10 TIPS TO IMPROVE OPERATIONS OF A SALT WATER DISPOSAL PUMP

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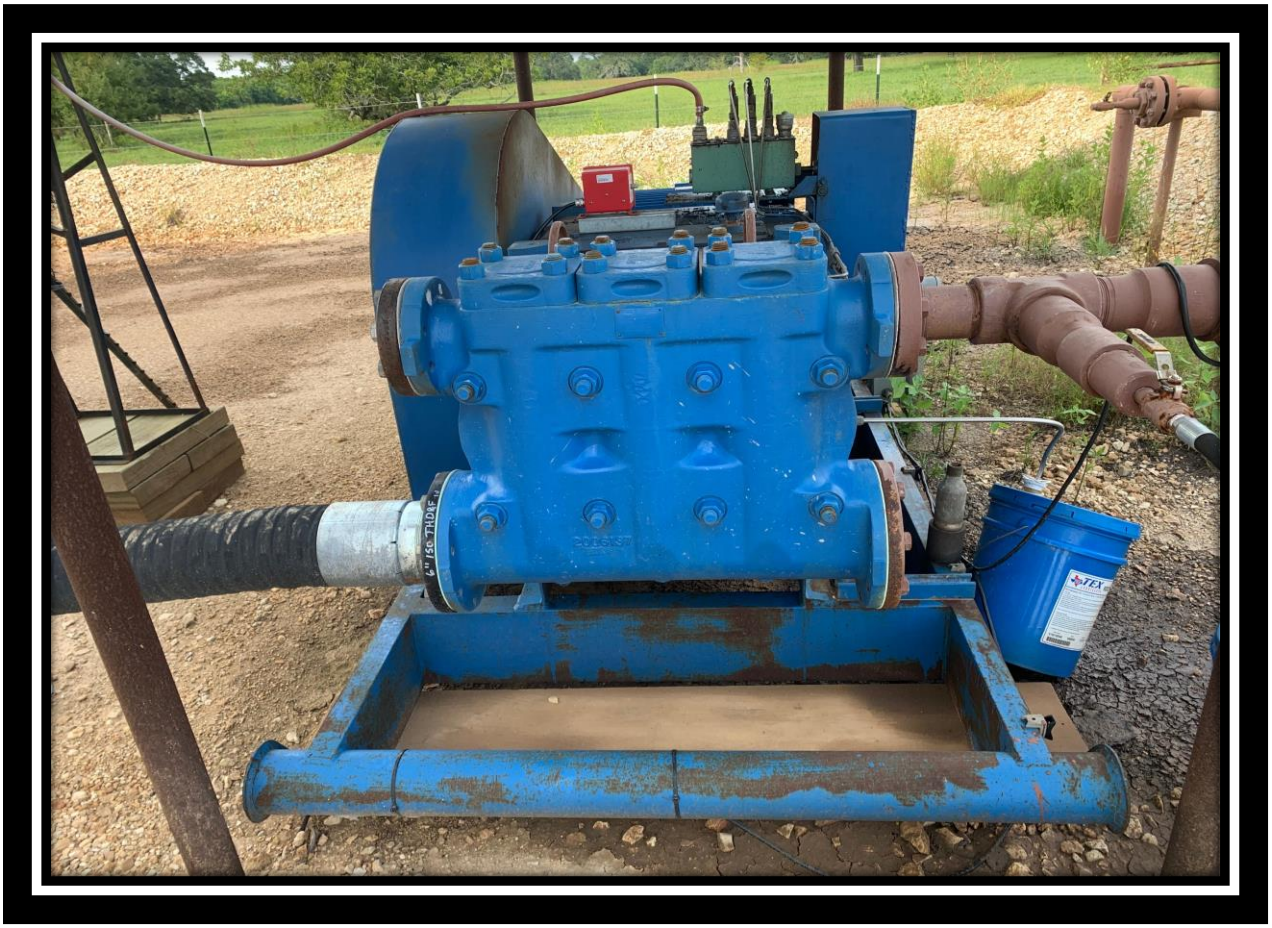

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In the oil and gas industry, a large amount of salt water is collected during the process of oil production. In Texas, for example, the salt water must be disposed of properly — a process that is overseen by the Railroad Commission of Texas.

The Commission is the state agency with primary regulatory jurisdiction over the oil and natural gas industry, pipeline transporters, natural gas and hazardous liquid pipeline industry, natural gas utilities, the LP-gas industry, and coal and uranium surface mining operations. The Commission exists under provisions of the Texas Constitution and exercises its statutory responsibilities under state and federal laws for regulation and enforcement of the state's energy industries. Zones are created by the Commission for disposing of the salt water, a process that requires salt water disposal pumps.

Salt water disposal into these zones may require up to 3,000-4,000 pounds of pressure. Pumps are required to handle this huge amount of pressure. Salt water can be pumped daily in amounts from 100 barrels a day to as much as 150,000 barrels per day. Reciprocating plunger pumps are most often used for this purpose.

In general, these triplex and quintuplex plunger pumps are installed to dispose of the salt water collected while extracting oil and gas. Salt water disposal pumps must be sized properly with the appropriate speeds to accommodate the pressure and volume to dispose the salt water.

Because of the high pressure and the corrosive salt water environment, improving the operations of these salt water disposal pumps is critical. Often, mechanics are charged with maintaining these pumps, but the functionality of these pumps require a special type of maintenance protocol.

The following are 10 expert tips to help eliminate the mistakes that can lead to salt water disposal pump failure. These tips also will contribute to higher profitability for the operator.

1. Ensure that the NPSH (Net Positive Suction Head) is accurate.

This is one of the most critical elements of improving the performance of salt water disposal pumps. The NPSH represents the pressure apparent in the suction line that feeds the pump. It doesn't pull fluid into the pump. The positive suction provides pressure to the pump.

On triplex and quintuplex pumps, the suction valve has a spring. There must be enough hydrostatic head (or pressure) to force the spring to contract and open the valve, allowing the fluid to flow through. Once the pump begins the forward stroke, the suction valve closes and the fluid is forced to flow through the discharge valve. The next batch of fluid forces it out of the pump. The suction system needs to be set up correctly to eliminate future problems. If the suction piping can be designed without any 90-degree angles this will help to avoid slowing the flow.

In addition, there must be enough accelerated head rate, which is the speed of the fluid in the suction line, to catch up with every revolution of the pump. With every revolution, the fluid in the suction line comes to a stop. Therefore, there must be enough pressure behind it to keep it flowing. If the pressure is not sufficient, cavitation can occur. Cavitation is a void in the fluid line and can cause air locks, which are dangerous for the performance of the pump. Operators will know this is happening because the pump will begin to bang loudly.

To obtain the NPSH, multiply the height of the water in the storage tank by .433. The width of the tank has no influence on this calculation. This provides the PSI of the fluid in the suction line. NPSH needs to overcome line friction and the suction valve spring pressure.

NOTE: Remember that the fluid in the suction line stops on each revolution (RPM), therefore, the NPSH needs to be great enough to catch up to avoid having a void between strokes.

2. Never operate a positive displacement pump without a pressure relief valve.

A plunger pump is a positive displacement pump. If you have a 2-inch plunger with a 3-inch stroke, every time the plunger comes forward it will move a column of water that is 2 inches by 3 inches. If something is blocking the discharge line, the fluid cannot be compressed so something will give. A rod or crankshaft could break, or other catastrophes can occur. Therefore, relief valves are critical to the operation of positive displacement pumps. It's also important to never have a block valve in front of the relief valve in the discharge line, especially between the pump and the relief valve. This is extremely important for the functionality of the pump as well as a safety issue for the operator. A valve cap can blow off the end of the pump and cause severe injury.

3. Ensure that the pump rotates in the correct direction.

Most horizontal pumps (quintuplex and triplex) have a splash lubrication system feature. In the power end of the pump there is a level of oil. As the crank turns over, it picks up some oil and distributes it through the system, which provides lubrication.

Pumps have an arrow that indicates the direction it should be turned. If turned the wrong way, it won't pick up as much oil and therefore not properly lubricate the pump. Some pumps have an internal lubrication system that distributes oil to all the connecting parts (gear rods, bushings, etc.) and they have a gage indicating the pressure. If turned the wrong way, the gage will register zero and not show any pressure and it will, therefore, not be lubricating the system. This can burn a pump quickly.

NOTE: When standing next to a triplex pump with the fluid end on your left-hand side and the power end on the right, the correct rotation will be counterclockwise. When operating a triplex pump at or below 100 RPMs, add an additional 10% more oil in the crankcase. (Exception: when the pump has a pressurized oil system).

4. Carefully calculate the plunger lubrication rate (and use rock drill oil for best results).

A force-feed lubricator on a pump is extremely important for the life of the packing and the plunger. This chart shows the sufficient lubrication required for the plunger size, recommended by packing manufacturers.

PLUNGER DIAMETER	DROPS PER MINUTE
½" to 1½"	8 – 10
½" to 2½"	12 – 14
2½" to 3½"	16 – 18
3½" to 4½"	20 – 22
4½" to 5½"	24 – 26
5½" to 6½"	26 – 30


As an industry standard, rock drill oil is recommended for best results. It's been proven that rock drill oil can triple the life of the packing.

5. Ensure that the pump speed (strokes per minute) is appropriate for the age of the pump and the application.

Manufacturers have recommended pump speeds (strokes per minute) that are for ideal suction conditions. In the field, however, the conditions are rarely ideal. Some pumps have been in operation for several decades and may not be functioning ideally. Finding the proper pump speed that is appropriate for the age of the pump and the application will increase its effectiveness. This ideal pump speed may not be what the manufacturer originally recommended.

To benefit the pump and its expendables when setting up the pump, (and if you can obtain the volume and pressure you require) run the pump at 300 RPMs or less. This is likely less than the original recommendation, but it will extend the life of the pumping system.

6. Use a centrifugal charge pump on multi-pump manifolds.

Should you have a low NPSH or multi pumps on a single manifold, it will be beneficial to use a charge pump. Many salt water systems will have one manifold with three pumps. Normally, in this case, the pumps are connected side by side. The pump that is furthest from the tank will get the least amount of fluid. This scenario requires a charge pump that will keep the line charged so that all the pumps receive the proper amount of fluid. Use about 30 pounds of pressure on the suction line of the last pump. This again requires an appropriate NPSH. There must be enough pressure on the line to move the fluid through all three pumps.

NOTE: Select a charge pump that will give you an output of 1 ½ to 2 times the total volume of the pump(s) on the suction manifold.

7. Ensure there is a high-low level switch on the tank to avoid damage to the pump.

The high-low level switch on a tank is designed to turn the pump on when the fluid level in the tank gets high. It shuts the pump off when the fluid level in the tank is too low. It's similar to a float switch on a boat's bilge pump. When the fluid level gets low enough that the NPSH is so low that it's not properly feeding the pump, then the pump needs to be turned off to allow the fluid level to build up again. This is especially critical for pumps that operate 24/7.

It's not a good idea to try to manually maintain the level of the tank. The high-low switch will operate automatically to keep the pump from cavitating.

8. Pulsation stabilizers can contribute to smooth operation.

Pulsation stabilizers are not a necessity, but they can help to keep the pump operating smoothly. Because the fluid is starting and stopping, there is pulsation of the fluid entering the pump. Stabilizers are designed to reduce the pulsation in your pump and discharge line. Install the stabilizers directly on the pump, or as close as possible.

NOTE: Keep in mind that the suction stabilizer protects only the pump. The discharge stabilizer protects the discharge piping.

9. Inspect the valves and clean the valve decks.

When changing valves in the pump, as each valve is removed, the seating surface should be inspected. Upon visual inspection, if you see feather-like markings, fluid has passed between the valve deck and the valve, and this is a problem. In this case, the fluid end valve deck will need to be reworked. Get into the habit of inspecting for this feather-like scarring as you pull each valve. When installing valves, clean the decks and dry them. Also make sure the sealing area on the valve is dry and clean. If the rate on the pump drops, or if you hear clattering, the valves could be the problem.

Most valves have a shoulder directly above the tapered sealing area. Ideally, when the valve is installed, there should be a 1/8 clearance standoff between the valve and the top of the seating area in the fluid end. With time, depending on the pressure, the valve deck on the fluid end will open and let the valve go deeper. If it goes deep enough, it will eventually hit the shoulder on the valve and not properly seat. Therefore, this should also be inspected regularly.

10. Install a lock-out, tag-out on electrically powered pumps.

If your pump is electrically driven, always install a lock-out, tag-out before any maintenance is performed on the pump. Mechanics have locks with a tag and number. If they cut a breaker, they put the lock on it. This identifies who is working on the pump so it can be determined whether it's ok to turn the breaker back on.

The best advice for improving the operations of a salt water disposable pump is to listen to the pump. Be familiar with it, and it will tell you when you have a problem. If there are issues that you can't understand, don't hesitate to ask for help.
