Condenser Splitting/Head Pressure Controls

A properly sized condenser will operate efficiently during warm and hot months with a standard refrigerant charge. However, a majority of units are required to operate at ambient temperatures below their design dry bulb temperature for most of the year. To eliminate iced evaporator coils or insufficient refrigerant at the evaporator during cooler months, condenser splitting, fan cycling, or condenser flooding is recommended to improve the efficiency of your condenser. The information below will help you in the design of your condenser so it will run efficiently all year.

Condenser Splitting Controls

Decreases in ambient temperature create excessive capacity for air cooled condensers. Increased condenser capacity causes inefficient system operation, which can increase energy costs. LRC offers Air Cooled Condensers with splitting controls, which can valve off a section of the condenser circuit during cooler seasons to ensure peak operating efficiencies. Condenser splitting increases head pressure by removing a portion of the condenser circuit and reducing the amount of refrigerant flowing through the condenser.

Condensers with a single row of fans are available with a control package consisting of an ambient sensing thermostat, a condensing pressure sensor switch, and a splitting relay. The splitting relay provides a set of dry contacts to control the valve(s) required to split the condenser (valve supplied by others). A pressure switch is also provided as a backup to prevent high head pressures during heavy load conditions.

Condensers with double rows of fans have additional controls and contactors to cycle the fans on the side of the condenser which has been split off. Unless requested, LRC's standard splitting configurations don't include fan cycling, however, custom systems are available to meet the needs of your project. Combining condenser splitting and pressure fan cycling is a good way to control head pressure.

Fan Cycling Head Pressure Controls

LRC's Condensers can be designed to cycle fans based on ambient air temperature or condensing pressure. Custom control panels can also be built to cycle fans based on electronic refrigeration controllers. Fan Cycling Condensers with a single row of fans will have a thermostat on each fan, so fans can cycle separately. Condensers with two rows of fans use one thermostat for 2 fans to cycle the fans in pairs. Fan(s) closest to the header run continuously and do not cycle. Control circuits are factory wired to a single control box for convenient field wiring and require an external power supply.

Ambient Fan Cycling

Electronic thermostats mounted near each fan to cycle fans on and off at preset temperature settings. Ambient fan cycling is recommended for multi-circuited condensers or single circuit condensers where there is very little variation in condenser load. In areas of mild ambient fluctuations, ambient fan cycling can be used to control head pressure. Combing ambient fan cycling with variable fan speed controls and/or condenser flooding can reduce the amount of refrigerant required to flood the condenser.

Pressure Fan Cycling

Pressure fan cycling is recommended for condensers which see a significant change in condenser load. Pressure switches, installed to monitor condenser pressure, will sense increased condensing pressure and will cycle fans to reduce condenser pressure at any ambient temperature. An optional pressure switch is available to cycle the fan(s) closest to the header. This option is recommended only for condensers with large variations in condenser load caused by heat reclaim, hot gas defrost or a high percentage of compressor unloading.

Variable Speed Controls

Variable speed controls adjust air delivery in direct proportion to the heat rejection requirements, allowing systems to perform efficiently in very low ambient temperatures. Variable speed controls electronically monitors head pressure, and varies fan speeds by altering fan motor voltage to maintain a satisfactory head pressure. Single or double sensing units can be ordered, with dual units monitoring the input with the greatest demand. Variable speed controls are designed to replace on/off fan cycling controls, multiple speed motors, temperature fan speed controls, and modulating louver

Condenser Splitting/Head Pressure Controls *(continued)*

systems. Variable speed controls can be used in conjunction with condenser flooding, for additional head pressure controls.

Flooded Condenser Head Pressure Controls

During cooler months, many units operate at ambient temperatures below their design dry bulb temperature. This can produce low suction pressure or refrigerant migration to the condenser, resulting in insufficient evaporator pressure which can cause the condenser to cycle inefficiently or not start at all. In areas with large ambient temperature fluctuations, condenser flooding is recommended to ensure the proper flow of refrigerant throughout the unit.

During summer conditions, the liquid side of condenser pressure valves are open, and the hot gas side of the valve is closed so there is no interference with the operation of the condenser. Under reduced loads and/or reduced ambient temperatures, the liquid side valve remains closed on start up, causing the condenser to flood. This reduces the effective surface area of the condenser, allowing the condenser to increase pressure quickly. Condenser flooding continues until the condenser pressure reaches the valve pressure setting. The gas side valve is open at start up, allowing a portion of the hot discharge gas to flow into the receiver. This prevents compressor short cycling as the high pressure needed for proper valve operation is maintained in the receiver. When the condenser reaches the desired pressure, the valve modulates to maintain adequate high side pressure regardless of the ambient temperature.

Selecting Valves

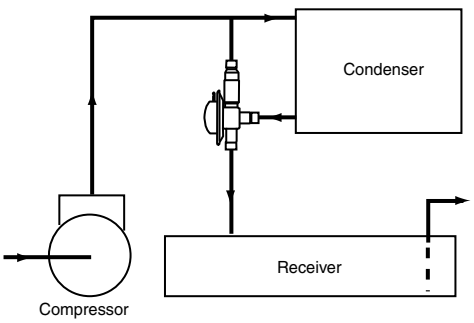
Valve ratings are based on net refrigerating tons at the evaporator, as refrigerants have varying pressure/temperature characteristics and require different flow rates to produce set refrigeration tonnages. PSIG settings are based on the type of refrigerant used in the condenser. Proper sizing of the valves is very important. Contact LRC's Application Engineers at 562-944-1969, and we will help you determine the proper valves needed for your project.

Flood Control Valve Installation

Figure 1 shows a standard control valve installed to regulate condenser flooding. Since the valve is tightly seated, an auxiliary check valve between the receiver and condenser drain line is not needed under normal circumstances. Migration can occur if the receiver pressure increases above the valve setting, which is possible if receiver's ambient temperature is at or above 90° F and the condenser is in a lower ambient.

Figure 1

Standard Control Valve Installation



For optimum head pressure control, the receiver should be located on the same level or below the condenser. If the receiver is installed above the condenser, an additional pressure drop will exist across the condenser coil and the control valve because of the lift between the condenser and receiver. The additional pressure must be accounted for when selecting the pressure control valve, to keep the total pressure drop across the condenser, liquid lift, and the control valve below 14 psi.

Depending on the installation, 2 to 10 valves may be required. When flood control valves are used, proper receiver selection is crucial. Receiver pump-down capacity should be 10% to 15% greater than the total refrigerant charge, including the additional refrigerant needed to flood the condenser. Indoor receivers should be located in a warm area, and outdoor receivers should be maintained at 60° to 65°, using proper insulation and/or heating controls. Such heater(s) should be wired in parallel with the compressor crankshaft heater so they are working only during the compressor off-cycle.

For assistance in designing a Split Condenser/Fan Cycling/Head Pressure Control unit, or if you have any questions designing or installing a condenser system, call LRC's Application Engineers at 562-944-1969, and we'll be happy to provide you with the information you need.