REFRIGERATION REVIEW

Recirculated Vessel Design

Time has proven that the use of vertical vessels is far more reliable than horizontal vessels, especially in recirculated systems. Simply said, a vertical vessel's ability to separate gas from liquid doesn't decrease as the vessel fills with liquid. The same is not true with horizontal vessels. As they fill, the separation velocity increases at a time when it has become critical.

In addition, pump suctions should be mindful of pump inlet size, where an eccentric reducer should be used with the flat of the reducer on top. Also, if the suction to the pump can have a slope up toward the valve so any gas bubbles can flow up away from the pump, and the pump suction stop valve as a globe valve be placed in the vertical part of the pump suction, cavitation can be minimized. More on pumps coming in a future issue of Refrigeration Review.

While there are no "right" or "wrong" ways to design vessels, there are some features that contribute to the reliability and functionality of a recirculating vessel. While the primary purpose is to separate liquid from gas, other thermodynamic functions are achieved. The use of recirculated liquid, liquid that has already been flashed to its evaporative temperature, permits air units to operate more efficiently because now the air unit doesn't waste coil surface in the flashing of liquid to gas. Normally, a direct expansion (DX) coil will lose 30% of its coil capacity in flashing of liquid before it provides its refrigerating effect.

Often overlooked is the importance of the location of the supply liquid to the recirculating vessel. The inlet of the liquid should always be placed above the liquid level. Pipe and valve failures have been observed from collapsing vapor locks in liquid supply lines located below the liquid level.

Another important aspect of the vessel is the size diameter which permits gas velocities to be decreased in the order of 150 feet per minute, so liquid and gas can be separated. A more accurate way to determine velocity is by the function of the vapor droplet size, which in turn is a function of the operating pressure. There are tables which depict velocity as a function of the saturated pressure of the vessel.

Another additional feature which facilitates in maintaining liquid on the recirculating pump suctions is the use of a solid square baffle plate placed just above the pumps' suction inlets. With the pump suction inlets placed at 45° just below the center of the square baffle plate, vortexing can be eliminated and the inlets protected against bubbles forming from liquid cascading out of the return suction line to the recirculator. This, coupled with the use of over-sized pump suctions (normally 4") and the use of centrifugal pumps with a low NPSH (anywhere from 1 to 1.5 feet of head), can provide extremely reliable service without getting pump cavitation under most operating conditions.

We will discuss the multiple uses of vessels and system design, such as liquid subcooling coils and desuperheater combination intercooler vessels in an upcoming issue.

Something to note: pressures in the recirculators can vary from time to time from defrost as well as liquid feed valves opening and closing.

Publix Super Markets -- Lakeland, FL

Wiscold -- New Rochelle, WI

Publix Super Markets -- New Vertical Vessel Being Installed

Spartan Foods -- Grand Rapids, MI

New Orleans Cold Storage -- New Orleans, LA

Sara Lee/Hillshire Farms -- New London, WI

Poultry Plant -- Collins, MS

Coors Brewery -- Elkton, VA

Poultry Plant -- Brazos County, TX

Minimum Charge Vessels

Publix Super Markets -- Jacksonville, FL