The Dual Valve System ORI / ORD

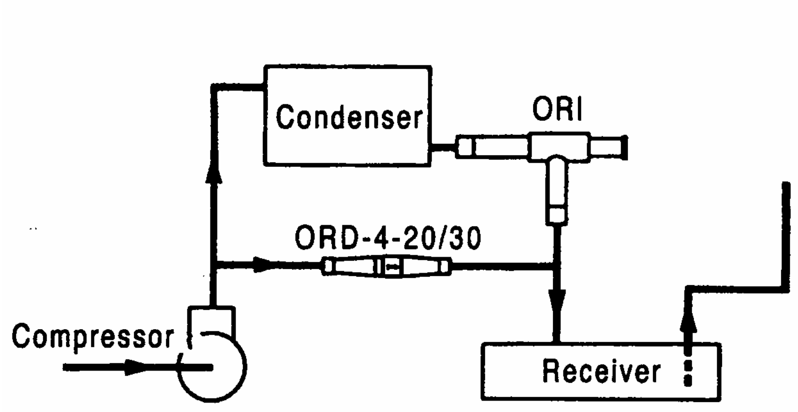

Figure 2. The Dual Valve System ORI / ORD

The Dual Valve System uses an **O**pen on **R**ise of **I**nlet Pressure Valve (ORI) and an **O**pen on **R**ise of **D**ifferential Pressure Valve (ORD). The ORI is a field adjustable pressure regulator. The inlet of the ORI Valve is installed at the liquid outlet of the condenser and the outlet of the valve is piped to the inlet of the receiver as detailed in Figure 2.

If the condenser pressure is above the ORI Valve's set point the valve will open allowing refrigerant flow to the receiver. If the condenser pressure falls below the valve's field adjustable pressure setting the valve will close raising the liquid level of the condenser thereby reducing the available condensing capacity causing a rise in condenser pressure. As the condenser pressure reaches the valve's set point the valve will modulate allowing refrigerant to pass through the valve maintaining a constant minimum condenser pressure during low ambient conditions.

The ORD is a fixed Spring Check Differential Valve meaning it allows refrigerant flow in only one direction and only when the refrigerant pressure is higher at the valve inlet than the outlet of the valve. The direction of flow is defined either by an arrow indicating direction of flow or a dot or band impressed at the valve outlet. Typically, the differential is fixed between 20 to 30 PSI depending on system design and the refrigerant used. Most Heatcraft applications use a 20-PSI differential.

The ORD valve is located between the compressor discharge line and the outlet of the ORI upstream of the receiver inlet as shown in Figure 2 above. The ORD works in tandem with the ORI. As the ORI modulates to maintain a constant and stable condenser pressure at the valve's field adjustable set point the differential pressure between the compressor discharge line and the outlet of the ORI increases in proportion to condenser pressure. If the differential pressure exceeds the fixed set point of the ORD hot gas is allowed to flow through the ORD into the inlet of the receiver. If the ODI is set to maintain 200 PSI condenser pressure (lowest expected design liquid pressure 180 PSI plus the fixed differential pressure of the ORD 20 PSI or 180 + 20 = 200) the ORD will allow superheated hot gas flow to maintain 180 PSI pressure upon the liquid level of the receiver.

If the condenser is not equipped with a separate liquid sub cooling circuit the effects of liquid sub cooling outside the minimum design operating range (minimum design liquid pressure and temperature) of the nozzle and expansion valve due to the flooded condenser conditions are negated by the injection of superheated hot gas into the receiver.

If the liquid line is properly insulated from the receiver outlet to the inlet of the expansion valve the liquid temperature can easily be maintained within the minimum design operating range (minimum design liquid pressure and temperature) of the expansion valve and nozzle during low ambient conditions.

If the condenser is equipped with a liquid sub cooling circuit the nozzle and expansion valve's minimum design operating range must be looked at very closely to ensure they not only fall within the minimum design operating range using the lowest expected liquid temperature which is typically equal to the winter design temperature for the locality but also the maximum summer time expected liquid temperature which is typically equal to the summer design temperature for the locality.

If the winter and summer design temperature differential is so wide that a nozzle and expansion valve cannot be selected to operate effectively and efficiently without starving the system in the summer or operating below the design operating range in the winter the minimum expected liquid temperature can be raised by either electing to delete the liquid sub cooler altogether or bypassing it during low ambient conditions in order to prevent the liquid temperature to fall be low the minimum design temperature yet still receive the capacity and energy saving benefits of liquid sub cooling during milder ambient conditions. **(See Technical Topic titled Refrigerant Distribution to learn more about the effects of liquid sub cooling)** Sub cooling circuits will be covered in more detail in the next section.

Liquid pressure is equally as important as liquid temperature. If the ORI is adjusted well above or below the lowest design minimum condensing temperature converted to pressure using the pressure, temperature relationship for the specific refrigerant used to select the nozzle and expansion valve both will be operating outside their respective operating curves.

Although both may operate effectively at a higher pressure setting which converts to a higher condensing temperature you must ask if the system is operating efficiently from a KW Per Ton Of Refrigeration point of view. The answer is no.

Conversely, if the ORI is adjusted below the minimum design condensing temperature used to select the expansion valve and nozzle both may be oversized for the resulting liquid pressure and temperature drastically affecting evaporator refrigerant distribution and evaporator performance.

Operating a system above the minimum condensing temperature for which the nozzle and expansion valve were selected not only can reduce overall system capacity it will also cause the system to consume more energy per ton of refrigeration effect. This means the correct ORI setting is the minimum condensing temperature converted to pressure used to select the nozzle and expansion valve plus the differential pressure of the ORD. **<u>This pressure setting is not factory set.</u>**

Unlike the Single Valve System the Dual Valve System is not refrigerant specific. An advantage over the Single Valve System is the Dual Valve System can easily handle the high flow rate requirements of large capacity equipment.

The disadvantages with the exception of flow capacity are the same. Charging methods remain the same with the exception that the minimum expected condensing temperature converted to pressure must be field adjusted preferably during low ambient conditions.