**Working mechanism of Pump**

A centrifugal pump is one of the simplest pieces of equipment in any process plant; however, plant engineers consider it as the heart of their plant. A centrifugal pump indeed is one of the most critical equipments ensuring the continuity of any process. Its purpose is to transfer the desired liquid to the desired point in the desired quantity.

The pump delivers the flow by converting energy of a prime mover (an electric motor or turbine) first into velocity or kinetic energy and then into pressure energy of a fluid that is being pumped.

The energy changes occur by virtue of two main parts of the pump, the impeller and the volute or diffuser. The impeller is the rotating part that converts driver energy into the kinetic energy. The volute or diffuser is the stationary part that converts the kinetic energy into pressure energy.

Thus, by creating resistance to flow (pressure or head) the centrifugal pump delivers the required flow.

**GENERATION OF CENTRIFUGAL FORCE**

The process liquid enters the suction nozzle and then into eye (centre) of a revolving device known as an impeller. When the impeller rotates, it spins the liquid sitting in the cavities between the vanes outward and provides centrifugal acceleration. As the liquid leaves the eye of the impeller, a low-­‐pressure area is created causing more liquid to flow towards the inlet. Because the impeller blades are curved, the fluid is pushed in a tangential and radial direction by the centrifugal force. This force acting inside the pump is the same as the one that keeps water inside a bucket that is rotating at the end of a string.

**ENERGY IMPARTED BY THE IMPELLER**

Once the liquid enters the eye of the impeller, it moves outward along the impeller. By virtue of its rotation, the impeller imparts kinetic energy to the liquid as it moves outward along the impeller.

The liquid accelerates and its kinetic energy increases and at the outer tip of the impeller the liquid possesses the highest velocity. The key idea is that the energy created by the centrifugal force is kinetic energy. The amount of energy given to the liquid is proportional to the velocity at the edge or vane tip of the impeller. The faster the impeller revolves or the bigger the impeller is, then the higher will be the velocity of the liquid at the vane tip and the greater the energy imparted to the liquid.

A pump failure is a mechanical or electrical problem that prevents a pump from functioning correctly. This can be caused by various issues, including a broken impeller, a loss of power, or a clogged filter. Pump failures can lead to severe consequences, such as flooding, water damage or complete failure of the piping system, so it is essential to take steps to prevent them.

In this article, we will discuss the causes of pump failure and common symptoms and ways to mitigate them. We hope this information will help you troubleshoot any problems you may experience with your pump and get it up and running again as quickly as possible.

There are several things you can do to help prevent pump failures. First, make sure the pump is installed correctly and maintained. Be sure to check the manufacturer’s instructions for information on how to care for your specific model. Second, use high-quality parts and filters. Third, be sure to check the pump for signs of wear and tear regularly. And finally, if you do experience a pump failure, be sure to call a professional for help. Pump failures can be serious, so it’s important to take all the necessary precautions to avoid them.

**What Are The Major Reasons For Pump Failure?**

Many issues have been identified that can lead to pump failure. However, it is often a series of issues or their combination that eventually leads to pump failure. Following are the major reasons for pump failure:

1. Lack Of Proper Maintenance:

Pumps need regular maintenance and servicing to function correctly like any other machinery. If they are not appropriately maintained, it can lead to pump failure.

2. Foreign Objects:

Foreign objects such as dirt, debris, rocks or gravel can get into the pump and cause damage or blockages. This can lead to pump failure or even damage the piping system.

3. Worn Out Parts:

The moving parts in a pump will wear out with time and need to be replaced. If they are not replaced as per the pump manufacturer’s schedule, it leads to pump failure.

4. Incorrect Installation:

All pumps need to be installed as per the pump manufacturer’s recommendations. If a pump is not installed correctly, it can cause problems and lead to pump failure.

5. Poor Quality:

Using a poor quality pump can lead to various problems, including pump failure. This is why you must always procure pumps from a reliable pump manufacturer.

6. Overheating:

Overheating is one of the most common causes of pump failure. It can be caused by several factors such as incorrect installation, insufficient lubrication or foreign objects blocking the cooling fins.

7. Vibration:

Excessive vibration can damage the internal parts and lead to pump failure. These vibrations are caused generally due to alignment issues, inherent installation issues or even overuse of pumps.

8. Cavitation:

Cavitation is a condition where air pockets are formed in the liquid being pumped. This can damage the pump and eventually lead to failure.

9. Corrosion:

Corrosion can damage the internals of a pump and cause it to fail. Corrosion generally happens when the fluid the pump is driving is corrosive or, at times, a lack of regular clean-up.

10. Electrical Issues:

Electrical problems such as voltage surges or power outages can damage a pump and cause it to fail. Many protective devices can safeguard the pumps from this, but sudden surges can still cause the pump failure.

**What Are The Major Symptoms Of Pump Failure?**

Instantaneous pump failures are easy to detect. However, pumps start showing particular symptoms over time, leading to pump failure. You must know these symptoms to act on time to save the pump.

1. The pump doesn’t seem to be working as efficiently as it used to.
2. You notice an increase in the energy required to operate the pump.
3. The pump makes strange noises that you haven’t heard before.
4. You see water or other fluids leaking from the pump.
5. The pump isn’t generating enough pressure to correctly move fluids through your system.
6. The pump is running hot, even when there’s no load on it.
7. The motor seems to be struggling or straining when the pump is running.
8. You notice vibrations or excessive movement coming from the pump.
9. The pump just stops working altogether.
10. You see smoke or fire coming from the pump.

How To Mitigate Pump Failure?

No engineer would want an operational pump to fail. It will only lead to process disruption and possible loss in revenue. Hence you must try and avoid pump failure as much as possible. Following are the ten ways to mitigate pump failure:

1. Use a reputable pump manufacturer with a good track record.
2. Select the right pump for the application – one that is appropriately sized and has the required flow and pressure capabilities. Your pump manufacturer can guide you in this process.
3. Ensure that the pump is installed by qualified personnel and meets all installation requirements as provided by the pump manufacturer.
4. Follow the manufacturer’s operating and maintenance instructions to keep the pump running smoothly and efficiently.
5. Inspect the pump regularly and perform routine maintenance according to the schedule recommended by the manufacturer.
6. Keep an eye out for early warning signs of pump failure, such as increased vibration or noise, leaks, or erratic performance, and take action to address them promptly.
7. Use high-quality pump parts and fluids, and make sure they are compatible with each other.
8. Be aware of the conditions that can lead to pump failure, such as cavitation, overheating, and dry running, and take steps to avoid them.
9. Use a monitoring system to track the pump’s performance and identify potential problems early on.
10. Have a plan in place for dealing with pump failure, including having spare parts on hand and knowing how to troubleshoot and repair the problem.

Following these tips can help mitigate the risk of pump failure and keep your operation running smoothly. If you experience a pump failure, working with the pump manufacturer or qualified repair service can quickly and efficiently get your pump up and running. Also, it is advisable that if you observe any of the pump failure symptoms, then you quickly inspect the pump and consult a pump expert if needed.

**Top 5 Common Pump Problems and Solutions**

Pumps play a crucial role in various industries, helping to move fluids efficiently. But sometimes, pumps can encounter problems that affect their performance. In this article, we'll discuss the top five common pump problems and offer solutions that can help you diagnose and fix these issues. By following these troubleshooting tips, you can either resolve the problems yourself or know when it's time to seek professional help.

**Leakage:**

Leaking is a common problem in pumps and often occurs when seals, gaskets, or other parts wear out or get damaged. Here's how you can deal with leakage:

Step 1: Look for visible leaks around the pump and its connections. Check if any seals or gaskets are worn out or damaged.

Step 2: Tighten any loose connections and replace worn-out seals or gaskets. Make sure all the components are properly aligned.

Step 3: If the leakage continues, it's best to consult a professional. They can check the internal parts of the pump, like the impeller or volute casing, which may need repair or replacement.

**Low Pressure:**

Insufficient pressure from a pump can disrupt the desired flow. To tackle low-pressure issues, follow these steps:

Step 1: Check the pump's suction line for any clogs (change this word for build up) or blockages that could hinder the flow.

Step 2: Inspect the impeller for damage or excessive wear. If needed, clean or replace the impeller to ensure it works properly.

Step 3: Make sure the pump is running at the correct speed and has the right power supply, as deviations can affect pressure levels.

Step 4: If the problem persists, seek professional help to inspect the internal parts, such as the impeller, casing, and evaluate the system's overall performance.

**Excessive Noise:**

Unusual or loud noises from a pump indicate underlying issues that require attention. Here's what you can do:

Step 1: Check if the pump is securely mounted and properly aligned. Loose mounts and failed bearings can cause vibrations, excessive noise or both.

Step 2: Look for debris, cavitation, or an air lock within the pump, as these can lead to noise problems. Clean the pump or install filters/strainers if necessary.

Step 3: Review the pump's speed and power supply. Installing a pump that doesn’t meet the duty/curve can create excessive noise and cause pump failure.

Step 4: If the noise continues, it's best to consult a professional. They can investigate potential internal issues, such as worn bearings or damaged parts, which may need repair or replacement.

**Motor Failures:**

Motor failures can disrupt the pump's operation and result from electrical or mechanical issues. Here's how to diagnose and resolve motor-related problems:

Step 1: Check if the power supply meets the pump's requirements in terms of voltage, capacity & amp rating (FLC).

Step 2: Inspect the motor for visible signs of damage, like burnt wiring or overheating. If you notice any issues, consult a professional for repair or replacement.

Step 3: Ensure the motor's bearings are properly lubricated and functioning well. Lubricate or replace them if needed.

Step 4: If the motor keeps malfunctioning, it's best to seek help from a professional pump engineer to investigate the electrical system & motor components.

**Inadequate Flow:**

Insufficient flow can occur due to blockages, incorrect impellers, or system design problems. Here's what you can do:

Step 1: Check the pump's suction line and inlet for any build up or obstructions. Clear them to allow a smooth flow of fluid.

Step 2: Verify if the impeller is correctly positioned and aligned. Adjust its settings according to the manufacturer's guidelines.

Step 3: Evaluate the system design to ensure it's adequately sized for the desired flow rate. Consult a professional to optimise the design if needed.