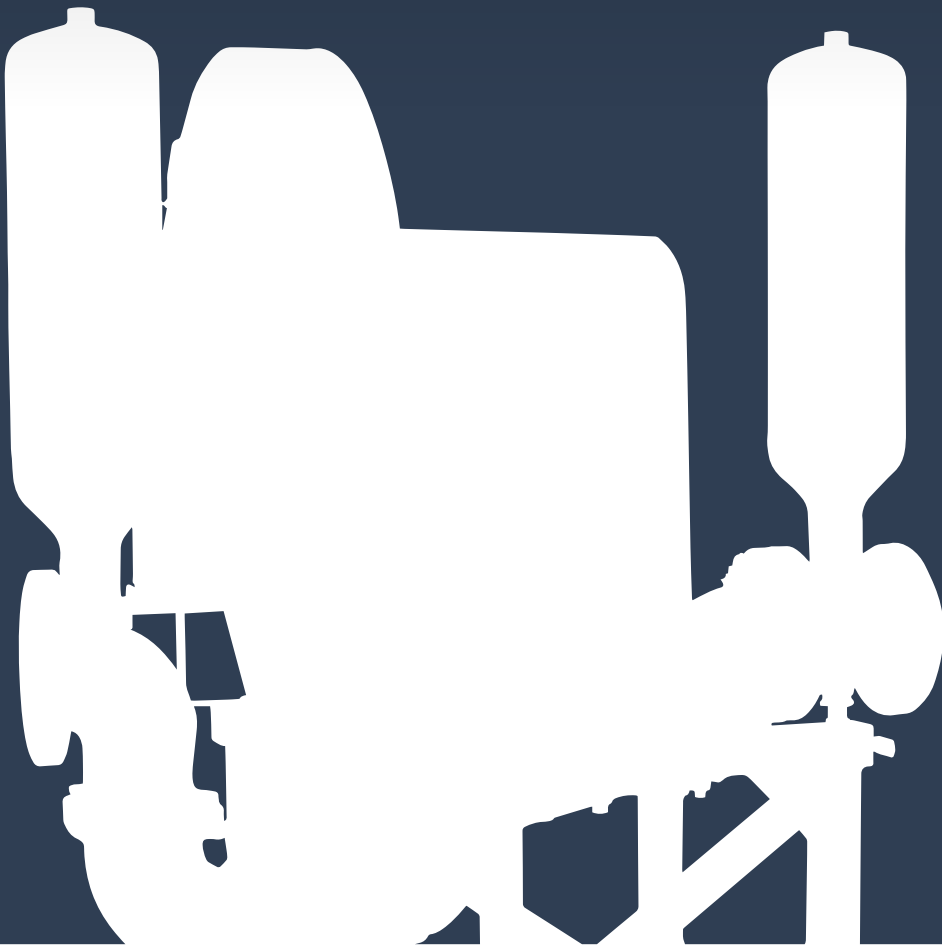


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# Pumping and Processing in Wastewater Treatment Plants



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# Reciprocating Positive Displacement Pumps Allow for Hassle-free Pumping and Processing in Wastewater Treatment Plants

Although the design of wastewater treatment plants has evolved over the past 50-plus years, basic pump technology requirements have remained the same. Reciprocating positive displacement pumps, like double disc pumps, are more relevant than ever in a variety of applications for longevity and pumping success.

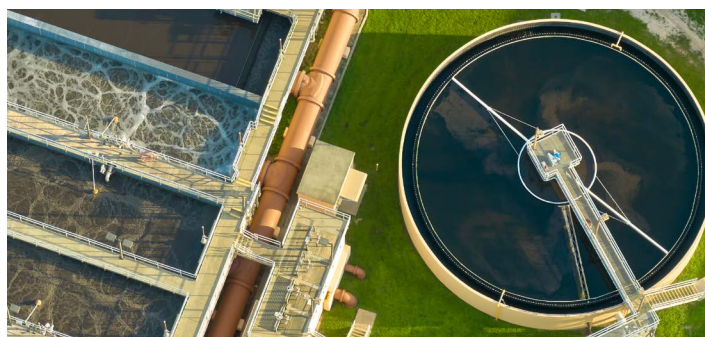


## A Pump Design for Any Process

It's not uncommon to find traditional wastewater treatment trains from the 1960s, 70s and 80s that are still operational. These trains include headworks, primary clarification, extended aeration, and secondary clarification. Many of the applications in these treatment trains are for primary or 'raw' sludge, processing materials, like heavy solids, grit and debris. These types of materials wreak havoc on ordinary rotary positive displacement pumps but can be processed with relative ease with a reciprocating positive displacement pump. The open internal design of a double disc pump allows it to handle solids laden and stringy materials.

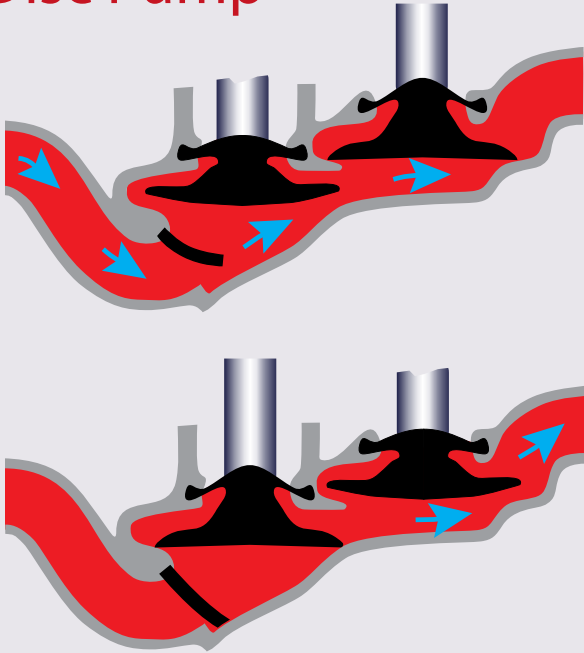
Pictured above is a belt press feed application at a plant in Kentucky.

To the right is a wastewater treatment plant.





## Anatomy of a Double Disc Pump



The pump's discs work in unison to perform the duties of both the pumping element and valving element, creating a double acting, non-clogging, pumping action. The hydraulic interaction between the discs moves fluid from suction to discharge. The discs are not captive in the pump housing, eliminating the flex fatigue failures that captive diaphragm pumps experience. Through an arrangement of connecting rods and a camshaft, a reciprocating action of the discs is created, forming a large cavity between the discs. The discs are rotated 180 degrees out of phase from one another, performing the duties of both pumping and valving during operation.

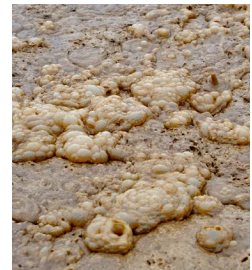
### Varying Clarification Processes

Primary clarification and secondary clarification, as well as gravity thickening clarification processes commonly produce a floating material called scum or skimmings.



Direct pipe scum pumping installation in Florida.

This material may contain grease, oils and other materials that have a lower specific gravity than water and float to the surface. This material is normally skimmed off the top into a scum collection trough to be pumped



away. Because a pump must often run dry and pass larger solids during this application, a double disc pump is routinely used. Other pumps generally don't have the capability of running dry without becoming damaged. The double disc pump can also be used to pump from the traditional scum wet well to the digester.

Penn Valley Pump's (PVP) Double Disc Pump offers an innovative suction piping option that is used for handling scum material. The material is pulled directly from the scum beach into the pump suction flange. This method

eliminates the wet-well or scum collection tank. Since the scum material is pumped away on every rotation of the clarifier skimming arm, this method of operation eliminates the buildup of a floating debris layer which can accumulate in the traditional wet well.



## Secondary Treatment Technologies

Over the last three decades, other secondary treatment technologies, such as the Oxidation Ditch, Sequential Batch Reactor (SBR), Membrane Bio Reactor (MBR) and Moving Bed Biological Reactors (MBBR) have been developed based on advantages in footprint, capital cost and higher quality effluent. These newer treatment processes commonly eliminate the need for primary clarification. However, they still require pumps for waste activated sludge (WAS), scum or skimmings, digestion, truck loading or dewatering of sludge.



Pictured above is an anaerobic digestion of sludge at sewage treatment plant.

centerline elevation. This is not a problem for a double disc pump because it can easily operate up to 20-feet in a suction lift condition and re-prime on its own.

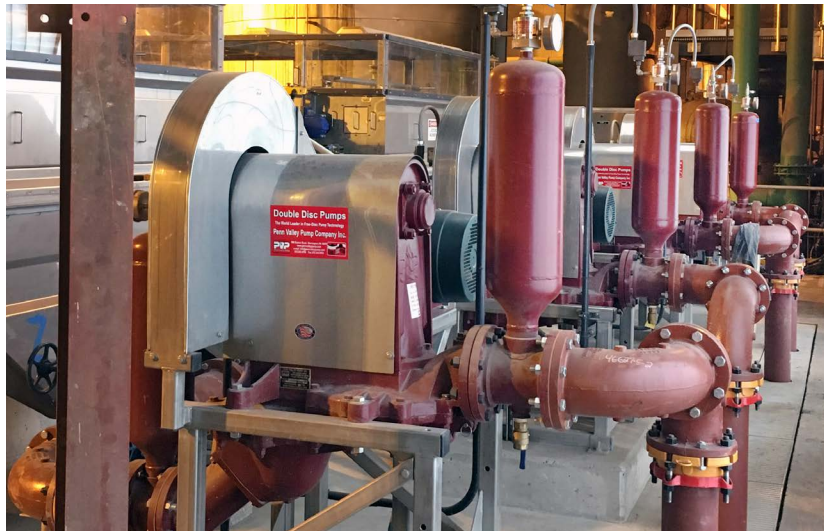
After the initial secondary treatment processes, the waste sludge (WAS) is then typically sent to some form of digestion to reduce the total pounds of solids that must be removed from the plant each year. These digestion processes include traditional aerobic or anaerobic digestion or more advanced digestion processes, like ATAD or 2PAD, which offer better solids destruction. Regardless of the type of digestion used, the plant will typically require sludge pumping of high solids concentrations. Because of its low friction design a double disc pump is well suited for handling these digested sludge applications.

Oftentimes during this process, the digesters need to be emptied. This emptying leads to the pump having to operate in a suction lift condition as the liquid level drops below the pump

centerline elevation. This is not a problem for a double disc pump because it can easily

operate up to 20-feet in a suction lift condition and re-prime on its own.





GBT thickened sludge transfer in New York.

### Thickened Sludge and Pumping

Many wastewater treatment plants use gravity thickeners to thicken the sludge for further processing. Another way of thickening sludge in wastewater treatment plants is the use of a dissolved air flotation (DAF) unit or mechanical thickening machine. A double disc pump is routinely used to pump these viscous, higher percent solids material.



A dissolved air flotation unit uses air and chemical addition to concentrate and float the sludge and then skim the thickened material from the top. Mechanical thickening devices include centrifuges, gravity belt thickeners, rotary drum thickeners and disc thickeners. These devices remove water from the sludge through mechanical means as well as using chemistry (polymer or other coagulants and flocculants) to help release free water. The sludge is typically concentrated to 4 – 6% solids and occasionally even higher. A reciprocating positive displacement pump can be used to feed the DAF or mechanical thickener and pump the thickened sludge material coming off the DAF or mechanical thickener. The pump's ability to handle the higher viscosity material with a lower wear rate makes it extremely reliable to install for this type of application.

### Waste Removal

As the sludge goes through the various primary, secondary and digestion treatment processes, biosolids with a range of solid concentrations are created and must be removed from the plant. This material can be sent directly to a landfill; it can be land



Pictured above is a belt press feed in Florida.

applied as a liquid, dewatered, and sent to a landfill; or it can be incinerated. Sludge can remain in lower concentration liquid form and get pumped into trucks and be hauled away for land application.

Another option is to dewater the sludge onsite. The dewatering process can be accomplished using a belt press, centrifuge, screw press, rotary press, and volute press. A double disc pump is often used to feed these dewatering devices at a wide range of flow requirements and pressures. Its low wear rate, no loss of flow as it wears, and little to no pulsing ensures a solid application that reduces the overall maintenance typically seen by pumps in these applications.

### High Strength Waste Streams

In the past few decades, many wastewater treatment plants began accepting septage and other industrial waste streams such as food waste to generate additional revenue, as well as to generate more methane gas through anaerobic digestion. A reciprocating positive displacement pump is commonly used to transfer these 'high strength waste streams' to the plant digestion system. This is because of the pump's ability to handle the heavy solids which are often abrasive, due to their content of sand and other inert materials. To extend the wear life of the pump housing and rubber wear parts in the pump, an internal glass lining material is often recommended for this type of application.

## Lifecycle Cost

Consideration of lifecycle costs is important. Knowing what to consider, including all relevant costs over time, like operational costs and procurement costs, as well as matching the equipment to a system needs for maximum benefit and intended duty, without oversizing the pump. This should help set you on your way of determining the lifecycle cost of your system and helping you choose which pump and other pieces of equipment are right for your application.





A double disc pump has many useful applications throughout the wastewater treatment plant process. The use of this pump will lower the total cost of ownership for the plant. The pump's ability to pass larger solids, handle higher viscosity material, run dry without damage, and require virtually no routine maintenance reduces pump downtime and reduces plant maintenance and labor costs. A great pump design, combined with strong application engineering and decades of experience in wastewater processing, offers the end user many years of hassle-free pump performance.

