

Specific Requirements for Extreme Low Ambient Conditions

The Low Ambient Kit and Heated, Insulated Receivers

Operating a refrigeration system under extreme low ambient conditions requires a more aggressive approach in order to maintain the minimum design condensing temperature and receiver pressure for an effective compressor start.

A condenser and receiver exposed to these low ambient conditions will suffer the effects of ambient sub cooling resulting in condenser and receiver pressures corresponding to the equivalent pressure corresponding to the ambient temperature.

In other words, a system using R- 404A for example, if the ambient temperature is -20F the resulting receiver pressure after a short off cycle will drop to its corresponding pressure, temperature relationship in this case 17.1 PSI. On a subsequent call for cooling the receiver pressure will be too low to feed the expansion valve resulting in short cycling on low pressure which may eventually lead to an oil failure trip requiring a manual reset.

In order to overcome this an optional Low Ambient Kit is installed on the unit. This consists of a Single Valve or ORI / ORD Head Pressure Control and a Time Delay Relay wired to delay on break across the low-pressure switch in order to prevent short cycling. Typically this timer is set to delay break across the low-pressure switch for one to two minutes. Once the timer times out the low pressure switch is released to act independently. The coil of the timer is wired across the room thermostat and the liquid line solenoid.

Heaters are installed on the receiver and the receiver is insulated in order to maintain a minimum receiver pressure. An outdoor ambient thermostat initiates the receiver heaters.

The entire liquid line must be well-insulated from the outlet of the receiver to the inlet of the expansion valve in order to conserve valuable liquid temperature so that the liquid pressure and temperature remains within the minimum design limits of the expansion valve and nozzle. **A suction accumulator is highly recommended** to protect the compressor from liquid slugging especially at start up when the liquid in the liquid line is at or near ambient temperature.

In order to prevent refrigerant migration from the receiver to the condenser a check valve is installed between the outlet of the condenser and the inlet of the receiver permitting flow to the receiver only.

Particular attention must be paid to the condenser circuiting. Typically condensers are designed to have the ability to reject 100% of the total heat of rejection in accordance to the compressor-operating curve at 95F ambient and 105F condensing. If a liquid sub cooling circuit is provided an additional 10% of the total surface area is partitioned for liquid sub cooling. Under extreme low ambient conditions the liquid in the liquid line

upstream of the solenoid and sub cooling circuit will be at no near ambient far below nozzle and expansion valve's the minimum design liquid temperature. If liquid is allowed to enter the sub cooling circuit under these conditions the resulting liquid temperature will remain below the minimum design liquid temperature leaving us with two options.

1. Order the equipment without a liquid sub cooling circuit and accept the capacity and efficiency loss provided by this circuit during milder ambient.
2. Bypass the sub cooling circuit during low ambient conditions as shown in Figure 5 and enjoy the benefits of the circuit during allowable ambient conditions and a stable liquid temperature that falls within the minimum design limits of the expansion valve and nozzle.

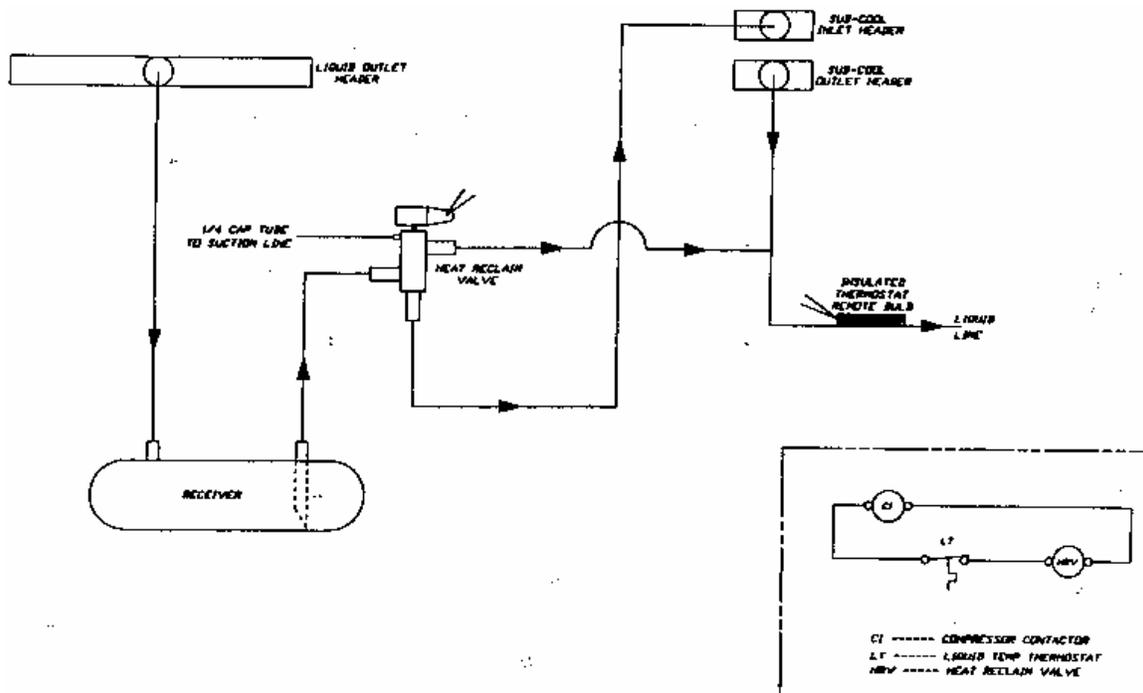


Figure 3. Liquid Sub Cooling Bypass