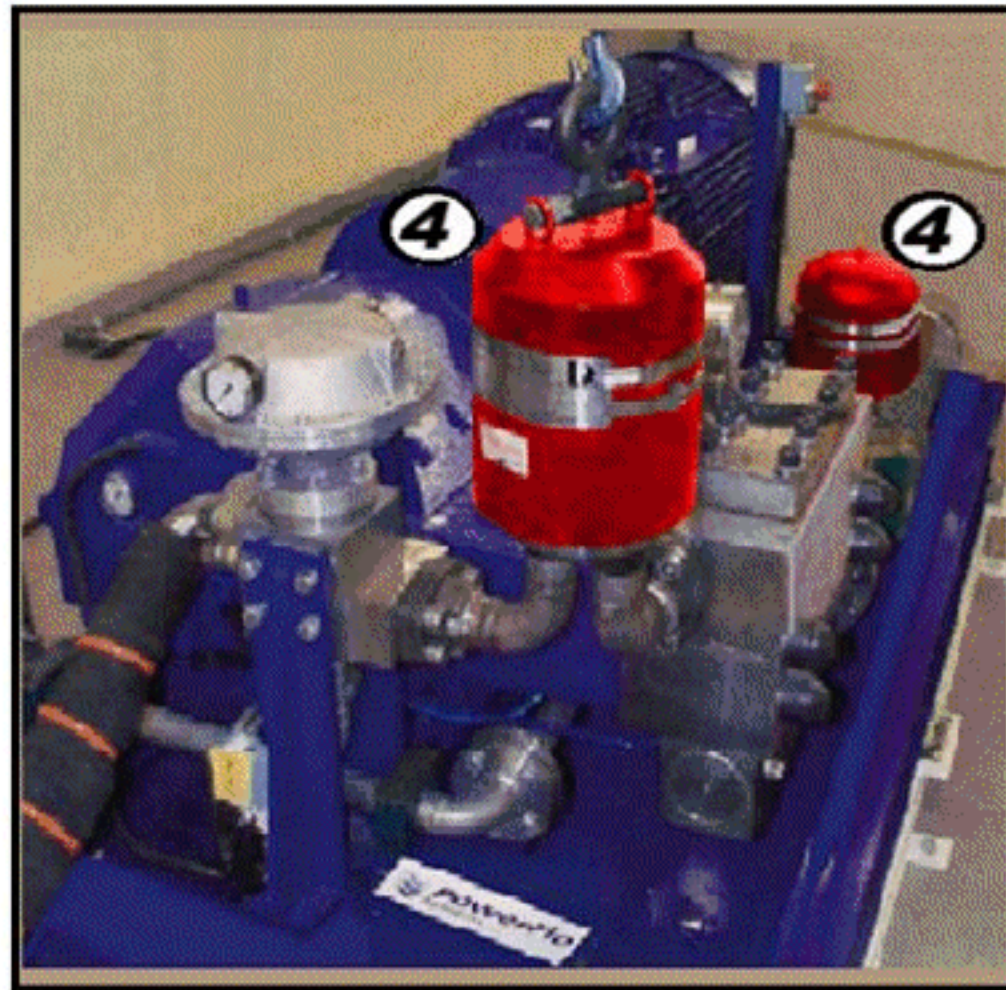


BELOW: How to ensure lowest in place cost and most performance by standard installation methods.

P23 *Halving the cost, and tripling the performance of pulsation dampening multiplex power pumps*

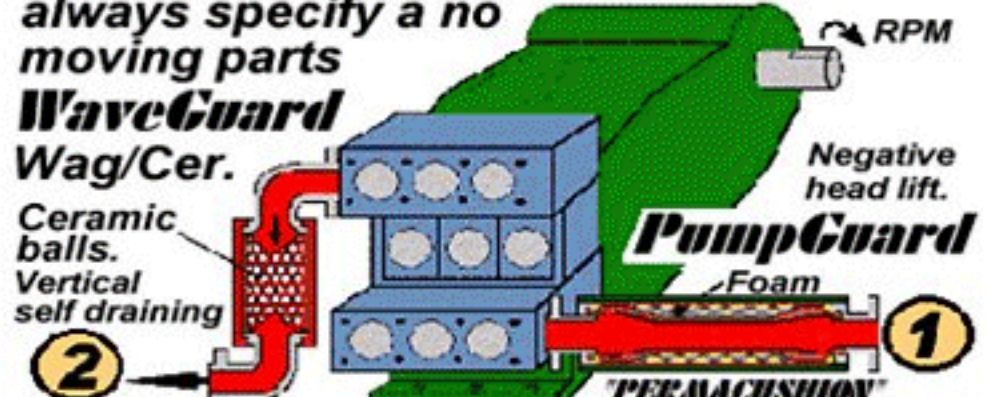
PUMPS make FLOW, SYSTEMS cause PRESSURE, pressure pulsation is a system response, AND a system responsibility NOT a pump manufacturers liability.

Triplex, Quintuplex, Septuplex "power pumps" And Pumps supplied to API 674 with PULSEGUARD® "pulsation suppression devices"

For long life of system components, Ex RO membranes and a multiplex pump always specify a no moving parts **WaveGuard** Wag/Cer.

PumpGuard Ceramic balls. Vertical self draining. Negative head lift. Foam. PERMACUSHION®



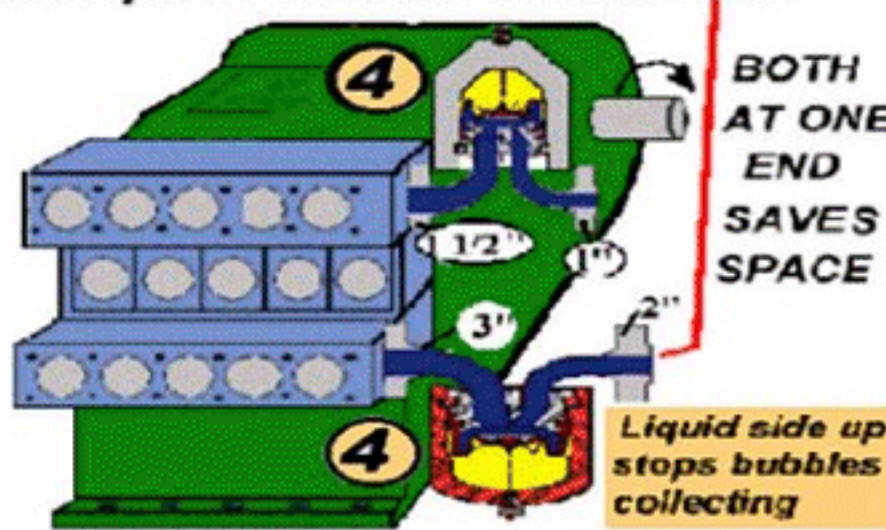
When pipe length natural shake rate = pump RPM, the result is pulsation

BEFORE Cavitation Pipe response Pipe line, high pressure response pulsation and resonance.

AFTER Suction Discharge Pump flow induced fluctuation only.

The before and after oscillograph traces were taken from a deep hole boring machine, the pumpage was cutting oil. The problem was that the pressure pulsation caused cutting tool "chatter" and showed up as bad surface finish & less than 20% life of the ceramic/carbide cutting tool tips.

Discharge pulsation often comes from poor suction conditions.



PipeHugger (4) upto 3" pipe. The ultimate in high frequency negative transient prevention stops suction side bubble generation.

PULSEGUARD IS DISSIPATED BY LARGE RATIO OF CONNECTION DIAMETER TO DAMPER DIAMETER

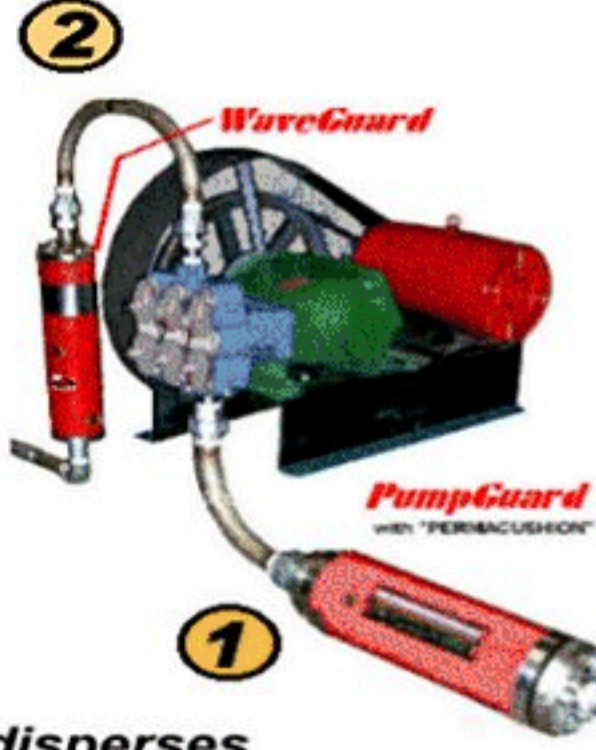
WaveGuard (2) Guards against pressure wave generation. For pipe systems 3" diameter through 12". WaveGuards have no moving parts, and no foam to clog and degrade.

PumpGuard (1) Guards against pump suction cavitation. For pipes 3" diameter through 12" diameter. PumpGuards have no N₂ (nitrogen) or air pre-fill or "pre-charge" requirement. Where ever possible use a bend with radius not less than 5 pipe diameters. "A 5 D bend"

The **WAVEGUARD** disperses pressure transients over a longer time base, and reduces their amplitude. WaveGuards are not flow fluctuation accumulators

The **PUMPGUARD** is a method of providing for pump instantaneous suction needs in large supply pipes without acceleration head loss. **

**** LOSSES OCCUR FROM ATTEMPTS TO CAUSE INSTANTANEOUS FLOW REVERSALS IN A SINGLE CONNECTION ****



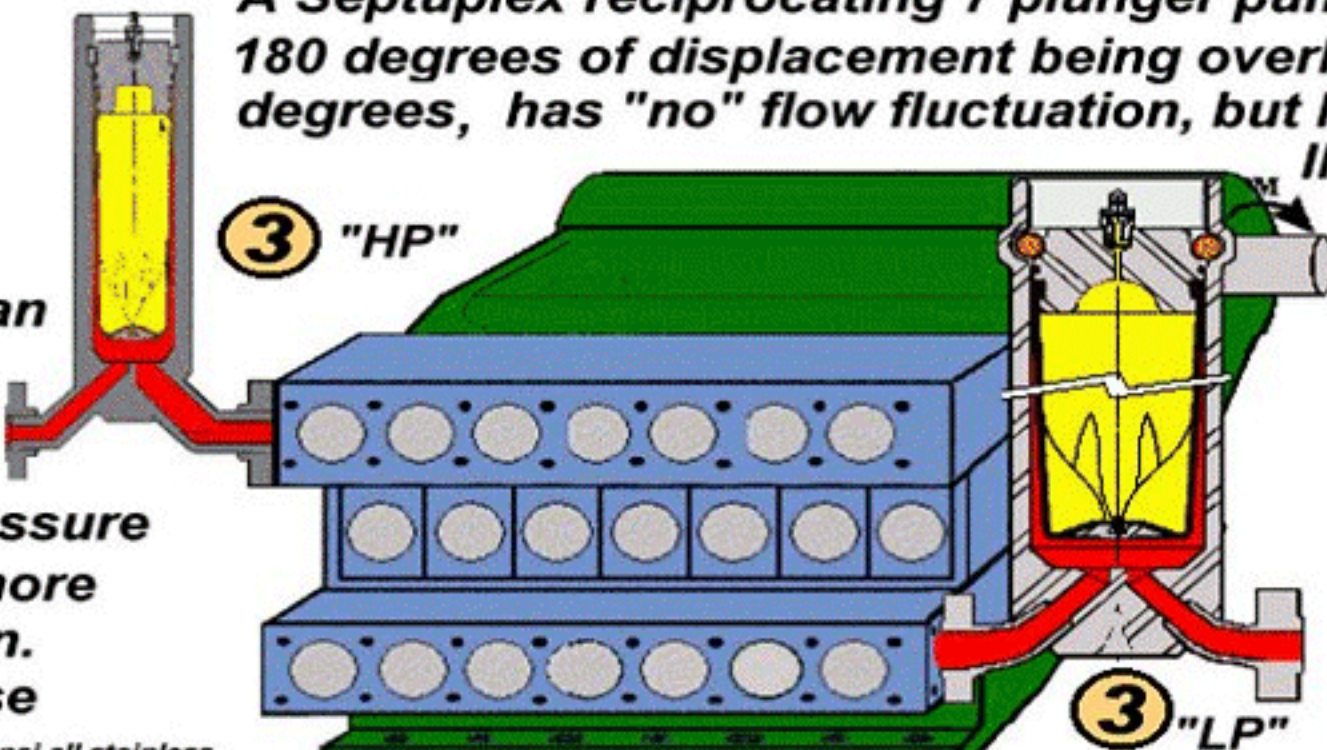
When you see a damper or a pump of particular interest, please request literature dedicated to that subject.

TALL AND SLIM PipeGuards, A LOW COST METHOD FOR EXTERNALLY CORROSIVE ENVIRONMENTS since '65

PipeGuard (3) Type- Pig/HP-TW Guards against pipeline fatigue.

* Pressure pulsation, travels through out a system at near 4000 mile per hour, say 300 faster than flow velocity. Catching pressure waves travelling faster than the fastest bullet, requires intercepting them.

PulseGuard® PIPEGUARD Pig/TW series "flow-through" dampers have intercepted pressure pulsation since 1965, and are proven 300% more efficient than copies with only one connection. And 250% better than copies with add on false flow through bottoms. Ex stock - 1/2" thru. 2.5", 500psi - 15,000psi all stainless.



A "Septuplex" reciprocating 7 plunger pump, with each 180 degrees of displacement being overlapped by 128 degrees, has "no" flow fluctuation, but lots of VALVE INTERACTION.

System response to Valve interaction is a major cause of high frequency pressure pulsation. *

* How many one connection silencer mufflers, filters, capacitors, have you seen ?

Dampers that do. Flow goes through. BUT Pressure Pulsation does not.

PULSEGUARD Inc.® Guard against Pulsation

In USA Toll Free, 1-888-DAMPERS (326-7377)
For the Americas --01(1)910-270-2737
BW & Color Fax, --01(1)910-270-0320
Color fax is 10 times faster than email attach, and there are no viruses.