Willard Says……

DREDGE PUMP PRIMING

Rule #1: Air is the enemy!

Rule #2: Air is the enemy!

The rest of the rules of priming are the same. Air is great stuff for breathing and flying but frustrating as all get out if it gets into or will not vacate your dredge pump shell.

Ideally, the best way to prime a dredge pump is to put it underwater a la a ladderpump so that it is flooded and even then there can be problems. We will discuss those later.

For now let us consider ways to purge the air in a hullpump or deckpump.

Eductor Priming:

Seal the discharge line at some point near the pump. The discharge line can be sealed using a flap valve or a pinch-to-prime device, filling it with water or by immersing a portion of it near the point where it leaves the dredge hull.

Seal the suction pipe by lowering it into the water.

Connect the suction port of an eductor to a port in the top of the pump shell or in the discharge pipe if the pump is a top discharge model. The goal is to use the eductor to pull a vacuum on the pump shell and cause water to enter and completely fill the pump shell. If the eductor is connected to the highest point in the system, it will be possible to remove all of the air. Any air leak in the pump/piping above water will increase the time taken by the eductor to evacuate all the air.

If the leak(s) is too large the rate of air leaking in will come to match the rate of air removal and complete evacuation will not be accomplished.

An eductor is a 3-port, no moving parts device that utilizes the venturi principle to pull a vacuum on one port whenever service water is run into and exhausted out of the other two ports. The eductor is ideal for priming a dredge pump. Properly piped a portion of service water flow can (and should) be fed to the packing gland and the balance directed into the eductor.

With the pump/piping system sealed against air intrusion, the eductor will evacuate the air in the system, the pump can be started with full prime. No-air-leak priming should take less than 5 minutes. Taking longer? Think air leak(s).

Discharge pipe shutoff valves.

These valves come in two flavors, the flap valve and the pinch valve. When choosing between them the best choice is none of the above.

Flap valves. These are overgrown check valves—remnants of the past. They are expensive, heavy, dangerous, finicky, and prone to wear out. If you have one of these things you know all of that. If you are thinking about getting one, don't.

Pinch-To-Prime Valve. It is a hydraulic powered clamp that squeezes shut a section of discharge sleeve located near the pump discharge. The pinch valve is the modern equivalent of the flap valve and is the better choice. They cost less and are easier to install and maintain.

Sub Prime System.

The simplest, no-moving-parts way to seal the discharge pipe is to arrange the discharge pipe adjacent to the dredge so that it remains submerged. Support the pipe with floats but position it so that a 40 to 80 foot section remains under water. This arrangement provides a continuous automatic water seal. The discharge pipe is always airtight. Prime by lowering the suction pipe into the water and use an eductor to remove air from the system.

HDPE plastic discharge pipe forms an automatic shutoff valve as long as no additional flotation is used to support it. Plastic pipe floats when filled with clear water, however, not high enough to allow air to enter.

Drop-The-Suction-Pipe priming.

This was the favorite method in the day of the friction winch with its free-fall feature. The procedure was simple- raise the suction until the inlet was higher than the top of the pump shell, open a vent valve on top of the pump shell and pump the system full of water. When water flowed out of the suction inlet and vent valve it was time to pump. Close the vent valve. Release the hoist brake. Start the pump at the split second the suction hits the water. Apply the hoist brake and catch the ladder before it bangs the bottom. If the timing was right, the pump primed and kept pumping. If the pump lost its prime the process had to be repeated because too much air got into the system before pumping commenced.

Modern dredges usually (and should) have hydraulic hoist winches, which lack a free-fall feature. If the pump is located in a well with its suction inlet at or very near the water surface the drop-the-suction priming procedure may work depending on how fast the hoist winch can lower the ladder. If it works, it is the simplest way to prime. It works on some dredges until the fuel tanks are close to empty at which time the pump height above the water is just enough to prevent sure-fire-every-time priming.

Natural Priming.

A pump may prime without problem if the eye of the impeller is at or below the surface of the water. If a pump seems to be close to priming but will not quite "take", check to see if air is trapped in the pump discharge line. Often the pump discharge port is the high point in the system and if this is the case it is worth a try to install a vent valve in the high point to allow air to escape. This vent may allow air to escape and make room for water.

Jet Assist Priming.

One sure-fire way to prime a hullpump is to install a suction jet assist. The jet system is thoroughly examined in ***Willard Says*** Suction Jet Assist. Many operators have assured me that quick dredge pump priming is the jet's greatest asset. If true, that is one hell of an expensive priming system. The fact is that if the jet is not enabling an increase in production of at least 20 percent then it should be removed and another way found to prime the pump. Given the almost universal ignorance of the true function of a jet assist it is not surprising that the most that can be said of it is that "it primes the pump fast."

Pump Startup Speed.

If the pump shell and suction pipe are completely full of water (no air) the pump will prime at any starting speed. High speed starting places high-torque starting loads on the prime mover and drive and serves no purpose. Slow starts are best.

A slow startup speed is mandatory if there is some air in the top of the shell. Slow rotation is more likely to cause the pump to lower the pressure at the eye of the impeller and cause water to commence flowing in from the suction pipe and proceed to full prime as all the air is gradually expelled from the pump shell. A fast turning impeller in a shell containing some air will fling the heavier water outward which will force the lighter air to move into an area of lower pressure—the center of the eye. The pump will **never** pump as long as this condition exists. The pump cannot pump liquid with its eye full of air.

Loss of Prime.

Over the years I have heard stories about dredges "that just quit pumping". After asking some questions the cause was usually found to be one of the following:

1. Gas in the deposit. Usually, gas is the culprit when a lot of bubbles or foam accumulate on the surface of the water above the suction inlet. Organic material, buried in the deposit has decomposed creating gas that remains trapped under water. Removal of the solids frees the gas and it either rises to the surface or enters the suction inlet to cause mischief. Pump authorities state that a pump will lose prime if the flow to the pump includes 2 percent air. I don't know who measured it and I don't know whether they measured it underwater (small bubbles under pressure) or at the pump inlet (big bubbles in a vacuum). Makes no difference. Too much air will cause your pump to lose prime. You can reprime and hope it does not happen again or at least not too often. If it does happen too often, you will have to install a gas ejector.

2. Air leaks. Any leak in that portion of the suction pipe that is above water will allow air to enter the suction pipe and will adversely affect pump operation. If the leak is large enough air may enter the system to cause the pump to lose prime. This typically happens when the vacuum increases above the normal operating value. Higher vacuum will cause more air to pass through the leak.

3. Packing leaks. Air can enter the pump shell through the packing gland especially when pulling a high vacuum. Air will likely enter if the service water pressure/flow is low, the gland is leaking badly and packing integrity cannot be maintained.

4. Cavitation. Running a pump at the edge of cavitation invites all kinds of problems. The hammering vibration beats the hell of out of the packing and opens the gap between the shaft sleeve and the packing. Water sprays out and air can enter. When the vacuum on the cavitating pump inlet increases further it is likely to quit pumping due to the combination of air entry and choking off.

5. Plugged suction pipe. When the velocity in the suction pipe becomes too slow, the particles fall out of the flow and come to rest on the bottom of the pipe. This condition causes an in crease in indicated vacuum and a decrease in production. Continued operation often is accompanied by a gradual increase in vacuum until the pump loses prime. Usually, the vacuum remains “locked” at a high value and falls back only after the pump is stopped. Hopefully, the backwash will flush the accumulated solids out of the suction pipe. I have seen the suction pipe plugged solid and have to be rodded out. Get a velocity meter, pick up the pace and pump at a higher velocity.

Air Leak Detector.

The neatest vacuum leak detection tool is a can of shaving foam. Spray all the joints while the eductor is creating a vacuum in the pump shell. A little hole will form in the foam over a leak.

Ladderpump Priming.

Most ladderpumps prime automatically, however, some adherents of Jack Daniels engineering principles install their pumps with a vertical down discharge. This really lousy idea not only causes priming problems by trapping air in the pump shell but also puts the discharge pipe under the ladder structure where heroic and dangerous measures are required to repair or replace it. But that is another subject.

Other ladderpump designs angle the discharge port upward and connect it to a long discharge sleeve. The sleeve curves up and then downward toward the hinge pin before attaching it to a steel discharge pipe. This arrangement traps air in the discharge sleeve and often prevents the pump from priming until it is 20 to 30 feet under water.

If air is trapped in a ladderpump/discharge pipe it can prevent pump priming until the pump is immersed to a considerable depth. The trapped bubble of air must be compressed sufficiently to permit water to rise high enough into the pump for it to prime. Solve all of these trapped-air problems by installing an automatic vent valve on top of the pump shell or the high point in the discharge pipe near the pump. Ask for details of how to build this vent valve if you are having this problem.

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