SEQUENCE OF OPERATION

KRAMER *THERMOBANK* HOT GAS DEFROST SYSTEM

WHAT IS THERMOBANK?

Thermobank is the only hot gas defrost system commercially available for single compressor system applications which utilizes a positive heat source as a re-evaporator. The heart of the Thermobank system is the heat storage "bank" which supplies an ample source of heat to fully re-evaporate all the liquid refrigerant condensed in the evaporator(s) during the defrost cycle. The Thermobank system provides not only a fast, efficient defrost cycle but also protects the compressor by ensuring that only "dry" superheated refrigerant vapor reaches it's suction intake.

In the Thermobank system, waste heat that is normally rejected through the condenser during the refrigeration cycle is utilized for heating the water stored inside the "bank" which is subsequently used as a heat source for liquid re-evaporation during the defrost cycle.

HOW DOES IT WORK?

REFRIGERATION CYCLE

During the normal refrigeration cycle, hot refrigerant gas discharged from the compressor passes through a heating coil "loop" submerged in the water filled "bank", heating the water, then continuing on into the condenser where it is condensed into a liquid. The liquid refrigerant then goes into the receiver, from the receiver through a separate sub-cooling loop in the condenser, (15 H.P. and larger units only), through the liquid line, liquid line solenoid valve and on to the expansion valve. The superheated suction vapor then exits the evaporator, travels through the suction line, through the suction solenoid valve and back to the compressor. Since the holdback valve is open when the suction pressure is lower than it's setting, (typically 15 to 20 PSIG), a spring loaded check valve, (4 PSIG), at the holdback valve inlet on low temperature systems prevents the suction vapor from passing through the Thermobank during the refrigeration cycle. On medium temperature systems where the normal operating suction pressure is well above the holdback valve setting, there is no need for a holdback check valve.

DEFROST CYCLE

After a predetermined period of compressor operation in the normal refrigeration cycle, the defrost timer automatically switches the Thermobank system into a defrost cycle. The following operations are then initiated;

- **Discharge solenoid valve at condenser inlet closes, (**see note).**
- **Bypass solenoid valve opens, (**see note).**
- **Suction solenoid valve closes.**
- **Evaporator fans stop.**
- **Hot gas solenoid valve at evaporator opens.**

**** Note: A fifteen second time delay period immediately precedes the activation of these (2) solenoid valves to allow for the transfer of liquid refrigerant from the liquid line into the evaporator coil(s). This small amount of liquid helps to initially "charge" the defrost cycle by providing an initial liquid source to the evaporators since the efficiency and speed of any well conceived hot gas defrost system is predicated on having adequate refrigerant pressure and flow, not simply a "warm" discharge gas temperature as commonly perceived.**

Hot gas from the compressor continues to pass through the "bank" loop but since the discharge solenoid valve at the inlet of the condenser is now closed, it is instead diverted through the low ambient module, (combination check valve / pressure relief), bypass solenoid valve, through the liquid line to the hot gas solenoid valve and into the evaporator drain pan loop. The vapor initially warms the drain pan and then flows through a check valve at the outlet of the pan prior to entering a side port inlet on the refrigerant distributor, bypassing the expansion valve. The warm vapor gives up both sensible and latent heat inside the evaporator causing the frost accumulated on the coil fins to melt and drip down into the drain pan.

The refrigerant, now condensed into a cool liquid, exits the evaporator coil and returns via the suction line to the condensing unit where it is prevented from directly entering the compressor by the now closed suction solenoid valve. It then passes through the holdback check valve, (low temp systems only), and into the hold back valve at the inlet of the Thermobank. This holdback valve creates a pressure drop, metering the liquid refrigerant directly into the Thermobank at a controlled pressure / temperature.

The liquid boils as it passes through the holdback valve and throughout the multiple-pass re-evaporator coil immersed in the warm water contained within the bank, absorbing both the sensible heat and latent heat of the water, causing the water inside the bank to freeze as the refrigerant is evaporated back into a gas. The refrigerant leaving the Thermobank re-evaporator coil is completely vaporized and returns directly to the compressor suction inlet as a "dry", superheated gas. The precise control and positive re-evaporation of all liquid refrigerant by the holdback valve and "bank" is the secret to the success of the Thermobank system, preventing compressor overload and / or subsequent mechanical damage to the compressor.

POST DEFROST CYCLE

Termination of the defrost cycle is positively controlled by a reverse-acting low pressure control which actually senses "evaporator" pressure upstream of the holdback valve inlet. At a predetermined evaporator coil pressure, the defrost termination control returns the timer to the refrigeration cycle. Immediately after defrost termination, the post defrost pressure control prevents the uncontrolled return of high pressure refrigerant vapor and any residual liquid still contained in the low side of the system by keeping the suction and liquid line solenoid valves closed, allowing this refrigerant to continue to flow through the "bank" until it's pressure is reduced to the cut-in setting of the post defrost control. Additionally, this control functions to provide an evaporator fan delay period, thereby preventing warm air and water blow off into the refrigerated space. Once the "evaporator" pressure is reduced to the cut-in setting of the post defrost control the suction solenoid valve opens, the liquid solenoid valve opens, (provided the room t-stat is closed), and the evaporator fan contactor is energized, returning the system to normal refrigeration.