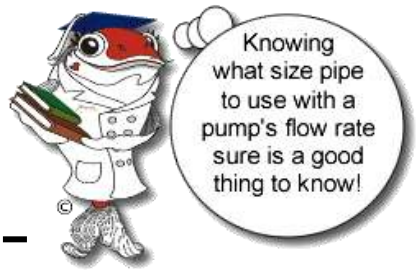
neoflux™
hallmark of EXCELLENCE



CAVITATION & PIPE FRICTION IN *AODD* Pumps

Cavitation is a hydraulic condition which can exist in any type of pump. It is primarily a situation in which the pump is discharging less liquid then its rated capacity due to reduction or lack of liquid supply to the pump intake. "Excessive Suction Lift, insufficient NPSH, or operations at high speed are common causes of Cavitation. Pitting, Vibration, and noise are common troubles stemming from Cavitation. While severe Cavitation is usually accompanied by excessive noise & damage to the pump, mild Cavitation may produce nothing more than a small reduction in pump efficiency & moderate wear of pump parts."

Diaphragm Pumps like other pumps, "Do not suck in liquids; they reduce pressure in the suction chamber, and external pressure, usually atmospheric, pushes the liquid into the pump. For any pump with a given size suction line, capacity or maximum speed is fixed by the existing NPSH." A diaphragm pump can be particularly vulnerable to a "Starved Suction" condition because it is generally pumping viscous, solid laden slurry. In fact, most cases of low flow rates can be traced to starved suction condition due to either high a static lift, too long a suction line, or a combination of both.

It is likewise possible to experience Cavitation even though the pump may have a "flooded suction". In this case it is due to trying to discharge more than can be pulled in through a suction line that is too long and/or too small in diameter. If slurry is quite "thick" it will only be possible to pump much smaller amount than the pump's full capacity.

Cavitation is harmful to Diaphragm life because on the suction stroke the diaphragm is being pulled mechanically by the shaft connected to the pressurized diaphragm. There is an "Unbalanced" pressure on the diaphragm equal to the amount of suction produced. Cavitation makes the "Unbalanced" pressure on the suction stroke higher. The lower the suction lift condition imposed on the diaphragm, the less the "Unbalanced" mechanical load, and the longer the Diaphragm life. Every Diaphragm has given number of flexes before failure. If the pump is cavitating, less liquid is being pumped per flex; therefore, diaphragm cost per gallon is increased.

Cavitation can be eliminated in the ***Neoflux*** AODD Pumps easier than with any other type of pump. Start the pump slowly by controlling the volume of compressed air to the pump by the use of a gate or globe valve. After the unit starts pumping, the throttling valve can be opened to increased capacity. The point at which further opening

of the valve increases cycling rate without an increase in discharge rate will be the Cavitation point and the valve should be closed slightly. Further attempts to increase capacity should be oriented around a larger suction intake line, larger pump, reduced lift condition and/or a combination of these conditions.

Under conditions of limited flow due to Cavitation, damage to the ***Neoflux*** AODD Pump most likely will be limited only to the diaphragms, in comparison to numerous expensive parts in other types of pump.

HIGH VISCOSITY PIPE FRICTION IN *AODD Pumps*

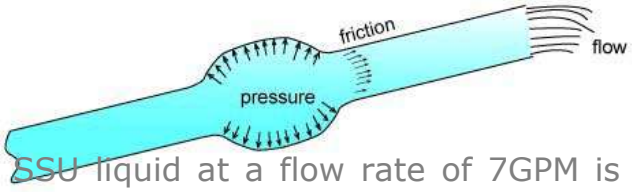
Viscosity is that property of a liquid which resists free flow. The most common method of expressing viscosity is in SSU (Saybolt Seconds Universal) or cP (Centipoise). Water at ambient temperature has a viscosity of 31.5 SSU or 1 cP.

Centrifugal Pumps can handle viscosities upto 500 SSU (100 cP). Beyond 500 SSU, a positive displacement pump must be used to move a liquid. Most pipe friction tables are based on water or at most go to liquids of up to 500 SSU. The ***Neoflux*** AODD pumps are capable of pumping viscous slurries. Next page describes a Pipe Friction Chart showing line loses at viscosities up to 5,00,000 SSU (15,900 cP)

Note: *These Friction tables give the loss in the Pounds per Square Inch (PSI). The losses at the very high viscosities (1,00,000 SSU & up) are great.*

Note also that all friction loses in these tables must be multiplied by the Specific Gravity of the slurry being pumped.

With the high friction loses observed at these high viscosities, suction conditions become Ultra Critical. At best there will only be a maximum of 14# available at sea level to push liquid into the pump.



For Example:

The friction loss in 100’ of 2” pipe of a 1,00,000 SSU liquid at a flow rate of 7GPM is 230#. (See Table Below) Through 10’ of 2” Pipe the loss would be 23#, well above the 14# available. It would only be possible to pull approximately 3GPM through 10’ of 2” pipe due to friction alone. No static lift would be possible.

The fact is that no pump can exert force on a liquid until it is in the pump. The only force able to act on the suction side is the earth atmospheric pressure of 1.47 PSI at sea level. Once the liquid is in the pump, ***Neoflux*** Pump can push with as much pressure as the air supply pressure available.

Typical "In Plant" air supply pressures are seldom over 100 PSI (6.9 BAR). Therefore, any calculated friction loss approaching this figure calls for either a shorter pipe, a larger pipe size or a reduction in the amount of elbows / bends. This will reduce the amount of friction loss.

CONSIDERATIONS FOR SPECIFYING A *NEOFLUX* AIR-POWERED DOUBLE DIAPHRAGM PUMP

- **Gallons per Minute (GPM):** Required Flow Rate or Output
- **Specific Gravity:** The Ratio of fluid density to that of water. Water equals to 1.0
- **Viscosity:** A measure of fluids tendency to resist a shearing force. Viscosity is not a constant, fixed property of a fluid; it varies with the condition of the fluid and system.
- **Temperature:** The temperature of the fluid at the pump inlet is usually of greatest concern.
- **Vapor Pressure:** The absolute pressure (at a given temperature) at which a liquid will change to vapor.
- **Static Suction Lift:** The Vertical Distance from the Center Line of the pump down to the Free Level of the liquid source.
- **Static Suction Head:** The Vertical Distance from the Center Line of the pump up to the Free Level of the liquid source.
- **Static Discharge Head:** The Vertical Elevation from the Center Line of the pump to the point of Free Discharge.
- **Dynamic Discharge Head:** Static Discharge Head plus Friction Head.
- **Pipe Diameter**, **Pipe Length** and the **Number of Elbows/Bends** are needed to calculate friction head.

We look forward to being of assistance in your process equipment requirements

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