10 WAYS TO
KILL YOUR CENTRIFUGAL PUMP

A WHITEPAPER

VERDER
passion for pumps

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Centrifugal pumps are reliable, low maintenance pumps. They are worldwide good for > 40% of all fluid transfer in industry. The centrifugal pump has a very simple principle, due to centrifugal forces caused by a spinning impeller, liquid is sucked in at inlet and pressure is built at the outlet. No valves are needed, and a minimum of moving parts. Because of this a centrifugal pump is a low maintenance, if well selected, reliable part in your process.

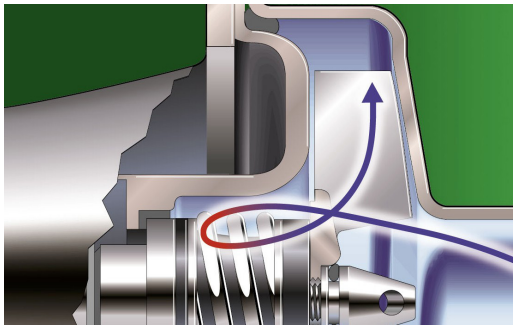
But there are some other essentials that can influence the results of the pumping process and can even damage the pump severely. Under the 10 most important essentials to avoid damage and create a reliable, safe pumping process with hygienic pumps.

1 Selection of the right pump size

Centrifugal pumps have a very atypical performance curve compared to positive displacement pumps. When the counterpressure in the pump will go down, the flow will go up and the used motor power will follow the flow. From the moment that the pump will need more power compared to the nominal power, it will start overloading and will heat up. If this process is lasting too long the isolation from the motor windings will burn and will cause an electric failure. Therefor it is very important that the entire process is taken into account when selecting the pump.

2 Select the right mechanical seal

The most critical part in a centrifugal pump is the sealing between the rotating shaft and the pump house. In hygienic centrifugal pumps this is most of the time a mechanical seal. The mechanical seal has two seal faces that are running to each other. In normal conditions there is always a film of liquid between the seal faces that guarantees the lubrication of the seal. If, off course, there is no fluid in the pump or the pump is sucking a lot of air, the seal faces will run dry and start to heat up. The elastomers in the mechanical seal will get burned and loose there sealing capability. This problem can also occur when the product temperature is too high and there is no flushing to cool down the seal faces.



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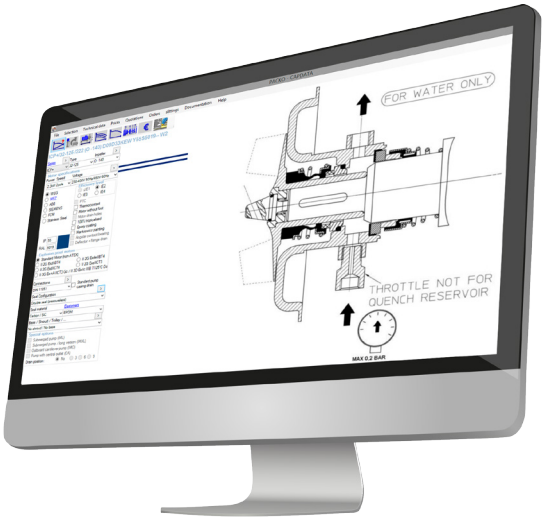
In this latter way the film evaporates and the lubrication goes down. Another possibility is that the fluid is high-pure. The fluid than loses its lubrication capacity and this will also cause some heat dissipation. This dry running problem can be prevented with a good mechanical seal configuration and the use of the right seal material.

3 Select the right installation format to avoid cavitation

This is a typical problem when for example the piping of the system at the suction side of the pump is not configured correctly. When there is too much resistance caused by a closed valve or a too small piping system, the NPSHa will be lower than the NPSHr. The pump will not work properly. When this problem occurs, air bubbles will be formed at the center (inlet) of the pump, because the fluid will drop below the vapour pressure and will start to boil. The air bubbles will implode when they come in a higher pressure part of the pump (outside) and cause an energetic jet reaction on the pump parts. Result: severe damage!

The impellers of industrial pumps are in cases of cavitation often full of holes. Cavitation also causes vibration: this will destroy the bearings, mechanical seal or the shaft connection or break the impeller screw.

When cavitation occurs the pump will also stop pumping the fluid. To prevent this problem in critical applications, and in fact in all cases, (because you want your system to work reliable) choose a pump with a very low NPSHr value, which will be able to work in tough conditions. Contact the author: with Capdata the perfect installation scheme can be configured.



***CAPDATA program** – No standard component sales, but a calculated solution in your process.*

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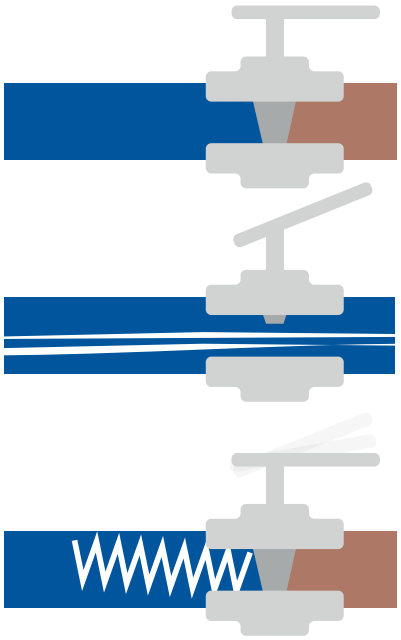


4 Select the correct process installation system to avoid water hammer

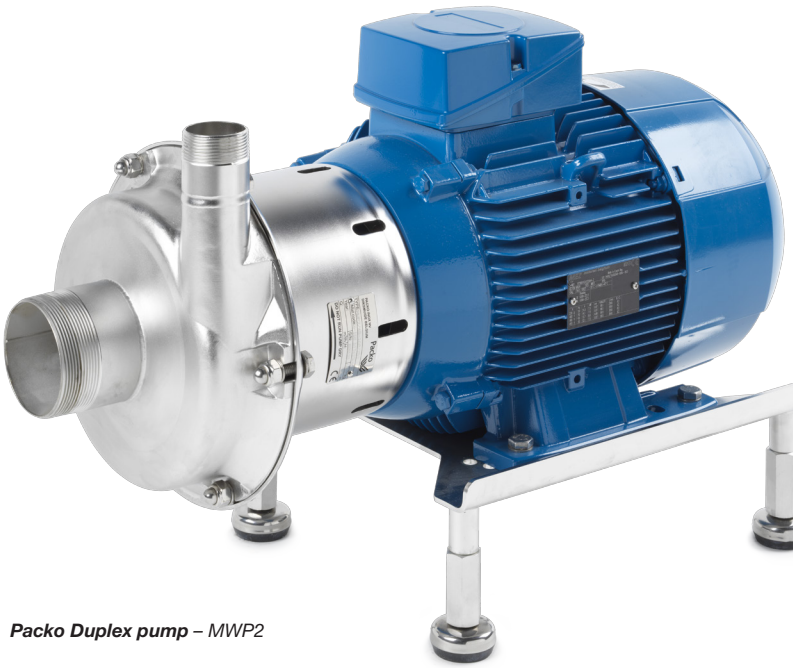
Water hammer is a typical problem that occurs in process systems with long lines and large piping diameters. This happens when a huge mass of fluid hits a fast closed valve and in reaction sends a peak pressure back into the system that passes the centrifugal pump. The mechanical seals, the backplate or even the pump casing can be damaged. This is a problem that has to be solved in the process installation by selecting slower valves and/or shorter piping, wherever this is possible.

5 The pumping of foreign objects

When the fluid flow is contaminated with objects such as bolts, nuts or other foreign objects your impeller will be stuck because there is only limited free space. Even if the pump is equipped with a free flow impeller or a channel impeller (where objects as big as potatoes are pumped with), metals or hard pieces will in most cases not pass the pump but will be stuck between the pump and the pump housing. The impeller, pump casing and/or bearings will be damaged. Due to the fact that a filter screen in the process installation is not an option in hygienic applications because of cleanability; Extreme caution in assembly-disassembly activities or a very good pre-screening from the bulk material is advised to prevent this problem.

6 Pumping abrasive fluids? Select a duplex pump

When your process needs a hygienic pump, but the fluid is very abrasive, it is a good option to select a mechanical seal made of SiC/SiC with hard seal faces.
But there is another problem to overcome: it is important for a hygienic pump that all wetted parts (including O rings) are in the fluid stream to ensure that the pump can be cleaned properly during CIP. A very abrasive fluid will attack the O rings causing them to leak. In the area around the mechanical seal, we want to create the highest turbulence for cleaning purposes; than metal cuts can occur due to fluid. In this case a duplex pump with a special design for abrasive food/feed applications is a good solution.



***Packo Duplex pump** – MWP2*

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7 Selecting the right seal for variable or high system pressures

Most hygienic pumps running at simple process conditions are equipped with bellow seals. The pressure between the seal faces is mostly dependent on the inlet pressure. With high inlet peaks some cluttering from the mechanical seal can occur, what will damage the seal faces by impact. But in the end a continuous higher inlet pressure at bellow mechanical seals will also create a huge wear from the seal faces. Both of these problems can be solved with a balanced/sterile mechanical seal that is independent from the inlet pressure.

8 Bad alignment of the pumps

Hygienic pumps are mostly not executed long coupled but closed coupled, so motor alignment is not an issue. The biggest problem is the alignment of the piping and the pump. Small hygienic pumps are mostly constructed from cold rolled stainless steel plate which is a very hygienic material but has a limited mechanical resistance when bended.

This means that misalignment will cause some tension and possible bending on the pump casing. There will be a risk the impeller touches the pump casing and these two parts will be damaged. The best solution is to follow the guidelines of the manufacturer on torque and forces that you can find in the manual.

9 Install motors with condensation holes to kill humidity

The biggest misunderstanding in the hygienic industry is that the cleaning team is destroying all electrical motors during cleaning procedure by spraying them too much with high or low pressure flows. In most cases, however, the culprit is humidity. Every electric motor must have an IP rate which indicates the degree of resistance against dirt and water penetration. Unfortunately there is no rating for the humidity resistance. When an electric motor runs it will heat up. Due to this temperature the air in the motor will expand and there will be air that will exit the motor. When the motor is stopped, the motor will cool down and there will be air with higher humidity from outside that will come in the motor. Causing

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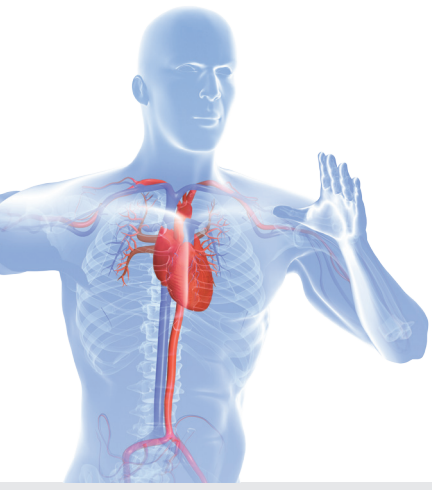
condensation. if this problem occurs regularly, there will be water in the motor that will kill the bearings and electric windings. Solution: Require a high spec motor that is executed with condensation holes below in the bearing flange that will lead the condensation water outside the motor. Strange but true in most cases the condensation plugs in the holes are mostly not unplugged in production.

10 Frequency converter and connections

Too long wires without a filter will cause EMC and isolation problems. With larger motors this can cause bearing damage. Bad electric connections will cause that the motor runs on 1 winding instead of 3 and will cause that it will burn. Overspeed will take too much power, underspeed will cause a ventilation problem. Wrong switching frequency from the inverter will cause noise that sounds like a broken bearing or a cavitating pump. Problems that we all could solve if we would just **RTFM** (Read The F... Manual).



To help selecting the best pump, installation model, the right motor etc Packo has created a computerized selection software program; CAPDATA. In this way always the best solution is selected for your process and your wishes. Contact us:

PM Hygienic

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