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Mechanical Seal Application

In the old days, mechanical seals were never specified on vertical turbines unless it was a hydrocarbon application in which leakage control is critical. Over the years however, vertical turbines have been adapted to accept mechanical seals in standard water applications, and as such have now become commonplace. Since turbines are arguably the most engineered pumps on the market, it's easy to miss just one construction feature that unfortunately leads to endless field service issues. Pump construction and overall installation must be thoroughly examined prior to employing a mechanical seal.

We'd like to discuss some pros & cons of mechanical seals versus conventional packing, and provide installation and application guidelines to keep in mind. Hopefully our comments will help raise the right questions to ask when considering a mechanical seal on a vertical turbine.

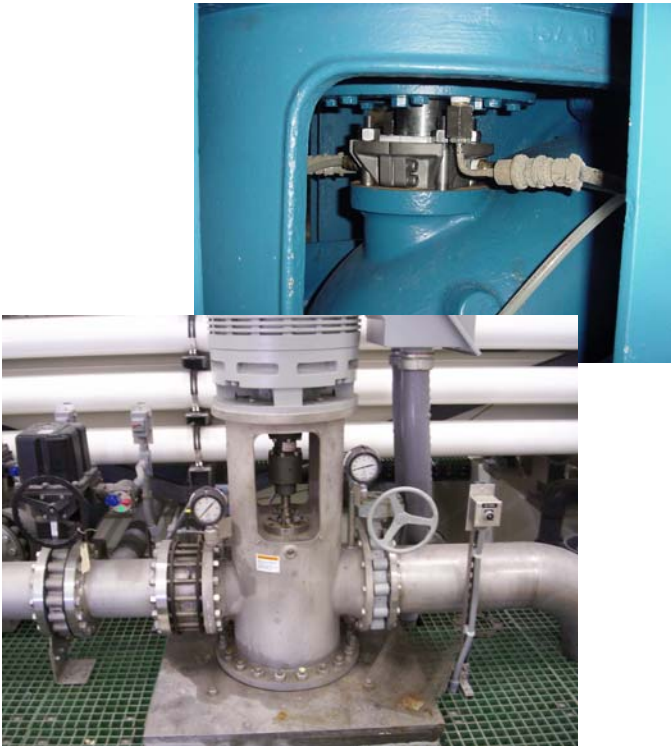
Mechanical seals became popular because "they don't leak". Ideally, non-abrasive clean water vaporizes as it passes across the seal faces, thus only water vapor exits the vent port. Split seals will tend to weep, creating a steady drip that sometimes gets misinterpreted as seal failure.



Applying a mechanical seal to a vertical turbine pump is not as simple as just switching out the packing box. There are many aspects of the installation to consider.

Labor

Depending on the mechanical seal design, installation can range from being easy to very time consuming. Impeller setting must be taken into account when setting the seal, otherwise incorrect spring loading will cause premature failure. Incorrect installation can quickly become costly in both time and money. In comparison, packing may also be time consuming to replace depending on the amount of room available in the discharge head to access the packing. Packing also requires a break-in period and periodic adjustment before operation stabilizes.



Cost

It's no secret that packing is inexpensive, whereas mechanical seals cost anywhere from several hundred to several thousand dollars. However, there is additional power consumption when using packing. On average, power consumption with a mechanical seal is typically 1/6th that of packing.

Operational Life

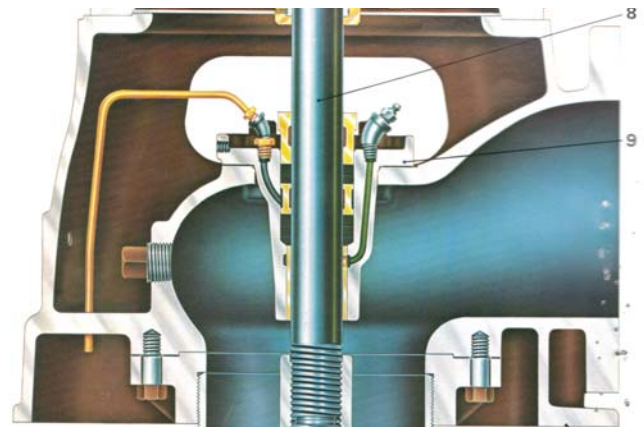
Depending on the application, mechanical seals may last anywhere from several months to several years before needing replacement. Packing on the other hand is typically replaced every year.

Failure

The most crucial components of a mechanical seal are the faces. Once they fail, there's nothing to hold back the flow of water and the pump must be shut down. Faces can easily be damaged by excessive heat, abrasives, misalignment, and improper flushing or venting. Whereas with packing, leakage will gradually increase over time, providing a warning sign that servicing is required soon. Most often, a pump with packing can limp along until some point at which it can be shut down to allow servicing.

Shaft Wear

Mechanical seals will not wear down the shaft like packing. All wear components are housed in the seal itself. On the other hand, a packed stuffing box will gradually wear down the shaft due to friction created from the packing. Packing must be adjusted as leakage increases from wear. A hardened shaft journal or separate sleeve may be employed to increase wear resistance. However such is not required when using a mechanical seal.



Runout

Mechanical seals require no more than 0.002" shaft runout, whereas a standard packed pump can accept 0.005" shaft runout.

Idle Time

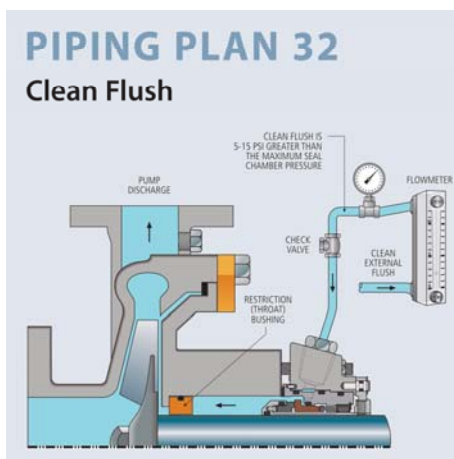
If the pump sits idle often, seal faces will dry and a scale or film may be left behind from water deposits. This scaling can wear down and even lock up the seal faces when the pump is restarted. Once the seal faces are damaged, there is nothing left to hold back the flow of water. Packing on the other hand, is more forgiving when a pump sits idle.

Startup / Pre-lube

Mechanical seals with standard silicon carbide vs. carbon faces need lubrication within 5 – 6 seconds of pump startup. This time reduces to 2 – 3 seconds with harder faces. Unfortunately, there are an ever-increasing number of pumps started slowly on VFD's or soft starts. Pump length and water level also play a role in how fast water reaches the seal box. When mechanical seals run dry, they generate a tremendous amount of heat with component temperatures easily reaching 400 to 500 degrees F. It becomes necessary to install a pre-lube system, which consequently increases cost.

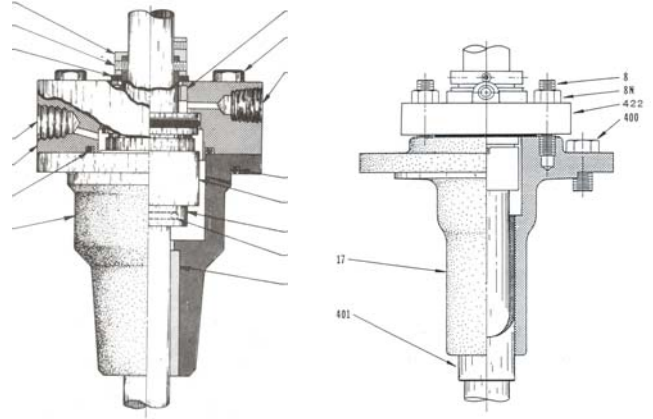
Abrasives

Mechanical seals do not like abrasive material because it will destroy the seal faces. If there is any type of abrasive material in the pumping fluid, then a flush system must be incorporated to protect the seal. The most common and easiest flush arrangement is API Piping Plan 32. Clean water is injected into the seal to cool the faces and flush the entire seal box, thus preventing abrasives from entering. If a flush system cannot be installed to protect the seal, then a packed stuffing box may be the better choice.



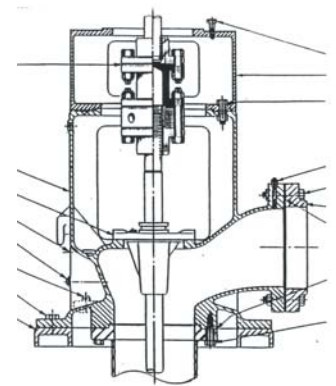
Seal Type

Each installation is different, and where one installation may be fine with an inside seal, another installation may require an outside or split seal due to limited access. Each seal design has its own advantages and disadvantages.



Inside Mounted Seal Outside Mounted Seal

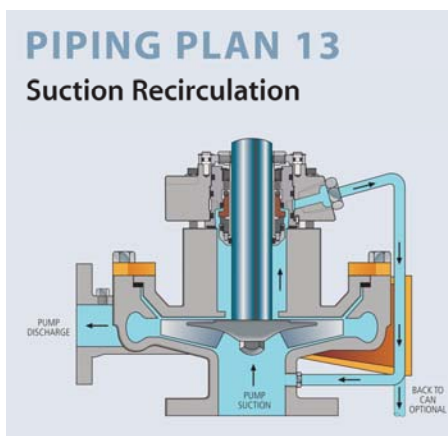
- **Inside Seals:** Inexpensive, but cumbersome to install on vertical turbines. A high ring base on top of the discharge head is required to allow seal replacement without removing the motor. If a vertical solid shaft (VSS) motor is used, a flanged spacer coupling is also required.
- **Outside Cartridge Seals:** Higher cost over inside seals, however are much easier to install on vertical turbines. A high ring base on top of the discharge head is required to allow seal replacement without removing the motor. If a vertical solid shaft (VSS) motor is used, a flanged spacer coupling is also required.
- **Split Cartridge Seals:** Most expensive seal design, and requires some careful work when installing. However, it does not require a high ring base or a spacer coupling. A split seal is advantageous when there's limited room available in the discharge head.



Pump Construction

Mechanical seals are acceptable when the pump and installation are specifically designed for their use. Unfortunately, it only takes one overlooked item to create a lot of cost and headache. Here are some guidelines to remember when employing a mechanical seal on a vertical turbine:

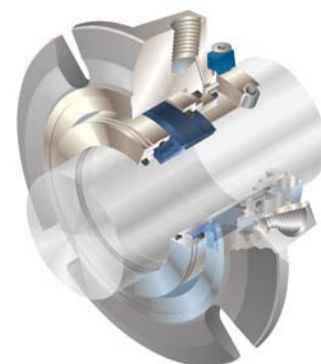
- Top section of column cannot exceed 5 ft, so as to keep the top lineshaft bearing support close to the seal housing.
- A steady bushing is required with vertical hollow shaft (VHS) drivers. VHS arrangement is typically not recommended due to tolerance stack up from the shafts, coupling, motor fit, bearing clearance, etc.
- A precision (API tolerance) flanged-adjustable-spacer coupling is required with vertical solid shaft (VSS) drivers.
- When using a cast iron head, a high ring base is required for all VSS arrangements. It is also required for VHS arrangements if removal of the seal is required without removing the driver.
- Confirm the seal will be lubricated within a few seconds of startup. Otherwise, install a flush or pre-lube system in accordance with one of the API piping plans.
- If abrasives are present in the pumping fluid, a flush system is required to protect the seal.
- If a flush system is not employed, the seal must at minimum be vented, thus to release air trapped inside the seal housing at startup. Otherwise, seal failure will occur from the faces running dry. API plan 13 is a common seal venting arrangement.



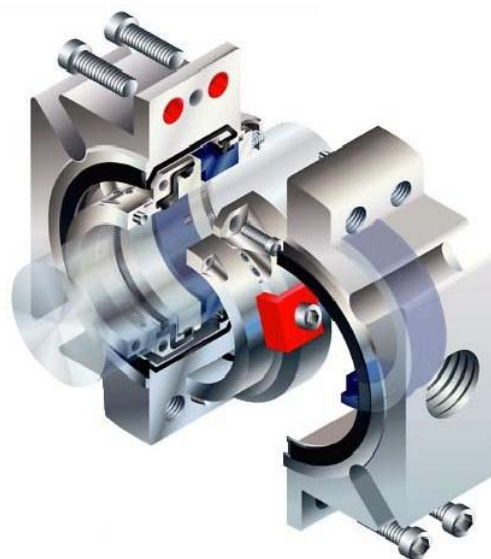
Flowserve Seals

If you've reviewed our price pages lately, you'll notice that only Chesterton mechanical seals are currently offered. Though these seals are well built, they are not always the most competitive depending on the application. Therefore, we've been working with Flowserve to introduce a wider range of seal options.

As an alternative to the Chesterton 155, Layne can now provide the Flowserve ISC single cartridge seal. The ISC seal is available for shaft sizes 1" thru 2 7/16", however it can only be employed with 125#/150# flange ratings.



For split seals, the Flowserve PSS III can be provided as an alternate to Chesterton's 442. The PSS III can be used with 125#/150# and 250#/300# flange ratings. However, at this time the PSS III is only available for shaft sizes 1 1/2" thru 2 7/16".



Please contact us for pricing and availability if you are interested in substituting a Flowserve mechanical seal.

Price Increases

Just a reminder that new multipliers for pumps and motors are now in affect. Please make sure that you are quoting jobs using current price pages, which are:

Standard Vertical Turbines – **Blue** pages dated April 1, 2008

Quick Ship Vertical Turbines – **Green** pages dated April 1, 2008

Firepump Vertical Turbines – Electronic Excel files:

Rev 15 VTFP ELECTRIC-AURORA
Rev 15 VTFP DIESEL-AURORA

Distributor Price Multiplier Schedule for Pumps and Parts – **Yellow** pages dated July 1, 2008

Distributor Price Multiplier Schedule for Vendor Equipment (Motors and Gears) – **Yellow** pages dated July 1, 2008

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