

Lift Station Maintenance for the Complete Idiot



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Don't Hate Me Because I'm a Lift Station

Nobody ever put in a sewage lift station because they wanted to. There are very few other pieces of equipment that are as universally hated as lift stations. What usually happens when you hate something? You avoid it like the plague. What happens when you avoid a lift station? It gives you plenty of reason to hate it. The simplest way to avoid problems with a lift station is to keep an eye on it. Get to know it and what to expect from it. Once you get to know it you will spot troubles while they are still small and avoid having both pumps give it up at 4:30 on a Friday afternoon.



This guide will take you through the care and feeding of your lift station. Follow the recommended procedures and your chances of experiencing a total lift station failure will be greatly reduced.

The Basics

The lift station is really pretty simple. The wet-well is the basin the pumps sit in. There are two pumps, each with its own check valve and gate valve. The check valves stop flow from coming back into the station when the pump shuts off and also keep one pump from

pumping back through the other. There are four control floats in the wet-well. These have a little mercury switch in them (like a thermostat). The lowest float is the off float, the next highest the lead float, and then the lag float, and finally the alarm float. We'll discuss floats in detail later. They send a signal back to the control panel that turns on the selected pump. In normal operation, the pumps switch back and forth after each pumping cycle. A device called an alternator selects which pump will be the lead pump. When the water level reaches the lead float, the lead pump is turned on. The other pump becomes the lag pump. If the water level continues to rise it will activate the lag pump. Then both pumps will stay on until the water level drops low enough to make the off float shut off. When the pumps shut off they reverse roles. The lead becomes the lag and vice versa. This is how they back each other up in case one becomes clogged or quits for any reason. As we will see later, it's also the reason you could go along not knowing one pump has quit until the other does and you have a major problem on your hands.

In the control panel there is a circuit breaker, a motor starter or contactor, and an overload for each pump. High voltage runs through these components. The pumps get turned on

and off by sending low voltage (110 volts) to the coil of the contactor. The contactor has points in it that are pulled together by an electromagnet. Power to the electromagnet (or coil) is also run through the overload protector. If for some reason the pump draws too much current (amperes) the overload will open and the pump will shut down. After the overload has cooled it can be reset. If the pump draws an extraordinary amount of current, like in the case of a dead short, a locked up pump, or water in the motor, it will trip the circuit breaker.

A printed circuit board controls the low voltage operation. The floats connect to this board.

Each pump has a hand-off-automatic (HOA) switch. In the hand position the pump will run no matter what the water level is in the wet-well and keep running until you turn it back to off or automatic. In the automatic position the pump is turned on and off by the float switches. There is also a control circuit master switch below the HOA switches that must be on for the pumps to operate. The control circuit will operate even if the circuit breakers are off. This is useful for troubleshooting without turning the pumps on and off. The contactor will still pull in, but without the high

voltage coming through it the pump will not operate.

There may be several optional features in the control panel such as elapsed time meters (hour meters), seal failure indicators, high water alarm, phase protectors, etc. If you are not sure what something does, you can check the electrical schematic on the inside of the door or give us a call.

Some pumps require capacitors to get the motors started. If you have a single-phase control panel you will have capacitors. There will be a start capacitor that will usually be black, a run capacitor that will usually be silver, and a little square brown box that is the start relay. Capacitor circuit troubleshooting is covered in detail in the control panel manual in the appendix.

Spend some time looking around the control panel. Do not put your hands, or a screwdriver, or anything else in the control panel unless you are sure that the power is off and locked out. Check it with a voltmeter. Don't ever assume that the power is off. Check and double-check it.



Down to the Nitty Gritty

Now that you have a basic idea of how the lift station works we need to look closely at the ways you can keep it working day in and day out. As you will see, an investment of 5 minutes a day can save you hours of headaches and thousands of dollars.

Rule No. 1 - Check the lift station on a daily basis. This is no big deal, takes about two minutes, and is the best insurance policy you can buy. Get in the habit of checking the lift station first thing every morning and the last thing at night. Even if you just stopped by to say hi to your lift station you would be doing yourself a favor. Pretty soon you would get used to the sights and sounds and smells and know when something out of the ordinary was going on. But to get the most out of your visit you need to look at a few things every day.

Care and Feeding

The single most important thing you can do to keep the lift station alive and well is to read and record the hour meters every day. The hour meters show how long each pump has run. You will have to open up the control panel to do this. When you do, be careful not to touch any of the

electrical components. Unless the panel is equipped with an automatic disconnect device there will be live voltage and it will be in the 230 to 460 volt range.

A calendar is perfect for keeping track of hour meter readings and other information about the lift station. Write down the current meter reading and subtract the one from the day before for each pump. Try and do this at the same time each day. Don't just write down numbers.

The pumps should alternate each cycle. If everything is working right the pumps will have each pumped the same number of hours in the time since you last read the meters.

Every lift station will be different. Some run 15 hours a day (7.5 hours per pump) and some only run 0.6 hours (0.3 hours per pump). After you do the readings for a week you will have a base line to work with. Depending on the type of project you have, you may get the same number of hours each day. A full apartment complex would have this type of flow. Or the hours may vary. An office/warehouse complex would have higher flows during the week and maybe no flow over the weekend. Get to know what to expect.



Hour meters in control panels can work two different ways. In some the hour meter for the pump keeps running even if the breaker or overload is tripped and the pump is being called for. In others the hour meter shuts down when the pump trips out on an overload. See what yours do. Turn off the circuit breaker to one pump and then turn the hand-off-automatic switch to manual.

Look at the hour meter closely and you will see that it is running. When you are satisfied that it is running push the test (or trip) button on the overload and check it again. If it is still running then you can diagnose a bad pump as being the one with the most hours on it.



For example, Pump No. 1 had 6.3 hours on it over 24 hours and Pump No. 2 had 14.8 hours. Something is wrong with pump No. 2. It's being called for and the hour meter is running but it is not pumping. The hour meter keeps running until the water level gets high enough to call for the lag pump and the wet-well gets pumped down. On the next cycle, No. 1 will be the lead pump and will pump O.K. so the meter gets the normal amount of time on it. If your hour meter shuts off when you trip the overload, the pump with the least amount of hours on it will be your trouble pump. You

need to know this to use the hour meters as a diagnostic tool. The hour meters will show you a problem before it becomes an emergency.

Let's look at a couple situations and see how the hour meters can save the day. Suppose you have a brown out one afternoon and the voltage gets low enough to trip out Pump No. 1 on an overload. The power gets back to normal before the water level reaches the lag float so Pump No. 2 picks up the slack. The next morning you see that Pump No. 1 has twice the hours on it that No. 2 does (your panel is the type that the meter keeps running even though the pump is not pumping). You do some basic troubleshooting, reset the overload, and everything is back to normal. No sweat. No emergency.

Now let's look at the other side of the coin. You get busy and blow off checking the lift station for a couple days. It's your day off so you head to the mountains. The brown out has tripped No. 1 out but you don't know it. That afternoon a plastic bag gets sucked up into Pump No. 2 and trips the breaker. A couple hours later tenants start complaining about sewage coming up in their floor drains and bathtubs and someone notices the light blinking on the lift station. You are in the mountains, the manager doesn't know anything about the pump

station, so he calls a pumper truck. It pumps all night until you get back to work the next day. You see all the commotion, walk over, hit the overload reset and Pump No. 1 takes off. You are a hero - until they get the pumper truck bill and realize from the log that the hour meters had been shouting out a warning that went unheeded.

If you do nothing else...read and interpret the hour meters.

One last word about hour meters. The meters could show that you have a problem, but the pumps could be working fine. Maybe the meter has gone bad. Maybe the alternator quit working. If the meters indicate a problem don't panic. Run each pump in the hand position and see if they will pump down. This will tell you right away if you need to look at a control circuit or hour meter problem or a pump problem. The important thing is that you will know you have a problem before it becomes an emergency.

Now that you have read, recorded, and interpreted the hour meters open up the hatch to the wet-well. Look down on the sides of the wet-well. There will be a scum or grease line at the level where the lead pump turns on. Above that should be clean. If not get a hose and wash down the walls. Under

normal operation the water level should never get above the lead pump turn-on elevation. Check this everyday. If you notice an accumulation of stuff above the line, it is an indication that the lag pump has to pick up the load once in awhile. If you have a major scum line at the lag pump elevation you have a pump that is not working. We will look at some of the possibilities for lag pump calls when we get to the troubleshooting section. Right now we are checking for normal operation.

Look closely at the floats. A small mirror stored in the control panel helps out here. Use the mirror to reflect the sun down into the wet-well. It makes a super powered flashlight. With a little practice you can use the mirror to inspect the whole interior of the wet-well. A 3" x 3" mirror is all you will need. Get one with a plastic frame - no metal. The floats should be free of grease. If you let the grease build up, the floats will get so heavy that they will not turn on. Make a float grabber out of a 6' piece of 3/4" PVC with a 90 on one end with a 6" piece glued into it. Get a pair of heavy-duty rubber gloves and something to scrape with. A wooden paint stirrer works well. Turn the HOA switches to off. Snag the float cord and bring it up to where you can work on it. Scrape the grease off



the floats and back down into the wet-well. I have seen several instances where a lift station overflowed only because the floats were dirty. Check them daily. Clean them regularly. Turn the HOA switches back to auto.

Use the mirror and look at the water level. Is there a large thick mat of grease and junk floating on the water? If so, you need to get rid of it. The floats can stick in this mat and ride up on it without turning on. You can break it up with a hose. This works a lot better if you do it once a week or so rather than letting the mat get 6" thick. Break up the mat and then run one of the pumps on hand until they just break suction (at the bottom of the pump) then turn it off. Keep hosing it down while the wet-well fills again and then pump it down until the pump breaks suction. A couple times of this is all it will take. About once a year you should have a pumper truck completely pump out and clean the wet-well. Turn the HOA switches back to auto.



That's all there is to the daily check.

Once every six months you should shut down the power to the control panel and tighten up every connection point in the panel. Verify that the power is off with a voltmeter before you get into the panel. The vibration caused by the

contactors pulling in causes screw connections to loosen up. I have seen total lift station failures simply because the neutral wires on both contactors loosened up and dropped out. First one pump quit, and then six months later the second one quit. People really hate to spend a thousand dollars for a pumper truck because of a loose wire. Of course, had they been checking the lift station everyday and following the other procedures I have outlined, they never would have had even a slight problem.

Every six months is a good time to check the voltage and amperage of each pump. If you don't have a good voltmeter and ammeter, get one. Read the directions and try it out. Read the voltage leg to leg and leg to ground for each pump and record them on the calendar. Record the amperage for each leg as well. If you have a single-phase control panel, check the start relay. The details for checking the relay are in the control panel manual in the appendix.

This is also a good time to look for rust and corrosion. Lift stations eat metal fast. Stainless steel and aluminum replacement parts are available for many of the components in the wet-well. Keep the lid cleaned and painted. Don't let rust get out of hand.

If you follow these procedures religiously you will have reduced the chances of your lift station failing by a great deal. Want even more insurance?

The first thing you can do is change the position of the control floats. Remember the sequence? Off, lead pump, lag pump, and then the alarm. That's the way 99% of the stations are set up. If your floats are set this way you will not know you have a problem until both pumps are out and the water level reaches the alarm. Loosen the fastener holding the cord into the float bracket and raise the lag pump float 3" above the alarm. This way if a pump fails the alarm will go off the whole time the water level is rising to the lag float. The alarm will only go off intermittently but it will catch someone's eye and alert you to a potential problem. If you cannot immediately fix the problem with the bad pump, either use the lead pump selector switch (if you are lucky enough to have one) or temporarily lower the lag pump float back down below the alarm float. Then if you see the alarm again you know you have a major problem.

Ever hear of Murphy's Law? The way it works with lift stations is when you pull a pump out for repair you increase the chances of the other pump failing. Your best bet is to have a spare pump

on site. It should have all the necessary brackets already on it and be ready to drop back down in the wet-well. The lift stations are equipped with a quick disconnect rail system. You should never have to go into the wet-well. Also, you can't go into the wet-well without special equipment and training. Don't take chances.

Lots of people die each year in confined spaces. The beauty of the spare pump is many fold.

At best it is going to take a few days to get a pump repaired. If it can't be repaired it could take a week or more to get a replacement. With your spare you don't have that worry. Also you only need a lifting device once. You can use a small crane, a tow truck, a forklift, or even a backhoe to pull the pumps. Once you get the bad one out, you drop in your spare and send the crane away. You take the bad one in for repair and put it in storage as the spare when you get it back. Spin the impellers of stored pumps every two weeks by hand to keep the seals from sticking together.

Keep spare parts on hand. At a minimum you should have a control board, contactor, overload, and float on hand. You also should have a supply of 2 amp and 3 amp fuses for the control circuit. If you have a single-phase panel, keep a run capacitor, start capacitor, and start



relay on hand. You can usually find an electrician at 1:00 am but 7-11's don't have much in the way of a capacitor selection.

Spare pumps and parts are not expensive when you consider you could have a pumper truck sitting there all night at \$150 an hour.

One last thing to think about as far as insurance is a remote alarm indicator or telephone autodialer. These devices can be hooked into the control panel and remote an alarm to a manager's office or even call you on a cellular phone and tell you that you have a problem.



There are complete troubleshooting guides in the appendix. But we ought to talk about a few basic things.

Circuit breakers and overload protectors are there to protect the motor from destroying itself. Current produces heat and these devices sense the above normal heat and shut down the motor. When the device cools it can be reset and the motor will try and start again. Some overloads have an automatic reset. Don't use it. Always do manual resets so you know what is going on. If a circuit breaker or overload trips out twice in a short

time, don't try it any more until you determine what the problem is.

Completely clogged or bound up pumps will trip the circuit breaker. So will a pump that has water in the motor. A partially clogged pump will usually trip the overload.

Beware of junction boxes in the wet-well. If you have a sustained power failure and the water level in the wet-well gets up to the junction box it could get water in it. When the power comes back on the water in the junction box causes the circuit breakers to trip.

If you have a junction box in the wet-well we recommend having all the connections in the box waterproofed. We have seen broken electrical conduit between the junction box and the wet-well that allowed rain or sprinkler water to get into the junction box and short everything out.

You've had a lot thrown at you in a short time. If you just take away one thing from this guide let it be CHECK THE LIFT STATION EVERY DAY - READ AND RECORD THE HOUR METERS. Do that and you will be a happy camper.

A Little Help From a Friend

If you have more questions, need spare parts pricing, or need a shoulder to cry on (lift station problems only, please) give me a call at (702) 293-4134. I'm here to help you help yourself.

Special for Those of You With Grinder Pumps.

Grinder pumps are a great invention and perfect for many applications. The grinder pump depends on a cutting device to chop everything that flows into the wet-well -- paper, plastic, wood, elastic, kid's toys, you name it -- into little bitty pieces. The more little bitty pieces it has to chop, the faster it will get dull. As it gets dull the pump has to do more work (just like us if we are using a dull knife). The extra work causes the motor and all other components to wear at a much greater rate. Dull cutters also cause pump clogging. If a grinder pump clogs up twice in a week it is a safe bet that the cutters need changing.

Pull your pumps after one year of use and check the cutters. You will see that there is a new very sharp (be careful!!) edge and a dull edge that has been doing all the work. If the working edge is still pretty much there and not rounded over, you can



probably adjust the cutters and put the pump back in and check it in a year. If it is really worn (you'll know it when you see it) it is time to turn over the cutters, to get a new cutting edge, and adjust them. This procedure is outlined in detail in the grinder pump manual in the appendix. If you keep your cutters sharp, a grinder pump will keep going and going and going. If you don't it will start driving you nuts. And it won't quit until you fix the cutters or burn up the pump and get another one. The neat thing about the Hydromatic grinder pump is the reversible cutter. Once you have used up both sides you have to buy a whole set. But in normal use you should get three to four years per side. A lot of people keep a set of cutters on hand. That way if they should have to have the pump out for any reason and find the cutters are dull they can take care of it right away. I know people that have quadrupled pump life with a good cutter maintenance program. The whole cutter reversing and adjusting procedure will take you 30 minutes the first time and less than 15 minutes from then on.

Except for getting into the pump. You can do all the maintenance and repairs on the lift station yourself with just a few tools.