



## The Pump Detective

By Doug Kriebel

Hot Oil Pump not making capacity.....we were called with complaint that a new pump was installed but not meeting performance.

Upon visiting the site we found the pump had replaced an old pump.

The system consisted of the pump which took suction from a shell and tube heat exchanger which was fed from an oil storage tank. 5 psig steam was used to heat the oil to a higher temperature to feed a reactor. The oil Sp.g = 0.86

The factory performance test shown in black was not being met, but rather a reduced performance shown in red.

We checked the usual suspects. The NPSHa was more than sufficient since the lubricating oil has a very low vapor pressure (less than 1' water), even at the 5 psig (228 degF) temperature. There was no lift involved, in fact a 10' positive head, and friction drop, including across the heat exchanger was only 5 psi...

$$\text{NPSHa} = \text{Atmospheric} + \text{elevation} - \text{friction} - \text{VP} = 34' + 10' - 5 \text{ psi} \times 2.31 / .86 - 0.1' = 30.5'$$

The pump NPSHr = 12'

We checked rotation, speed and took the pump apart to check impeller diameter....nothing.

Finally the process engineer opened a drain in the suction pipe to the pump...and out came foaming liquid.

Inspection determined the heat exchanger had a tube leak and condensate (water) was getting into the oil being pumped. The VP of the water at 228 deg F is 5 psig (45')....even a small amount of water would be enough to decrease the NPSHa below the NPSHr and cause the pump to cavitate.

This was the cause for the loss in capacity. It was interesting to note that the pump didn't have any other symptoms of cavitation: No vibration or noise.

