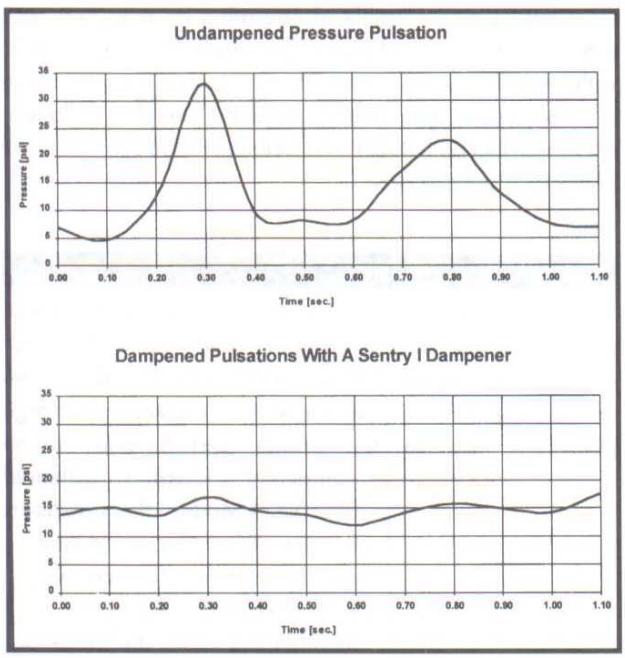
BLACOH FLUID CONTROL

CASE STUDY: INLET STABILIZER

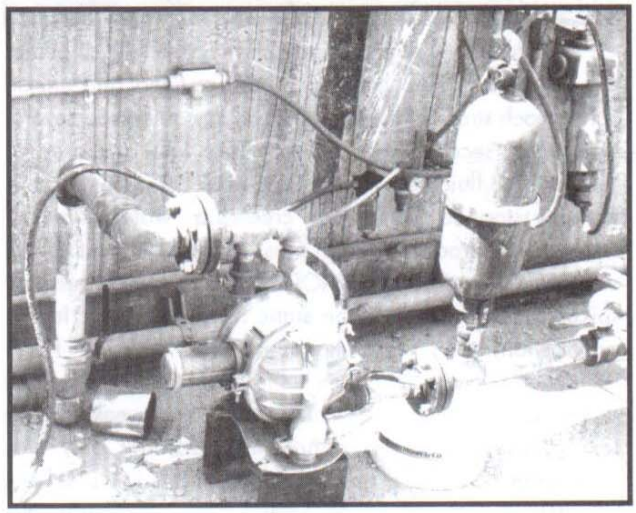
BLACOH FLUID CONTROL, INC.

APPLICATION...

A nationally recognized leader in the manufacture of quality paints, uses air operated double diaphragm (AODD) pumps in process and transfer applications. In this particular application, the AODD pumps are used in a tank storage area to transfer Texonal®, a solvent based paint additive, to the production facilities within the plant. The



AODD type pump is especially suited to the paint industry. The compressed air operation of the pump eliminates the danger of electrical explosion due to sparkling, and AODD is sealless, which reduces the potential for leakage. The use of elastomeric diaphragms, instead of metal to metal contact points, permits the pumping of non-lubricating fluids. Due to the on/off demand of this application, the use of an AODD pump is ideal. The air operated feature allows the pump to be "dead headed" at the delivery point with an on/off valve as demand requires. When the liquid pressure in the pump's discharge line equals the compressed air pressure driving the pump motor, the pump just stops or "stalls" with no pressure relief required and no damage to the pump.



AODD pumps, however, do have an Achilles' heel. On the inlet stroke of the pump, the motive diaphragm is pulled inward mechanically by a shaft, creating a mechanical strain on the diaphragm. The suction stroke of the pump also forces a pressure strain on the diaphragm due to the vacuum created in the fluid chamber. In order to minimize the damaging effects of the unbalanced strain, AODD pump manufacturers place limits on the amount of positive inlet pressure to the pump - a maximum Net Positive Suction Head (NPSH). The limit is typically 10 psi with PTFE diaphragms and 13-15 psi with rubber diaphragms. Texonal® requires the use of PTFE diaphragms.

In this application, the AODD pump was placed at the bottom of a 20 foot tall Texanol® storage tank. The height of the tank and the specific gravity of the Texanol® combined to produce a static inlet pressure of around 8 psi. This is close to the maximum NPSH allowed for PTFE diaphragms, but within the pump manufacturer's NPSH recommendation. At 80% of the maximum NPSH, diaphragm life would be shortened, but the case study does not end there, the real trouble begins when the pump is turned on.

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PROBLEM...

With the reciprocating action of the AODD pump, two alternating inlet ball valves are opened and closed during each stroke of the pump - stroking can exceed several strokes per second. Each time the ball valve is closed or "seated" the fluid velocity, created from the inlet stroke, is abruptly stopped. This action creates a "water hammer" effect, which produces a high pressure spike, similar to that of a quick closing valve. An AODD pump can create pressure spikes two to four times the static NPSH pressure. In this application, the "water hammer" was over 16 PSI - exceeding the manufacturer's limit. With this inlet force, the Teflon® diaphragms were lasting only three weeks before failure. Every time a diaphragm failed, not only was maintenance required and production halted, but solvent was leaked into the containment dike. Obviously, this was unacceptable to the pump user, who was reviewing alternative pump types for this application.

This "ball valve hammer" spike was able to cause so much damage to the diaphragms because, as the ball valve closes on one side of the AODD pump, the alternating ball valve opens as the motive diaphragm begins its suction stroke. This suction stroke creates a lower pressure area in the fluid chamber. Since high pressure always seeks low pressure, the "ball valve hammer" spike travels directly to the opposite fluid chamber, slamming open the ball valve and forcing all of its pressure onto the motive diaphragm. The force of the spike severely weakens the integrity of the diaphragm by distorting its shape with unbalanced pressure loads and concentrating stress onto one area of the diaphragm causing the PTFE to "cold flow".

SOLUTION...

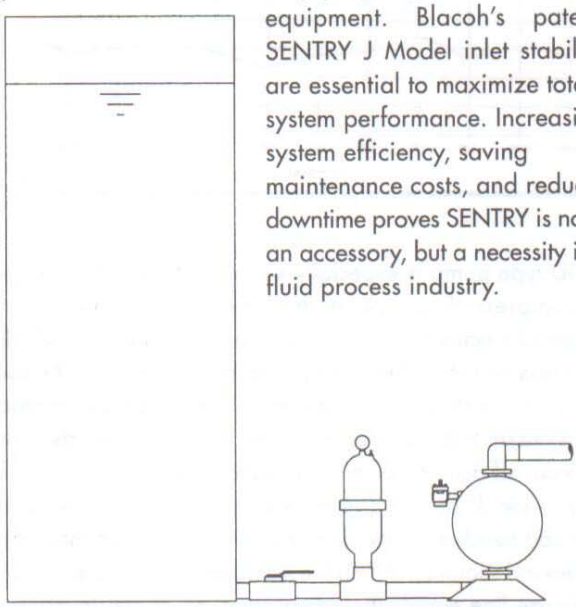
Pumping Solutions, Inc. of Ontario, California installed Blacoh SENTRY I hydro-pneumatic Inlet Stabilizer on the inlet side of the AODD. The patented SENTRY J Model is specially designed to cushion and absorb the water hammer spikes created when the pump's inlet ball valves close. In order to be effective, the inlet stabilizer was installed within 10 pipe diameters of the pump's inlet and charged to 50% of the static NPSH. Now when the inlet ball valves close, the inlet stabilizer absorbs the momentary pressure spike and accumulates the accompanying surge of liquid because the stabilizer is the lower pressure area. When the pressure spikes are cushioned, the effect of high acceleration head is diminished and the stress is removed, resulting in increased diaphragm life.

RESULT...

Instead of the previous three-week diaphragm life, the pump is now capable of operating for over one year without a diaphragm failure. This results in an entire year without spills, clean-up, repairs, maintenance, or downtime due to diaphragm failure. Since the initial installation, additional Blacoh SENTRY Inlet Stabilizer have been installed in the tank storage area.

SUMMARY...

As a pump's inlet pressure limit is approached, diaphragm life is drastically reduced. Without proper stabilization, inlet side pressure spikes are just as destructive to the pump and its components as the pump's discharge pulsations are to the piping system and in-line equipment. Blacoh's patented SENTRY J Model inlet stabilizers are essential to maximize total system performance. Increasing system efficiency, saving maintenance costs, and reducing downtime proves SENTRY is not just an accessory, but a necessity in the fluid process industry.



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