PUMPS THAT EXPERTS SELECT.

Self Priming Pumps

Self-Priming Pumps are used all over the world in many applications. They are used to pump fluids out of sumps, tankers and buried tanks.

If a self-priming pump is installed like a standard pump, it will not “self-prime”. To understand why self-priming pumps must be installed differently from standard centrifugal pumps, it is important to understand how they work.

A pump is said to be primed when its casing and all the suction piping are full of liquid. The beauty of self-priming pump is that they do not need either an external vacuum source or a foot valve and filling source. Please note that a self-priming pump will re-prime if it becomes air bound.

Some of the considerations to be made:

1. Remember that the maximum liquid life is about 25 feet. This is based on atmospheric pressure, which varies with elevation and the pump’s efficiency. If the liquid you are pumping has a specific gravity greater than 1, then divide 25 feet by the specific gravity to determine the effective lift you can expect. If the liquid has a high vapor pressure, vaporization can occur in the suction line at the point of highest vacuum. The lift for these liquids will therefore be lower. Make sure to check for NPSH available to determine your maximum lift. This pump is right at 25 feet. But NPSHA indicates that it should be all right too.
2. Minimize suction elbows. Suction elbows should be limited to 1 or 2. More elbows cause more friction loss, which may reduce NPSHA and cause vaporization in the suction line.
3. Limit your suction piping to lengths under 25 feet. The longer the pipe is, the longer it will take to prime the pump.
4. The suction pipe size should be the same as the pump suction size. The larger the diameter of the pipe, the more air that must be evacuated and the longer it takes to prime the pump.
5. Avoid suction piping check valves or foot valves. These valves only adds friction loss and reduces the NPSHA.
6. Provide for a bleed line, normally ¼ inch. This line should be located in the discharge pipe between the pump’s discharge flange and the discharge check valve or isolation valve. This bleed line should run back to the suction source. Air at 77 degF has a density of 0.074 lb/ft3. This is about 840 times less than water density. Let’s say a water pump can generate 100 psig. When it pumps air it will generate approximately 100 psig/840= 0.12 pisg. During the priming cycle your pump can not generate enough pressure to open the check valve and evacuate the air in the pump casing. So to have a reliable system, always install a vent (bleed) line.
7. On unitized self priming casing the impeller and discharge volute cutwater clearance is close (1/8 inch) to insure the liquid-air mixture will be completely expelled and will not simply recirculate around with the rotating impeller. When the impeller is trimmed then you must modify the cutwater to maintain this 1/8 inch clearance.
8. Follow the minimum suction pipe submergence guidelines to prevent vortexing
9. When a self-priming pump shuts down, the discharge pipe must be designed such that enough liquid flows back into the pump to fill the self-priming chamber. Therefore do not put a 90 degree elbow on the pump discharge. Always allow for plenty of pipe before the discharge check valve and isolation valve. The volume of the pipe should be equal to the volume of the casing.
10. The suction piping should be designed such that no high points are created where air can be trapped/accumulate which can prevent priming. Historically this has been problematic on top of unloading rail cars.
11. The priming time is a function of the pump size, impeller diameter, and suction pipe length and size. The pump curve priming time is base on the static lift of suction pipe size that is the same as the pump suction nozzle size. For suction pipe lengths greater than the static lift height, the priming times will

increase in direct relation to the ratio of the total pipe length above the liquid level to the static lift height. And for pipe diameters other than the pump suction diameter, the priming times will vary as the square of the ration of the pipe diameter to the pump suction diameter.

To calculate the total priming time for a given system:

1. Correct the static lift for liquids with specific gravities other than 1.0, since the priming time curve are based on ambient temperature water. Multiply the static lift by the specific gravity of the liquid in order to obtain the effective static lift.

   Les = SL x S.G.

   Les – effective static lift in feet of liquid
   SL -- maximum static lift in feet from the free surface of the liquid to the Centerline of the pump suction, or the highest point in the suction piping, Whichever is greater.
   S.G.—specific gravity of the liquid being pumped.
   Use the effective static lift number when you go to the pump priming time curve.

2. To determine the system priming time at the effective static lift use the following formula:

   PTt = PTLes x SPL/Les x (Dp/Ds) 2

   PTt – total system priming time in seconds
   PTLes- priming time in seconds determined from the pump priming time curve At the effective static lift.
   SPL-- total suction pipe length above the liquid level, in feet.
   Les--- effective static lift, from priming time curves, in feet.
   Dp--- nominal pipe diameter in inches
   Ds--- nominal pump suction diameter in inches.