



# Flowrox Packaged Pump Systems Offer Convenience, Cost Effectiveness and Help to Eliminate Potential Chemical Spills

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Flowrox Packaged Pumping System Deliver Sodium Hypochlorite Safely and Effectively in Camden, TN

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## Executive Summary

Packaged Pump Systems offer a level of convenience for users with a system that has been assembled and tested for operational effectiveness. The system is started by simply connecting suction and discharge piping and appropriate electrical connections and then starting the pump. All factory and safety tests have been performed prior to delivery to the customer.

Another feature is the built in safety of the packaged pump system. The base of the system provides spill containment and can be equipped with appropriate alarms. Even if the system is placed within an area that already has spill containment basins the packaged pump system will restrict leakage to the basin. Pressure relief valves are also installed for upset conditions to prevent damage to the system and also minimize safety issues.

Packaged pump systems are equipped with all the necessary and desirable auxiliaries that deliver both safety for the system and users as well as help ensure the pump is located in the most desirable environment to be successful and prolong pump operational performance.

Contractors and consumers often do not heed manufacturer's recommended installation instructions and often do not add required or recommended auxiliaries. This often leads to sub-par performance of pump or even premature failure of the pump. By purchasing a packaged pump system the pump is housed in the ideal environment with all of the correct auxiliaries to make the pumping assembly optimal.

Finally packaged pump systems offer value to the consumer in many ways. First the system is engineered by qualified engineers to help the pump perform at its peak level of pumping performance and provide the longest service life. By purchasing a packaged pump system there is no need to hire electrical, mechanical, structural contractors to lay out the entire system. So for this reason a packaged pump system is economical when considering all the costs. There are various safety measures taken within a packaged pump system. Spill containment, spill alarms, pressure relief valve, safety shut-off valves, gauges and pulsation dampening are all safety features of a packaged pumping system. Packaged pump systems also minimize the footprint required and can even be wall mounted for convenience.



Figure 1. City of Camden Waste Water Plant

The Camden Tennessee waste treatment plant started a project to eliminate chlorine gas for disinfection. Throughout the United States wastewater network, this trend has been taking place for many years due to the potential hazard of release of chlorine gas in populated areas. The natural replacement is sodium hypochlorite. Sodium hypochlorite and its derivatives can be used as a powerful disinfectant that eliminates residual pathogens from water in the final stage of the water purification process. Metallic salts such as ferric sulphate and alum can be added to bind impurities and reduce harmful and malodorous substances. Sodium hypochlorite is used in numerous industries for water treatment and disinfection of water. Other typical uses are in cooling towers in power plants to thwart algae growth, steel mill water treatment and food and beverage for cleaning and disinfection to name a few.

Sodium hypochlorite is a chemical that is somewhat unstable and under the right conditions will revert back to its gaseous state. With the right environmental conditions, sodium hypochlorite can cause significant problems for certain styles of pumps. For instance, on warm summer days many diaphragm pumps may experience a phenomenon called vacuum degassing or vapor lock. This is simply where the sodium hypochlorite reverts to its gaseous state and stalls the diaphragm pumps. When this happens the delivery of sodium hypochlorite stops and the pumps need to be re-primed and started again causing a nuisance for the operators. The pump of choice for the city of Camden was a peristaltic pump because it eliminates the possibility of vacuum degassing. A peristaltic pump does not distinguish or care what form medium is delivered to the suction side of the pump. It simply delivers either liquid, gases or high solids.

The project included construction of a new building that included new tanks and chemical feed equipment. The new equipment would replace gas chlorine with liquid sodium hypochlorite as the disinfection and de-chlorination methods. There are many peristaltic pumps to choose from and some key decisions were made by the engineers of the city that the peristaltic pumps must have some important features. They required that the pump housing must be minimum Nema 4X and the pump must be capable to accept a 4 - 20 mA signal to operate the pump and provide a 4 - 20 mA feedback. The pumps required must be capable of a 2500:1 turndown and have a reliable means to stop the pump when a tube leak is detected. The Flowrox pumps met all of these requirements and more. The Flowrox pumps have a patented hastelloy C sensor in the head of the pump which will sense conductive liquid once it comes into contact with the hastelloy C sensor. The pump will shut down and a signal will be sent to the PLC that there is a tube failure on the pump. Also the LCD screen on the pump will announce the tube failure as well. On average it takes about 1.5 seconds for the pump to shut down after the sensor has been tripped. These safety features had a strong impact on the decision to select Flowrox pumps.

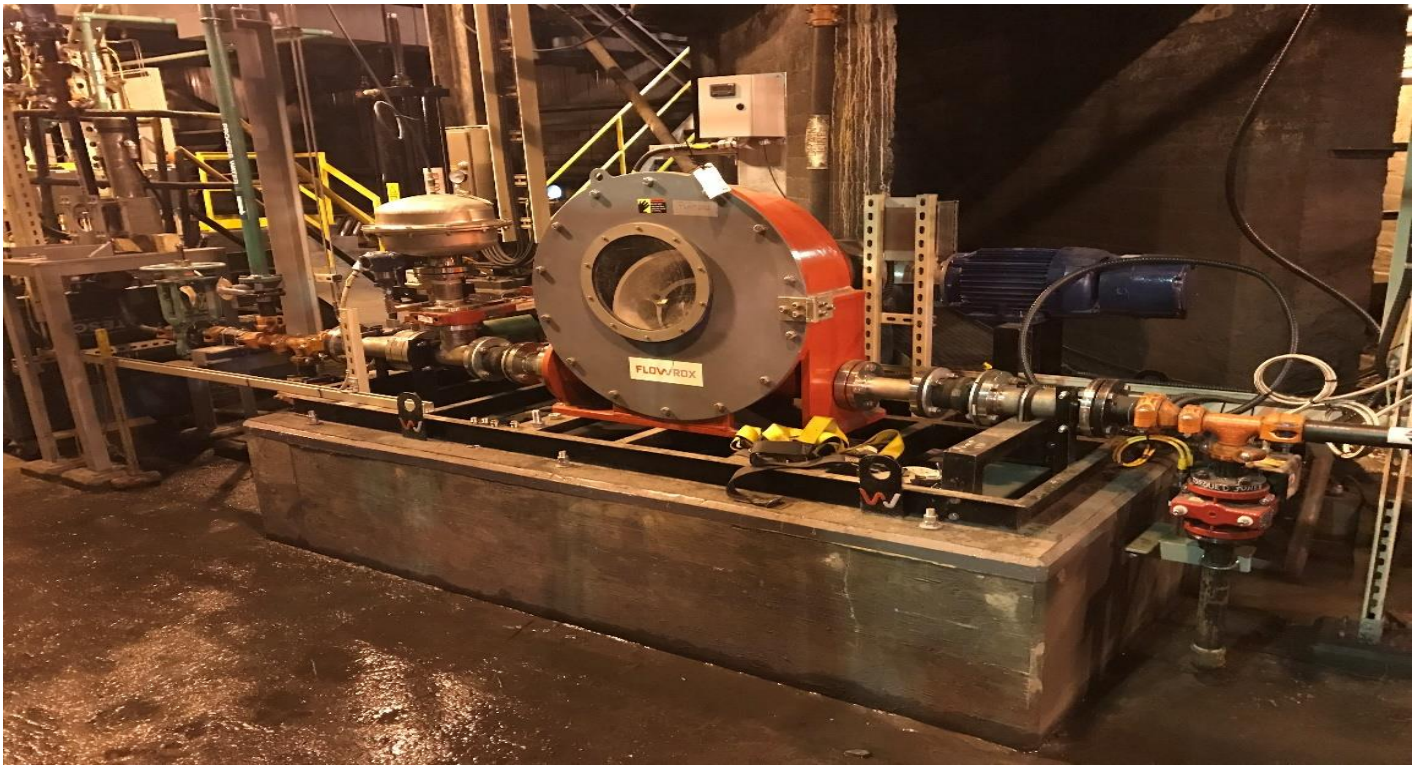
The city of Camden was also interested in purchasing the pumps as a complete packaged pumping systems. Pump users and contractors often make small errors in pump layout and auxiliary equipment supplied with pumps which can often reduce pump effectiveness and harm pump component lifetime. By purchasing Flowrox Packaged Pumping Systems the pumps are placed at the factory in a controlled packaged system with all the auxiliaries and layouts that are right for pumping performance. A typical packaged system will have pulsation dampening, calibration columns, pressure gauges, pressure safety release valve and a drain port alarm system on the base of the spill containment structure. All of this equipment is assembled and tested at the factory and a factory acceptance test (FAT) is performed on the complete assembly before it is shipped. The result is that the entire assembly arrives to the customer's site and is truly plug and play. They only need to connect the necessary electricity and piping and the complete system is then ready for operation.

Another desirable feature of the Flowrox Packaged Pumping Systems was that the city had limited space for installation. For this reason the city requested systems that would be wall mounted. Flowrox Packaged Pumping Systems can be either floor mounted or wall mounted. The bases of the units are rotationally molded solid components. So there are no weld seams and entire unit has excellent corrosion resistance. The units supplied were duplex units, meaning two pumps per base, and were 36-inch width. They were then mounted to the wall with stainless steel mounting provided with the units.



Fig. 2: Flowrox Packaged Pump Systems installed at Camden, TN waste water facility

These packaged pump systems were small and included only two pumps per base. However, Flowrox can accommodate up to four pumps per base and the bases can be stackable or meaning they can be interconnected to accommodate many pumps. Flowrox is also not limited to only its small pumps for packaged pump systems. Flowrox has delivered to many industries much larger packaged pumping systems.

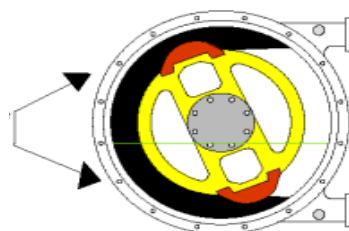


**Fig. 3: Large Flowrox Packaged Pumping Systems**

One key element that Flowrox desires potential customers and users of Flowrox to understand is how our advanced peristaltic pump designs significantly reduce operating costs. In order to help users understand we need to explain about how the Flowrox pump differs from other peristaltic pump designs and how this superior design significantly reduces operating costs that are often unbelievable.

Flowrox peristaltic hose pumps utilize a single eccentric roller to compress the hose once every 360 degree revolution. Since the 1930s peristaltic pumps have been based on fixed rotation point directly in the center of the pump casing and then two shoes (metal bumps) or two rollers compress the hose as it is rotated. These designs compress the hose of the pump twice as many times as Flowrox compresses its hose. Many people assume that the medium determines hose life in peristaltic pumps. The medium has an impact but in more than 90 percent of the cases the number one determinant of hose life is how many time the rubber hose is compressed. Since the Flowrox hoses are compressed only half as many times the hose lifetime is double these other designs. Hose failure is the main repair component of a peristaltic pump so Flowrox operating costs are half that of other designs. But the reality is even more in favor of Flowrox's design. The other designs can also generate a significant amount of heat which limits pump rotation speed and further degrades pump hose life. Flowrox pumps do not generate this type of heat build-up and thus the hoses in the Flowrox pumps often last two to five times longer than competing designs. One example was at a power plant in Ohio where the shoe design hose pump was costing the customer \$29,000 per year in operating expense (included hose costs, glycerine, energy consumption, maintenance time). Flowrox supplied its rolling design peristaltic pump and one-year operating expense was reduced to \$9,000 per year. So the 5 year operating expense for the shoe design was \$145,000 and the five-year operating expense for the Flowrox pump was \$45,000. The five-year operating expense savings were \$100,000 by switching to Flowrox. Flowrox hose life was 2.7 million revolutions where the shoe design pumps were a little over 518,000 revolutions before hose failure.

Two fixed shoes grind against the rubber hose, creating two compressions for every 360 degree revolution.



Piping scheme convoluted. Not conducive to conventional piping arrangement.

Lubricant fill line is very high.

**Fig. 4: Dual Shoe Design**



**Fig. 5: Flowrox rolling design peristaltic pumps with patented hose compression system and hose connection system**

Flowrox launched its first smart pumps and valves in September 2015 at Minexpo show in Las Vegas. These valves and pumps are industrial internet of things (IIoT) ready and are capable of performing advanced diagnostics on pump and valve performance.

Flowrox Smart Solutions offering is different than many company's IIoT offerings. Flowrox IIoT offering includes the pump or valve and all the instrumentation to provide feedback and intelligence but our offering also includes a digital twin visual interface where the actual smart product exists. So it is a digital replica of the process in which it is housed. Then all readings from the instrumentation is fed to the digital twin and the complete process can be monitored visually from any smart phone, tablet or PC that has connection to the Internet.

Flowrox's digital twin interface is called Malibu and has several features. It incorporates a document management system into the digital twin interface. All maintenance manuals, user manuals, drawings, spare parts and other are connected through the digital twin interface and all this documentation is simply a point and click away for the owners of the products. This allows for extremely rapid deployment of personnel to salvage an asset that may be in trouble.

One of the advantages of employing IIoT connectivity to virtually any asset is that it allows maintenance teams to be proactive rather than reactive. For instance, when monitoring pump condition a warning may appear reporting vibration in the bearing area of the pump. Maintenance can be dispatched to replace an inexpensive bearing with little or no downtime. However, if left unattended the bearing may fail and cause complete damage of the pump housing causing extensive repairs and significant downtime. Flowrox Malibu was designed to be capable to be retrofitted to any asset in a facility. So Flowrox Malibu is not limited to Flowrox products only.

Adding IIoT connectivity and analytics will require training for all levels of plant personnel. The shift from reactive maintenance to proactive will require understanding at all levels of any type of facility. Process plants of all types have significant opportunities to reduce downtime and maintenance costs. Some companies are claiming they are gaining as much as one full month of production per year when compared to their peers. Profitability can increase by as much as 10 percent, maintenance costs can reduce by as much as 2 percent and fuel or energy costs can decrease by 2 percent. The potential savings and increase in productivity by employing IIoT connectivity can be quite large.

The city of Camdem chose not to utilize IIoT capability on their Flowrox Packaged Pumping Systems but Flowrox has the ability add this feature to any pre-existing Flowrox equipment or even other assets regardless of manufacturer of the equipment.

Packaged pump systems can help to deliver reliable and cost effective solutions to customers of all types. Adding digital twin imagery and asset monitoring can help reduce unwanted downtime and increase process availability.

## About the Author:

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