The Flooded Condenser using a Headmaster

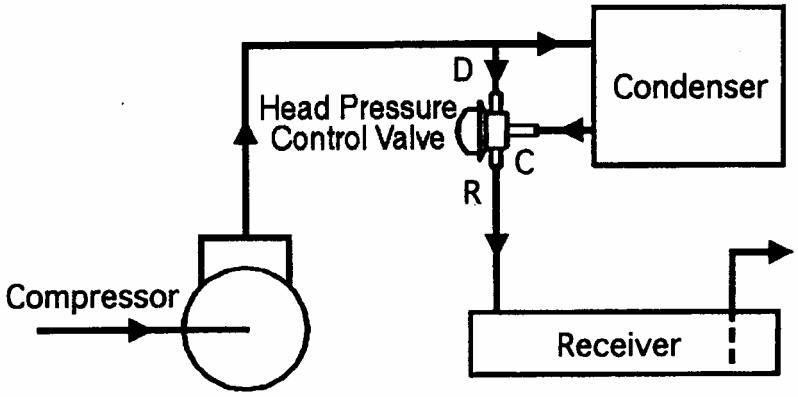


**Figure 1. Single Valve Flooded System**

Under low ambient conditions the condenser surface is reduced by flooding the condenser with excess refrigerant. The excess refrigerant is stored in the receiver when not required in the condenser.

Figure 1 shows a Single Valve Flooded System. The standard valve used by Heatcraft is nonadjustable and fixed at 180 PSI except Scroll Compressor applications, which are fixed at 100 PSI. When 100-PSI Valves are used be sure to select the appropriate valve and nozzle for this lower expected head pressure.

At condensing pressures above the valve setting, flow enters Port C and exits Port R. When the condensing pressure falls below the valve setting, the valve modulates to permit discharge gas flow through Port D. As the Three Way Valve opens Port D, Port C closes proportionately. The receiver pressure is maintained at the valve pressure setting by injecting hot gas pressure upon the liquid level in the receiver. The reduced opening at Port C restricts liquid refrigerant flow so that the liquid level in the condenser rises. The valve modulates maintaining a constant pressure in the receiver at the valve setting and sufficient liquid in the condenser to maintain that pressure.

If the equipment is equipped with only one condenser fan that fan runs continuously. If the condenser fan is equipped with multiple fans the fan closest to the condenser inlet header should run continuously and the remaining fans can be turned off using an ambient thermostat or a pressure control.

The nozzle and expansion valve should be sized to provide even refrigerant distribution at the minimum expected condensing temperature converted to pressure, which is equal to the valve's nonadjustable factory pressure setting and the maximum condensing temperature typically 105F. The maximum condensing temperature is based on the unit's condenser design upper operating limit. Condensers are typically designed to have the capacity to reject the total heat of rejection up to 105F condensing without loss of rated catalog capacity.

The advantages over this method of head pressure control compared to Pressure Fan Cycling are as follows:

1. A constant and stable minimum head pressure (180 PSI except Scroll Compressor which run at 100 PSI) placed upon the surface of the liquid level of the receiver prevents the loss of efficiency experienced with pressure fan cycling due to expansion valve hunting.

2. Since the condenser is flooded during operation below the valve pressure setting liquid sub cooling is increased however hot gas is injected directly into the vapor side of the receiver warming the liquid in the receiver. If the condenser is not equipped with a separate liquid sub cooling circuit and 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.

The disadvantages are as follows:

**1.** The winter refrigerant charge must be either calculated or the winter charge must be topped off during low ambient conditions. Typically, the system can be charged to a clear sight glass under normal ambient conditions. Weight the charge and add an additional 15% of refrigerant by weight. This winter charge should be sufficient to allow operation down to approximately 0F. If a 30% additional refrigerant charge by weight is added the winter charge should be sufficient to allow operation down to –20F however be sure the receiver capacity is large enough to store the winter charge during summer operation and allow for a pump down without exceeding the receivers 90% capacity. An optional oversized receiver may be required. A second charging method is to weight in no more than 90% of the receiver capacity. **These charging methods should not be used when the liquid line solenoid valve is installed at the condensing unit. Use caution. A system should never be charged to levels that exceed 90% receiver capacity.**

**2.** The valve's pressure setting is not field adjustable.

**3.** The Single Valve System is limited to low horsepower equipment due to the low flow capacity of the valve. Larger units may require an additional valve piped in parallel to achieve the required flow capacity. Cost and space limitation may now become a factor.