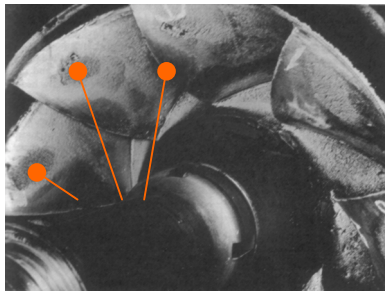
DrX Application Note

DrX	DrKnock
Subject	Simple cavitation reduction
Note Ref.	**AN270.08**

Background

A visit to a Swedish oil refinery gave an opportunity to observe some operational difficulties for starting up large sump pumps. The pumps were situated some 30m below ground with an output pipe diameter of 1m. These units are to ensure the supply of auxiliary fire system water throughout the plant.



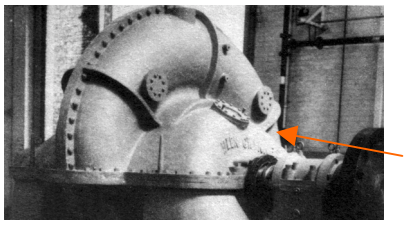
From an operational perspective significant time is spent by the maintenance department refurbishing pump rotors due to the extensive damage caused by cavitation. Cavitation occurs when a pump is running and air pockets within the liquid collapse due to pressure conditions. This implosion causes very destructive localised forces resulting in pump rotors and pipework becoming excessively eroded.

Preventative methods to date had been reliance on the maintenance engineers' 'listening' skills, and some high cost vibration analysis which was not giving clear indications and only applied to constant speed pumps.

The particular problem identified with the sump pumps was that cavitation occurred during startup. The control room manually set the target flow and there was no facility to monitor the cavitation susceptibility whilst the pump was accelerating. In this particular case the cavitation was so extreme that it was easily audible above the motor and pump noise.

Solution

Using DrKnock to detect the condition, a simple feedback mechanism is established with the control room to indicate the presence of cavitation.



The DrKnock could be fitted almost anywhere on the pump housing since the noise resulting from cavitation travels through metal well.

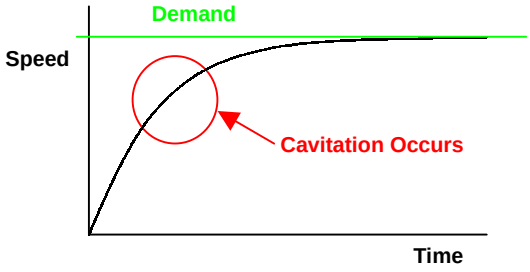
However, the best placement is as near as convenient to the output side of the pump.

The addition of this single DrKnock now informs the operator in the control room that cavitation is present or not during the pump start-up.

Original Pump control

Operator sets the flow demand and lets the pump ‘freefall’ to its desired flow rate.

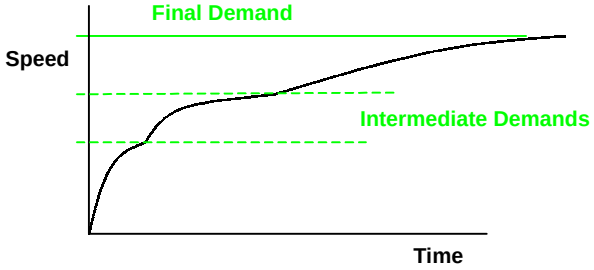
As the pump motor accelerates to respond to this demand various speeds will produce various pressure effects causing destructive cavitation.



Modified Pump control

Operator sets the flow demand and observes the cavitation indicator (the output from DrKnock). If cavitation occurs the demand is decreased a little and the final demand is achieved more gradually.

In effect this is a soft-start mechanism with human control.



The result is much lower cavitation occurrence, lower maintenance costs, improved equipment lifetime, reduction in metal debris in process fluid, more efficient energy management.