Problem	Possible Cause	Recommended Action
	Clogged strainer	Remove and clean screen
	Pump impeller damaged	Replace
	Insufficient NPSH (Net Positive Suction Head)	Lower pump or raise pressure or relocate
	Pump too small	Replace pump or impeller
	Partially air-bound pump	Vent pump casing
	Pump running backwards (three phase)	Reverse any two motor leads
	Improper motor speed	Check wiring and voltage
Pump or system noise	Entrained air	Vent system
	Pump cavitation	Lower pump or raise pressure or relocate
	Pump misalignment	Re-align pump (see note)
	Worn pump coupler	Replace; check alignment
	Excessive water velocity	Install balancing cocks or parallel piping
	Poor foundation (base-mounted)	Provide rigid foundation with adequate grouting
	Pipe vibration	Provide adequate pipe support
Premature failure of pump components	Improper pump (size) (type)	Replace
	Improper pump location	Relocate
	Pump misalignment	Re-align
	Over-oiling of pump	Check manufacturer's instructions
	Under-oiling	Check manufacturer's instructions
	Pump operating close to or beyond end point of curve	Balance system
	Excessive piping load	Provide proper pipe support

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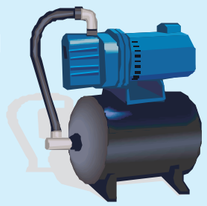
Servicing & Troubleshooting Of Pumps

In the operation and maintenance of water treatment and sewage treatment plants, pumps are among the most critical equipment. However small they may be, when pumps fail, the plant stops functioning. Though these are bought out items, knowledge about their servicing and troubleshooting will help in identifying the cause and solution of problems even before the pump service engineer visits the plant.



Servicing

Let's look at three main areas for service:

- Lubrication
- Seal replacement
- Alignment

All's Well when Oiled Well

Lubrication is probably the single most important step of a maintenance programme to keep a pump running without problems. Obviously, the manufacturer's recommendations as to the type of lubricant and proper lubrication intervals are the best place to start. But it's a starting point; not the final word. The reason is that the manufacturer does not know how the equipment is being used. How it is used will affect how much you lubricate it. A couple of factors that affect the lubrication schedule are - how often you run, or don't run, the pump; what type of environment is it in? Is it hot, dirty, and dusty? Or is the pump lucky enough to reside in a cool, dry, location? Thus you can see that the answer to, “How often should I lubricate a pump?” is, “It all depends.” Not much of an answer. So here's where experience comes into play. The more you know about the system, the better you are able to protect it. If you are lacking in experience, don't worry, you have something else to rely on: common sense.

To help you determine a lubrication schedule, check your records to see how the system is performing. What have you done in the past to maintain the system? Have you been successful, or unsuccessful in the past? If you do not know, you have not maintained a good set of records. So now, you need to start a log. There are a few things you want to put in that log: suction pressure, discharge pressure, how the pump is running (hot? noisy?), when was it lubricated?

You are going to lubricate bearings, on occasion. Generally there are two types of bearings: sleeve bearings and ball bearings. Everything about them is different. One of the best ways to determine when to lubricate either type is based on how hot they are running. If you have a way to measure temperature, great. If not, you will want to err on the side of lubricating them too often. After all, cost of grease or oil is small compared to time and cost of replacing the bearings.

Let's start with ball bearings. Before you start pumping grease into a grease fitting, check to see if there is a plug in the grease relief hole. If there is, remove it. You do not want to pump new grease into the bearings with no way of removing the old grease. Too much grease can be just as harmful as too little grease. You want to keep pumping new grease in until you start to see all the old grease come out.

You are done with greasing that bearing, but do you want to put the grease plug back in? Many people will simply throw the relief hole plug away for fear that the next person will forget to remove it before they start to pump in grease.

For sleeve bearings, you want to add oil. Not just any oil. Once again, use what the manufacturer recommends. This will be a non-detergent oil. There is an important reason for this. Oil evaporates - detergent doesn't. As oil evaporates, concentration of detergent becomes stronger. You can see that each time you replenish oil, you add even more detergent to oil. Once the oil is added, it is absorbed by a wick that deposits it where it's needed, between the sleeve bearing and the shaft to maintain a thin film of oil between the two. The wick has an important job. Therefore, you will want to inspect it. If it is scored or burnt, replace it. If it feels waxy, it can no longer do its job effectively.

Sealing the Deal

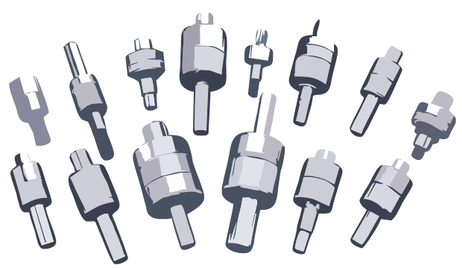
The most likely reason for disassembling a pump is to replace the seals. Even if seal replacement is not your reason for disassembly, it's a good idea to replace the seal while you have the pump apart. The seal kit that you bought contains all the parts you need. Replace the whole thing and not just an individual part. When you remove the seal, put on your detective's hat. Ask yourself: why did the seal wear out the way it did? Were there grooves in the seal? This could be a sign of a high concentration of suspended or dissolved solids. Suspended solids < 10 microns will get between two seal faces. May be you need to choose a seal that is more tolerant of these solids. Maybe you need to determine if there is a way to remove these solids from the system.

Your chemical concentration may be too high. A seal has two highly polished surfaces mated up to each other. Yes, no liquid is supposed to leak between the two surfaces, but it does - it has to. The thin film of liquid between the two surfaces heats up due to friction. The heat is then removed when the liquid evaporates. You never see that evaporation because it is extremely small. But, like oil in the sleeve bearing, chemicals are left behind. They can then cause grooving in the seal.

If you find that you are replacing seals often, perhaps you need to look at the type of seal you are using. If you can't remove the high concentration of chemicals, perhaps you need a seal that is more tolerant of high concentration. Other factors that will affect seal selection are pH levels and temperature. The last word on seals is that they are most often damaged during their installation. Be especially careful when putting the seal in. Don't touch its surface with dirty hands. Use soapy water to slide the seal on shaft, since petroleum products may affect the seal. Try not to chip the seal when placing it on the shaft and don't run the seal dry. Open the service valves to flood the pump cavity before running the pump. As you disassemble the pump, you'll have to deal with gasket surfaces. Whenever you're dealing with a gasket surface, be careful not to scratch these machined surfaces as this may cause a leak path. Always use new gaskets when putting the pump back together.

Keep it Straight

Alignment is a concern for flexibly coupled pumps. The coupler's job is to transmit power from motor shaft to pump shaft. It can also take up minor misalignment. The key word here is minor. Exactly how much has been determined by the coupler manufacturer, based on several factors, so use their recommendations.



How you check alignment is basically determined by rpm. The lower the rpm, the less sophisticated a method you can use. At 1,450 rpm you can get away with aligning the shafts with just a straight edge and taper gauges. At 2,900 you'll want to use a dial indicator. For higher rpm and greater accuracy, you may need a laser.

Check that the pump and motor shafts rotate around the same axis. This means you have to check the parallel and angular alignment. To change these alignments, you'll have to place or remove shims from under the motor and move the motor from side to side.

After you've placed shims under the motor, tighten the motor down to check alignment again. It's always better to use few larger shims than a large number of thin shims. After you've placed the pump in service, recheck the alignment when the pump reaches its operating temperature.

Obviously, there's a lot to cover when servicing a centrifugal pump. Here, we've just touched on some of the main areas of concern. Along with that, final advice is to use common sense and be methodical when working so as to not damage the pump - or yourself.

Troubleshooting

Typical problems associated with pump operation and initial or first level action are provided in this section. While troubleshooting, look at these probable causes and their solutions.

Problem	Possible Cause	Recommended Action
No circulation	Set screw is not tight, coupler loose on shaft	Tighten set screw in recess in the shaft
	Impeller slipping on shaft	Check to see if impeller is placed on the key way of the shaft Tighten impeller nut
	Air-bound system	Vent system
	Air-bound pump	Vent pump casing
	Broken pump coupler	Replace; check alignment
	Clogged impeller on piping	Locate and remove obstruction
	System valve closed	Open
	Pump electrical circuit broken	Check all related low and line voltage circuits
Inadequate circulation	Air-bound system	Vent system
	Air-bound pump	Vent pump casing
	Clogged impeller or piping	Locate and remove obstruction