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APPLICATION OF THE DOUBLE DISC™ PUMP ON DIFFERENT SLUDGE TYPES

BLENDED SLUDGE

Combination of sludge including primary, waste activated and/or secondary. Typically has chemical addition such as polymer, lime or carbon. The grit and rag content can be moderate to severe and abrasiveness is increased if lime or carbon is used.

The Double Disc™ pump is well suited to handle these applications given the nature of the mixed sludges and potential grit and rag content.

DEWATERED SLUDGE

Dewatered sludge is produced from the dewatering process and is the product that comes from mechanical dewatering devices such as belt presses, centrifuges and rotary presses. The dewatered sludge is a relatively dry material and can either be pumped by high pressure pumps or conveyed.

This Double Disc™ pump is not suitable for these applications given the dryness of the material and the high pressures generated through the friction losses of the dry material in the line.

DIGESTED AEROBIC SLUDGE

Sludge is fed into the digester and air/oxygen is added to the process. Digested sludges are easier to pump versus untreated and primary sludges as the digestion process breaks down the fibrous material. Depending on where the pump suction is located there may be a significant amount of rag and grit. Most digesters operate at an elevated temperature to ensure proper digestion.

Depending on the actual application centrifugal type pumps and positive displacement type pumps are used. The Double Disc™ pump is well suited for both recirculation and transfer applications given the ability to handle the grit and rag content that may be present. Recirculation applications that operate on a 24 hour operation will benefit from lower pump operating speeds to extend pump life. With a variety of elastomers available the proper choice is made depending on the temperature of the application.

DIGESTED ANAEROBIC SLUDGE

Sludge is fed into the digesters where organic acids are formed which are then converted to methane. Digested sludges are easier to pump versus untreated and primary sludges as the digestion process breaks down the fibrous material. Depending on where the pump suction is located there may be a significant amount of rag and grit. Most digesters operate at an elevated temperature to ensure proper digestion.

Depending on the actual application centrifugal type pumps and positive displacement type pumps are used. The Double Disc™ pump is well suited for both recirculation and transfer applications given the ability to handle the grit and rag content that may be present. Recirculation applications that operate on a 24 hour operation will benefit from lower pump operating speeds to extend pump life. With a variety of elastomers available the proper choice is made depending on the temperature of the application.

DISSOLVED AIR FLOTATION (DAF)

DAF sludge is created by introducing air into the sludge causing the material to float to the surface. The DAF is then skimmed and deposited to a sludge holding tank or pit. The material can contain floatables that float to the surface with the sludge. DAF contains differing amounts of polymer added as part of the thickening process. The sludge normally comes off the DAF unit at percent solids of 3 – 8%. The polymer addition to the sludge makes the calculation of friction loss very difficult at best. Past history has determined that friction losses can be substantially higher (5 – 10 times) than non-polymerized sludges at the same percent solids concentration.

The Double Disc™ pump can be effective for this application given the ability to run dry, good air handling capability and ability to generate high vacuum. The suction condtions should be flooded and lines kept as short as possible. Pump speeds should be kept relatively low to avoid pulling the entrained air out of the sludge. The pump will normally be either mounted to a sludge hopper connected to the DAF unit or to a larger sludge storage tank.

The discharge piping hydraulics (static elevation, line size and length) must be carefully reviewed and calculations made to estimate the discharge pressures. The use of glass lined pipe is recommended as it has proven to reduce the friction loss and resultant discharge pressures. Given the higher friction losses, DAF sludges require relative low to medium operating speeds to ensure proper pump operation. Given the amount of entrained air in the sludge an evaluation of the discharge pressure is important as elevated pressures (30 – 40psi) can cause pump to air bind and affect flow. Past experience has proven that mixers placed in the sludge holding tank to mix and de-aerate the sludge drastically improves the fluid handling characteristics of the material and improves pump performance.

A variable frequency drive is recommended given the potential large variation in percent solids. As the sludge reaches the higher percent solids of 6 – 8% a lowering of the pump speed may be required to prevent air introduction into the suction line and/or cavitation.

FOAM

Nocardia foam is generated by the aeration basins from the Biological Nutrient Removal (BNR) process. It is characterized as a light fluffy material with large amounts of entrained air. The material can also contain floatables. Given the large amount of entrained air the hydraulic characteristics are much different than water or sludge.

The Double Disc™ pump is an excellent choice given the ability to run dry, good air handling capability and ability to generate high vacuum. The suction line conditions must be carefully reviewed and lines kept relatively short. Pump speeds should be kept relatively low to avoid

pulling the entrained air out of the sludge. An evaluation of the discharge pressure is important as elevated pressures (30 – 40psi) can cause pump to air bind and affect flow. The use of an air release valve at higher discharge pressures will allow the pump to de-aerate the sludge and create a more easily handled material.

FERRIC SLUDGE (WATER TREATMENT PLANT)

Some water treatment plant processes use the addition of ferrous or ferric sulfate to promote coagulation and settling in the clarification process. This process results in a settled ferric sludge that is recirculated and then removed through a dewatering process. The sludge is brown to red in color given the high ferric content. The material is abrasive given the makeup of the settled solids.

Given the abrasive nature of the sludge and 24 hour operation on the recirculation application the Double Disc™ pump is well suited for this application given the low wear technology design and lack of maintenance requirements. Pumps should be supplied with low to medium operating speeds and hardened housings to lengthen operating life.

GRAVITY THICKENED SLUDGE

This process generates thickened sludge by allowing sludge to settle in a large gravity thickening storage tank. The sludge will normally thicken to 2 – 4% solids and then is sent for further processing. It is typically blended with other types of sludge and then sent to a dewatering process.

The Double Disc™ pump is well suited to handle this application given the nature of the mixed sludges and potential grit and rag content.

GRIT

Grit is typically removed from the incoming raw sewage as it enters the plant. This material is mostly water entrained with grit. It is highly abrasive and will fall out of suspension when not moving at higher velocities. To ensure effective pumping the grit must be fluidized to remain in suspension.

This application is typically handled by centrifugal pumps. However the Double Disc™ pump with its low wear technology and seal-less design holds advantages when variable flow and/or a suction lift requirement exists. As the material tends to settle, a VFD with soft ramp up feature or motor starter with soft-start is recommend to allow pump to slowly ramp up to speed to minimize the hydraulic shock required to energize the fluid column. The use of a water flush system is recommended at pump shut down to clean line and reduce settled material for pump start-up. Pumps should be supplied with low to medium operating speeds and hardened housings to extend wear life.

LIME SLUDGE (WATER TREATMENT PLANT)

Some water treatment plant processes use the addition of lime and alum or soda ash for softening. These chemicals are normally fed into a solids contact clarifier where settling occurs as part of the softening process. The resultant lime sludge then has to be removed

which is either done by truck loading and hauled away or through a dewatering process. The sludge is normally grayish white in color and is very abrasive.

Given the abrasive nature of the sludge the Double Disc™ pump is well suited for this application given the low wear technology design and lack of maintenance requirements. The use of a water flush system is recommended at pump shut down to clean line and reduce settled material for pump start-up.

As the material tends to settle, a VFD with soft ramp up feature or motor starter with soft-start is recommended to allow pump to slowly ramp up to speed to minimize the hydraulic shock required to energize the fluid column to get material to flow. Pumps should be supplied with low to medium operating speeds and hardened housings to extend wear life.

LIME SLURRY

Lime slurry is made from either mixing water with hydrated lime (calcium hydroxide) or through the slaking process by adding water to quick lime (calcium oxide). The resultant slurry is used for a variety of water and waste water treatment applications. This is a very difficult material to pump as precipitation occurs that leads to scale build-up (calcium carbonate) in the pipe, fittings and valves. The material easily settles out of suspension when not moving. It is very abrasive given the amount of inert materials (sand) that remain in the product from the mining process.

The Double Disc™ pump is one of the few positive pumps found to be effective at handling this material. Most applications require 24 hour/ 7day per week operation. All lines are recommended to be flexible hose to minimize the scaling potential. The use of a water flush system is recommended at pump shut down to clean line and reduce settled material for pump start-up.

As the material tends to settle, a VFD with soft ramp-up feature or motor starter with soft-start is recommend to allow pump to slowly ramp up to speed to minimize the hydraulic shock required to energize the fluid column to get the material flowing. Pumps should be supplied with low to medium operating speeds and hardened housings to extend wear life.

PRIMARY SLUDGE

Primary sludge is taken from the bottom of the clarifier in the initial clarification process. Depending on the plant headworks screening equipment the sludge normally contains large amounts of grit, rags and other debris. The percent solids can change quite dramatically anywhere from 2 – 8% depending on different times of the year and upset events.

The Double Disc™ pump is an excellent choice for this application. The pump design allows the unit to operate longer without the wear given the higher grit content. The pumps solids handling capability allows the unit to keep operating when other units will fail or clog.

A variable frequency drive is recommended given the potential large variation in percent solids. As the sludge reaches the higher percent solids of 6 – 8% a lowering of the pump speed may be required to prevent air introduction into the suction line and/or cavitation.

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SCUM

Scum consists of the floatables skimmed from the surface of primary and secondary clarifiers. The usual debris found is the buoyant materials such as toothpaste caps, bottle caps, condoms, paper, applicators, etc.

This Double Disc™ pump is well suited for this application given the solids handling capability and the ability to run dry. The best applications are those with a flooded suction since the suction pressure helps move the debris through the pump. Suction lift applications are still feasible, however depending on the amount of scum material there is a potential for the debris to dewater under the discs. An occasional water flush is recommended to clear any debris.

Penn Valley has re-engineered many scum applications by entirely removing the conventional scum beach and piping the scum line directly to the suction side of the pump. A larger diameter pipe is used to gain retention volume and the pump is operated off a timer system to empty the line.

SECONDARY SLUDGE

Sludge from the primary sludge clarification process and/or the waste activated sludge or from a blended sludge tank. Blending tanks are used to mix and add chemicals such as polymers. The grit and rag content can be moderate to severe.

The Double Disc™ pump is well suited to handle these applications given the nature of the mixed sludges and potential grit and rag content.

SEPTAGE

Septage applications are typically characterized by treatment plants accepting domestic sewage from septic haulers and portable toilet companies. Septage normally contains large amounts of paper products and a wide variety of debris. Septage often contains large amounts of grit and sand making it very abrasive. The type of screening device at the unloading station varies in size and function. Most septic haulers want to unload in the shortest time possible and will by-pass the screen if possible.

The Double Disc™ pump is the best positive displacement pump available for this application. The design will wear longer on the abrasive grit and sand and pass the majority of the debris. If the screening devices allow solids to pass that are larger than the solids handling ability of the pump size a grinder is recommended to extend pump life. An occasional water flush is recommended to clear any debris.

THICKENED WASTE ACTIVATED SLUDGE (TWAS)

Thickened Waste Activated Sludge is characterized as the sludge that comes from the mechanical thickening process. The typical mechanical equipment types are: gravity belt thickener, rotary drum thickener, and thickening centrifuges. TWAS contains differing amounts of polymer added as part of the thickening process. The sludge normally comes off the thickening device at percent solids of 3 – 8%. The polymer addition to the sludge makes

the calculation of friction loss very difficult at best. Past history has determined that friction losses can be substantially higher (5 – 10 times) than non-polymerized sludges at the same percent solids concentration.

The discharge piping hydraulics (static elevation, line size and length) must be carefully reviewed and calculations made to estimate the discharge pressures. The use of glass lined pipe is recommended as it has proven to reduce the friction loss and resultant discharge pressures.

The suction conditions should be flooded and lines kept as short as possible. The pump normally will either be mounted to a sludge hopper coming of the thickening device or to a larger sludge holding tank. Pump speeds are critical to assure a successful application. Given the higher friction losses, TWAS sludges require relative low to medium operating speeds to ensure proper pump operation.

A variable frequency drive is recommended given the potential large variation in percent solids. As the sludge reaches the higher percent solids of 6 – 8% a lowering of the pump speed may be required to prevent air introduction into the suction line and/or cavitation.

WASTE ACTIVATED SLUDGE (WAS)

Waste activated sludge is typically characterized as a relatively clean sludge with light grit and rag content. The typical percents solids are 1 – 3%. The pump will normally be mounted with a flooded suction condition which makes this a very easy application for the Double Disc™ pump.

Usual operation is with a simple timer and motor starter that allows the pump to run for programmed intervals and programmed duration throughout the day. Pumps put into this application generally last several years before any maintenance or parts are required.

WAS is typically fed to dewatering devices such as mechanical thickeners for additional thickening or directly to belt filter presses, centrifuges or rotary presses for dewatering. The Double Disc™ pump is an excellent choice for these applications given our consistent flow rates as the pump wears. Unlike close tolerance pumps that fall off in flow as the pumps wear the Double Disc™ pump provides a constant flow rate over time with no fall off in flow. The dewatering operation remains consistent from day-to-day with no adjustments in pump speed or polymer dosage.