

What is the sealing technology of choice for water and wastewater treatment?

This month's "Sealing Sense" was prepared by FSA members Phil Peck, Eric Vanhie and Andy Martin.

Water and wastewater treatment is not a glamorous or popular topic. However, it is a critical part of our everyday lives that is often taken for granted. For example, the last thing on anyone's mind during a major sporting event, such as the Super Bowl, is water and wastewater. During halftime, though, thousands of treatment facilities handle the demand when millions of people use their facilities at the same time.

Municipal treatment facilities are sophisticated operations that use chemical and biological processes to contain and convert dangerous waste into an environmentally safe and often reusable material. Since most of these facilities are operated and funded by a municipal governing body, cost control, efficiency and reliability are top priorities. The review of common applications, rotating equipment and sealing options found in a typical treatment facility is important.

Rotating Equipment

Like most process facilities, wastewater treatment plants have a variety of rotating equipment to handle the volume and different fluids being processed. These include centrifugal pumps (vertical and horizontal), submersible pumps, progressive cavity pumps and large axial flow pumps. Sealing options that provide reliable and economical solutions to contain the fluids being pumped are available for each type. These include designs for the wide range of pump sizes used in treatment facilities.

Sealing Options—Compression Packing or Mechanical Seal

The most common sealing option is compression packing. In addition to providing adequate leakage control, it is economical and provides additional bearing support to the shaft. However, it experiences wear and requires regular adjustments and a clean water flush. Further, it can wear the shaft sleeve that it seals upon.

Mechanical seals are also widely used and provide reliable, safe and economical containment of pumped liquids. Different seal types are used depending on the service



Image 1. Typical components of a bellows seal

conditions and fluid character. Component seals—such as the elastomer bellows seal (see Image 1)—are used extensively and have demonstrated excellent reliability in many applications within a treatment plant.

Cartridge, pusher type seals with stationary springs that are installed out of the pumped fluid are effective for handling the abrasive solids and are simple to install and maintain. The seal type or design almost becomes an owner/operator preference.

A solution growing in popularity and preferred during the past decade is the split seal. Some of the equipment found in a treatment plant is very large, creating unique challenges to installing and maintaining the seal. The development of split seal technology has made installation much easier and faster, especially with between bearing horizontal pumps and large pumps. The maintenance of large pumps typically requires special lifting equipment, and replacing a typical seal can take many hours.

Split seals significantly reduce the time needed for installation or replacement and can eliminate the need for special tools or lifting equipment. The bottom line may be a significant reduction in life-cycle cost of the equipment. With split seal technology, seal installation is just like the installation of compression packing, except the leakage is decreased, and the friction on and the wear of the shaft sleeve is eliminated.

Feedwater—Handling Solids and Abrasives

Wastewater treatment facilities process solids-containing liquid from a wide range of sources. Typically, ambient temperatures prevail and large volumes of liquid and every



Left: Image 2. Typical split seal design—open
Above: Image 3. Typical split seal design—closed



Image 4. Split seal installation— influent pump with a 15-inch shaft

kind of solid imaginable are processed. The amount of solids at any given time will be a guide to the optimum mechanical seal arrangement. However, the design will almost always include hard faces (silicon carbide) to handle the abrasives that are present.

Since water is the base fluid, stainless steel is the most common and acceptable metallic component of the seal for most applications. However, some applications with excessively high or low pH or those in which other corrosives are present might require a higher base metallurgy. The abrasives are the most common and challenging part of wastewater applications.

Seal Arrangement

The amount of solids present, typically defined as a weight percentage of the fluid being handled, will drive the decision to use a single or dual seal arrangement. The typical single seal with two hard faces can handle as much as 10 percent solids when installed in a big bore seal chamber without flushing or in conjunction with API Plan 02. In a pump that is equipped with a standard bore seal chamber, the typical single seal is limited to a few percent solids unless water is injected into the seal chamber per API Plan 32. A throat bushing in the bottom of the seal chamber should be used with API Plan 32 to minimize water consumption while providing a clean environment for the seal. Treated water is commonly used as a flush medium because it is readily available and does not require removal later.

For solid concentrations above 10 percent, single seals typically can be used, but an external flush will be imperative. If an external water flush is not desirable or available, dual pressurized seals should be considered for high solid concentrations. The most common flush plan for dual seals is API Plan 54. API Plans 53 A and B are rarely used. Single mechanical seals are

usually preferred over dual seals because of the lower initial cost and simplicity of operation and maintenance.

Seal Design Considerations

A few specific aspects must be considered when sealing a pump in a wastewater treatment facility. First, routine, axial adjustments to the impeller are needed to maintain the pump's efficiency when handling solids. When such an adjustment is made, the seal must be able to accommodate this axial movement. Depending on the type of mechanical seal—component or cartridge—additional steps/care may have to be taken. The second aspect involves cleaning the seal chamber before shutdown. The seal chamber can trap solids that could cause problems during the next startup if not removed adequately.

Future Demand Increase

As our population continues to grow, the volume of wastewater to be treated and the number of wastewater treatment facilities will increase. Protecting our environment and producing usable byproducts from wastewater benefits everyone. Mechanical seals will continue to play a key role in making this possible and cost effective through the use of proper designs, materials and environmental controls. Contact a local seal manufacturer or distributor for more information or assistance on the specific needs of an application.

Next Month: *Will storing my CNF gasket and sheet too long degrade performance?*

We invite your questions on sealing issues and will provide best effort answers based on FSA publications. Please direct your questions to: sealingsensequestions@fluidsealing.com.

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