REFRIGERATION REVIEW

Surge Drums -- The Achilles Heel of Ammonia Refrigeration

Before the advent of reliable ammonia circulating pumps, surge drums were widely used as a means of moving high pressure liquid to an evaporator, air unit, or heat exchanger. The hazards of surge drums became well-known, in that sooner or later the operating level device would fail and the surge drum would fill up with liquid, and then all hell would break loose. That being the decrease in the suction pressure that would cause the surge drum to "percolate", not unlike a coffee percolator, with many violent and catastrophic results.

I have talked about critical flow pressure in a previous article (here), and that occurs when pressure downstream is half the pressure upstream, creating sonic velocities in the gas and/or liquid in front of the gas -- therein, the hazard of hydraulic thermal shock.

I still see some designers falling back and relying totally on surge drums to protect suction refrigerant lines. While the failures are well known, the one that sticks out most in my mind was when I was called in to go to Elsa, TX, to document what had happened in a large ice plant. This occurred in the late 70s or early 80s, in which an operator was starting up a brine tank used to produce block ice. His startup procedure was supposedly simple: he would turn on one 7x7 HDI compressor, slowly pull the suction down, and as the pipe started to rumble he would manually start closing the suction valve. On this occasion, he didn't start closing that valve soon enough, and the liquid slug got all the way to the compressor, not only lifting the safety heads, but lifting the head completely off the compressor and blowing ammonia into the face of the operator, who lived but was permanently blinded thereafter.

Even into the 80s and 90s, I run across engineers who promote the use of surge drums, and I have been in awe over the years of lessons unlearned, creating possible hazardous conditions. Typical horizontal surge drums used for evaporators are their own worst enemy in that, as they fill up, the sectional area for gas separation is

decreased. The same analysis applies to horizontal recirculators still used by some designers, and unless a horizontal separator is grossly over-sized, you are just waiting for it to fill up beyond its capacity to separate liquid and gas. Where traditionally designers will establish operating levels about 1/3 up the surge drum, we will always, in the shop drawing review, decrease the height to 2" to 3" from the bottom of the surge drum, and in addition have the surge drum suction also pass through a much larger recirculator vessel as its final protection.

Design safety -- if at all possible, eliminate surge drums and if necessary, pass them through a final vertical recirculator.

Attached is a picture of what happens when liquid cannonballs have no place to go.