Liquid Pumping And The Pressure Enthalpy Chart

The enthalpy chart shown is for the typical cycle. Line AB represents loss of of pressure or expanding refrigerant The point of expansion is at point A. The expansion valve can be at any point along line A-B, depending on losses prior to the expansion valve.

For the expansion valve to perform properly it must have solid liquid at the entrance to the valve. Therefore, the preferred location for the valve would be at the intersection of line A-B and the saturation curve or into the subcooled portion of the diagram.

At point A, the pressure of the liquid is lifted with the use of a refrigerant pump by 10 to 12 lbs. The liquid refrigerant would be elevated to point A'. This represents an increase in pressure without an increase in temperature. The refrigerant at point A' is in a subcooled state.

Notice that the normal head pressure system and in the LPA system with floating head pressure the refrigerant is always in a subcooled state at point A'.

The liquid pressure drop and needed flow rate is calculated for the system to assure that the liquid refrigerant will arrive at the expansion valve at a point between the point A' and point A. These calculations determine the pump size Therefore, vapor free liquid will always be supplied to the expansion valve at the lowest head pressure we are able to achieve.

The conventional expansion valve will operate at capacity with a 30 lb. pressure drop across the orifice. The data supplied by Sporlan are for valves at 85% full stroke. Correction factors for lower liquid temperatures are supplied on the Sporlan valve charts.

Ambient subcooling is not free if we are floating the head. The dotted line from D' to A' indicates the increase in head pressure needed to arrive at point A'. The work of the compressor to provide 7 degrees of subcooling equals .169 hp per ton. The work of the liquid pump requires .008 hp per ton.