

CAVITATION IN LIQUID RING VACUUM PUMPS

What Is It?

Cavitation is defined as the erosion of pump parts caused by the formation and sudden collapse of vapor bubbles in a liquid. During the compression cycle, these bubbles will implode creating a void that is rapidly filled with liquid. This action results in forces approximately equivalent to 30,000 PSI of pressure acting on the metallic surface. **The implosion of water vapor bubbles on a rigid surface causes a pitting erosion of the metallic surface. In a liquid ring pump, the damage is typically noticed on the leading face of the impeller vanes (close to the hub) and on the port plates (close to the ports).**

What Is the Cause?

In a liquid ring pump, cavitation is a result of excessive amounts of condensable vapors. There must be a minimum percentage of non-condensables pumped in order to prevent the occurrence of cavitation. This minimum amount varies with the pump size and various other interrelated factors including the seal liquid vapor pressure (which is dependent on temperature), the pump suction pressure, seal liquid flow rate, and the pump physical characteristics.

When Will It Occur?

Cavitation in a liquid ring pump can occur for the following reasons:

- 1) If the suction pressure approaches the vapor pressure of the seal liquid at its operating temperature, flashing of the liquid occurs resulting in the formation of vapor bubbles in the rotor chambers. Subsequent compression of these vapor bubbles results in cavitation.
- 2) If the service liquid supply temperature is too high, the vapor pressure may be too close to the operating pressure, again resulting in an excessive amount of vapor which implodes during the compression cycle and causes cavitation.



DID YOU KNOW?

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CAVITATION IN LIQUID RING VACUUM PUMPS (continued)

- 3) If there is insufficient service liquid flow into the pump, there is less liquid to transfer the heat of compression, hence, the temperature rise increases. This can cause the vapor pressure of the liquid to approach the absolute operating pressure and boiling can occur. Subsequent compression of these vapor bubbles results in cavitation.
- 4) If pumping excessive amounts of condensable vapors, the pressure in the pump will drop excessively due to condensation of the vapor and the low partial pressure of gas. The pressure in the impeller cells can drop to a point that is dangerously close to the vapor pressure of the service liquid resulting in flashing of the liquid and cavitation from compression of too much vapor.
- 5) If there is too high a seal liquid flow, the pump casing can become flooded and therefore cannot get any non-condensable gas.



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