How to Control Liquid Ring Vacuum Pumps

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Liquid ring vacuum pumps are versatile machines because they can handle “wet” loads and can operate down to around 1” HgA. They require proper operation and monitoring, however. This article will address several monitoring and troubleshooting situations involving liquid ring vacuum pumps (Figure 1).

A check valve will prevent a backflow of gases at start-up or shut-down of the system. When choosing a check valve, a low pressure drop type should be considered to minimize pressure loss in the system. A butterfly style check valve normally has the lowest pressure drop.

Typically for pressures of 100 mmHgA and less, some sort of anti-cavitation or suction pressure control is needed. The simplest type is a manual bleed valve such as a globe valve. If automatic opening and closing is required, then an inexpensive spring operated diaphragm valve can be used. In this design, the suction pressure opposes the spring. When the vacuum in the sensing line

Sight flow indicators or rotameters can also be used for visual assurance of flow. The rotameter can be used to regulate flow and indicate the quantity of flow. (Note that on recirculated systems without a recirculation pump, a rotameter should not be used due to the pressure drop associated with it.)

A seal liquid cooler (heat exchanger) is needed to remove the heat of compression, friction and condensation. Different types of exchangers can be used.

For example, plate and frame heat exchangers are economical and best suited for the close temperature approach required; shell and tubes are the conventional heat exchanger; and a coiled heat exchanger is compact, saves space and has better heat transfer characteristics vs. a shell and tube style.

If a liquid cooled heat exchanger is not possible, then an air cooled model can be considered.

The temperature of the seal fluid directly affects the vacuum at which the pump can operate. A good troubleshooting device to have installed on the system is a bi-metal thermometer. This will indicate the temperature of the seal fluid so it can be compared to design. If remote monitoring or shutdown is required, then a temperature transmitter, RTD or thermocouple can be installed.

Liquid ring pumps require a shaft seal flush. Packing glands, single mechanical seals and double mechanical seals all require a clean source of flush fluid to cool and lubricate the shaft seals. For packing glands, the flush fluid enters the stuffing box and is dispersed across the glands. The packing will have some dripping associated with it, which means it is being properly lubricated and cooled. For single mechanical seals, the flush fluid lubricates and cools the seal faces, and on many liquid ring pumps, the flush