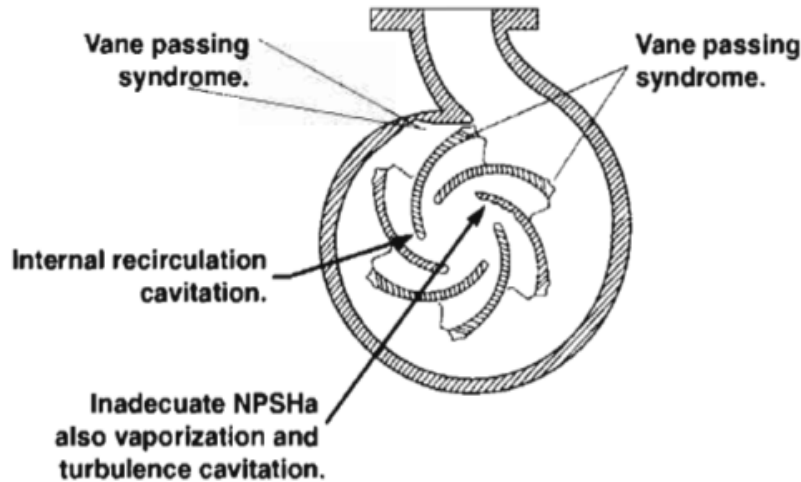


# CAVITATION IN CENTRIFUGAL PUMPS



## Pump Cavitation Definition

Pump cavitation is the formation and subsequent collapse or implosion of vapor bubbles in a pump. It occurs when gas bubbles are formed in the pump due to drop in absolute pressure of the liquid below vapor pressure. These gas bubbles occupy space inside the pump and affect the pump's operating pressure and flow. With vapor bubbles in the low-pressure zones of the pump, the motor's energy is wasted expanding the bubbles instead of bringing more liquid into the pump. As the bubbles pass into the pump's high-pressure zones, the motor's energy is wasted compressing the bubbles instead of expelling the liquid from the pump. The bubbles can collapse as they pass from low- to high-pressure zones in the pump. When vapor bubbles collapse inside the pump the liquid strikes the metal parts at the speed of sound. The noise generated from these collisions of gas bubbles into the metal parts of pump sounds like pumping marbles and stones.

## Causes of Pump Cavitation

- Drop in pressure at the suction nozzle due to low NPSHa. If the fluid at pump suction is not available sufficiently above the vapor pressure of liquid at operating conditions, then vaporization of liquid and formation of gas bubbles is very likely, leading to cavitation.
- Increase of the temperature of the pumped liquid Increase in liquid temperature at the pump suction point increases the vapor pressure of the liquid. Thus it becomes more likely for operating pressure to fall below this vapor pressure limit, hence leading to bubbles and cavitation.
- Increase in the fluid velocity at pump suction. Increase in fluid velocity at pump suction can typically be caused by higher liquid flowrates than the design case. As per Bernoulli's principle, higher liquid velocity means higher velocity and lower pressure head. Frictional pressure drop in the pump suction also rises with rise in the flowrate, making low pressure and cavitation at pump suction more likely to occur.

- Reduction of the flow at pump suction. Certain minimum flow is required by the centrifugal pumps to keep them from running dry, as indicated by the pump performance curves. If liquid flow falls below this limit, possibility of developing vapor in pumps and cavitation increases.
- Undesirable flow conditions caused by obstructions or sharp elbows in the suction piping. Sharp elbows, valves, other fittings and obstructions cause more frictional pressure loss in the pump suction, thus increasing possibility of low pump suction pressure leading to cavitation.
- The pump is not selected correctly. Every centrifugal pump has a certain requirement of positive suction head (NPSHr). If the pump is not selected properly NPSHa might fall below this NPSHr limit, causing cavitation.