that the main bearings are beginning to fail. This is the opportunity for maintenance teams to be proactive and replace an inexpensive bearing before it self-destructs and potentially causes much more costly and in depth repairs. These alarms can be built into IIoT monitoring to send e-mails to the appropriate individuals when a disturbance occurs.

Two different brands of pumps or all types of industrial machinery can be equipped with IIoT monitoring. Through constant monitoring a user can truly determine which pump has the lowest total cost of ownership. All failures and alarms will be tracked. All costs of repairs and downtime can also be monitored. Flowrox's Malibu Smart Solutions can be installed on any piece of industrial equipment to provide a comprehensive analysis of any given asset. Flowrox personnel will consult with the user to determine what they would like to monitor. Additional instrumentation may be required to provide feedback of asset condition.

Figure 3. Digital twin imagery viewed from smart tablet.

With Flowrox's Malibu we also create digital twin imagery of the asset so that the user sees a digital image exactly the same as the real environment. The image and all performance alarms and dashboards can be seen from any smart phone, smart tablet or PC with an internet connection. Finally, Flowrox also embeds a document management system where all drawings, manuals, and repair videos are all housed so the user has all pertinent documentation at their disposal instantly. In normal plant environments, the user may have to enter multiple systems to capture the required data. Malibu makes it easy and helps speed repair and reduce asset downtime.

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