LDi P14 *Whether **Liquid Dynamics "PulseDoctor"** on site services, you yourself, or a local oscillograph user captures the shock and pulsation "signatures", it is essential that readable suction side plots be taken first, and interpreted.*
A combination of these suction system samples will be shown by a plot.
30 years experience studying plots of "pressure over time" is an advantage.

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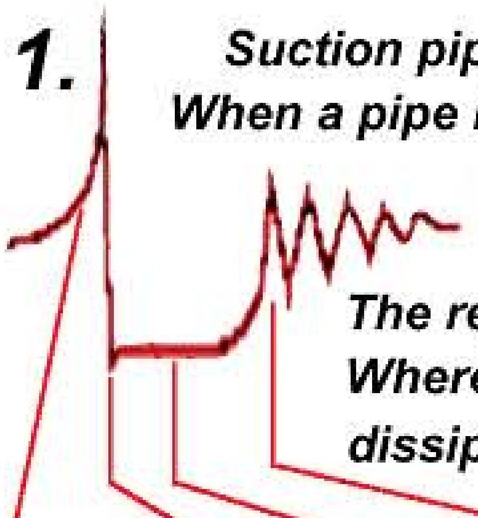
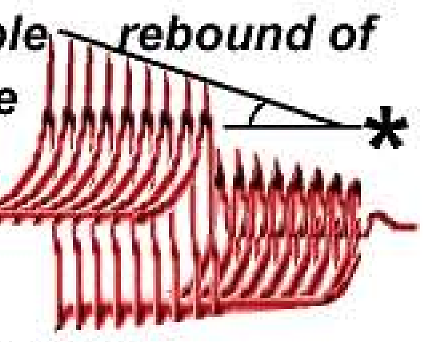
1.



*Suction pipe signature, where a pump momentarily lost prime, or was started too fast for the suction pipe length. When a pipe is oversized, yet not so large that it becomes an amplifier, you will see this, a multiple rebound of each pressure change. The interval between each repeat of the pressure signature is related to the pipe length and pressure wave velocity, depending on "softness". The repeats will be equivalent to 1400 meters per second + or - , & the length round trip. Where the height of each repeat decreases, as sample shown here, the pipe is slightly dissipative. It has a little delt P * (Pressure Drop). Good, as it prevents resonant amplification.*

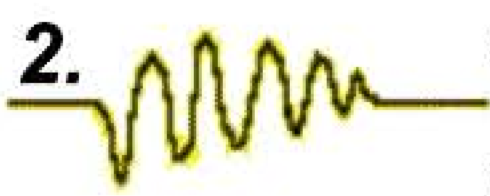


The de-solution of air, having the same effect as reaching vapor pressure, is characterised by a flat bottom to the pressure signature. This indicates a pressure below which it cannot fall. Often called "cavitation".

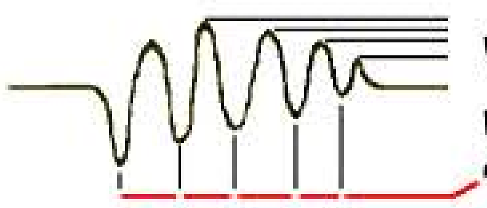
When pump is NOT: Centrifugal, Vane, Lobe, Gear, Progressive cavity, Screw etc.

NOTE: If the suction supply system is designed to feed a reciprocating pump, a signatue like this may be seen for every stroke. Do <u>not</u> increase the pipe size or the supply pressure force, put a supply close to the pump.

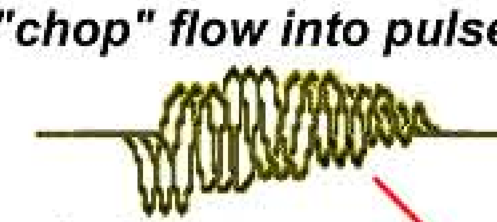
2.



Suction pipe pressure signature, where a check valve is often before the pump to maintain the prime. A check valve or "foot" valve, is never simply held open by the viscous drag of the liquid. Check valves modulate between nearly closed and near full open. They often "chop" flow into pulses.

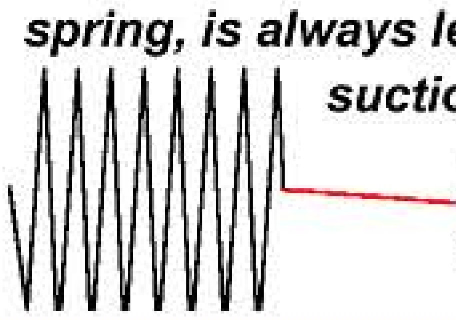


Valve beat fluctuations are characterised, particularly when they are integral with a diaphragm or plunger pump, by a different interval between beats,aka "frequency", different pressure level, and normally with a rounded top and rounded bottom.



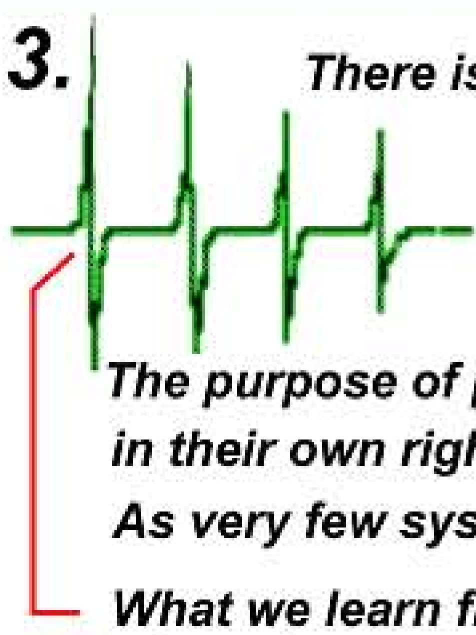
When pipe is long, & size gives a good dp, that "scrubs" pulsation with "reynolds action" reverberations will not be seen, they will have been dissipated against the pipe wall.

The mass of liquid is always greater than the weight of a check valve moving element, and the force even of a check spring, is always less than the pressure in the liquid. The supply column to a pump always excites the movement of the suction check, it then behaves according to its own response characteristics and the pounding of the liquid.



When a supply system is broken into slugs and voids by air out of solution, check valves are hammered and the pulsation becomes as violent as a relief valve bouncing.

3.



There is a tendency in the trade, to ignore valve action and the chopping of flow, & to diminsh the importance of correctly selecting pipe size, then to consider everything in terms of "acoustics". By acoustics the experts seem to mean only the results of pressure activity that is reflected from the closed or open end of a system, and from direction changes in the conduit. In acoustics, all that is relevant is the speed at which pressure changes travel from place to place.

The purpose of piping systems is to convey volume or mass of liquid from A to B. The forces of inertia are important in their own right for pump efficiency. No pump can do anything unless the liquid can freely and steadily move into it. As very few systems work simply by reservoir head, or by syphons, maintaining the prime on pumps is essential.

What we learn from this precise frequency and its transient nature, is only that something sudden happened in a pipe of an exact length, the length of which is determined "acoustically" according to its softness.

LDi recommend you consider acoustic response, but concentrate on mass transfer.

As the speed of sound depends on the "softness", or the effective modulus for the liquid and the pipe elasticity - both of which depend on temperature - it is somwhat problematic to make recommendations for system changes based on "acoustic" criteria. The temperature is always changing and so also the acoustic response.

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