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Section "F"

THE OPERATION OF "THERMOBANK" IN KRAMER COMPRESSOR SYSTEMS

WHAT IS THERMOBANK?

Thermobank is a completely automatic hot vapor defrost system employing a re-evaporator. Thermobank as distinct from any other defrost system is a heat "bank" which supplies sufficient heat to fully re-evaporate all liquid formed during defrost in the evaporator. Thus, Thermobank not only insures a positive rapid defrost, but also protects the compressor by insuring that only dry vapor reaches its suction intake.

In the Thermobank system, condenser waste heat is utilized by storing part of it in the "bank" during the normal refrigeration cycle for use during defrost.

HOW IT WORKS

1. REFRIGERATION CYCLE (FIGURE 1)

During the normal refrigeration cycle hot refrigerant gas discharged from the compressor passes through a heating coil submerged in the water filled "bank", heating the water. then continues on to the condenser where it is liquefied. The liquid refrigerant then goes to the receiver, continues on to the expansion valve and into the evaporator. The superheated suction vapor returns to the suction intake of the compressor by way of the open suction solenoid valve. Since the holdback valve is open when the suction pressure is lower than its setting (10 PSI, R12; 20 PSI, R502 typically), a spring-loaded check valve at the holdback valve inlet prevents suction vapor from passing through the "bank." Spring-loaded check valve not supplied on "F" models.

The heating coil in the water filled "bank" has a built-in bypass which diverts the hot discharged gas directly to the condenser when the water in the "bank" is sufficiently warm. The heat stored in the "bank" does not heat the refrigerant in the cold suction stream which bypasses the "bank" during the normal refrigeration cycle.

In compressor systems 3 H.P. and smaller employing Thermobank, the suction vapor passes through the holdback valve and through the "bank", both during the refrigeration and defrost cycles. In these small systems the holdback valve is sized for low pressure drop.

2. DEFROST CYCLE (FIGURE 1)

After a preset period of compressor operation a timer automatically puts the Thermobank system in a defrost cycle. The following operations are initiated by the timer:

1. Hot gas solenoid valve opens.
2. Suction solenoid valve closes.
3. Liquid solenoid valve closes.
4. Evaporator fans are stopped.

The hot gas and drain lines must be soldered together for their entire run in the refrigerated space so that the drain line is kept warm for free drainage. Hot gas vapor from the compressor goes through the hot gas solenoid valve (opened by the timer) to the evaporator, where it first heats the evaporator drain pan. This vapor then enters the evaporator through a side inlet on the distributor, bypassing the expansion valve and proceeds to defrost the evaporator coil. Water from the defrosting coil drops into the evaporator drain pan and is discharged through the drain line.

The refrigerant, now a liquid, having given off its latent heat is prevented from reaching the compressor because the suction solenoid valve is closed. It enters the Thermobank through the holdback valve and the liquid is metered into the re-evaporator coil at a controlled pressure.

The re-evaporator coil is immersed in the water of the Thermobank which has been maintained warm by the discharge gases going through the heating coil during the refrigeration cycle. The liquid refrigeration fed into the re-evaporator coil is now evaporated by the warm water in the "bank."

The re-evaporating pressure controlled by the holdback valve is set sufficiently low to actually freeze the water in the "bank", thus utilizing not only the sensible heat, but also the latent heat of water.

The refrigerant leaving the Thermobank re-evaporator coil is completely vaporized and returns to the compressor in a dry state. This, plus the positive control of suction pressure provided by the holdback valve, prevents compressor overloading.

3. POST DEFROST

After a preset time for the defrost period, the timer automatically closes the hot gas solenoid valve, but prevents the

evaporator fans from cycling back on until the evaporator pressure is reduced to its normal setting.

During this period the water defrosted from the coil into the drain pan has had sufficient time to be completely drained. The timer then restarts the evaporator fans, opens the liquid and suction solenoid valves, and returns the system to the normal refrigeration cycle.

COMPONENT VARIATIONS IN THERMOBANK COMPRESSOR SYSTEMS

1. WITH SURE-START WINTERSTAT (FIGURE 2)
The Sure-Start Winterstat consists of three components.

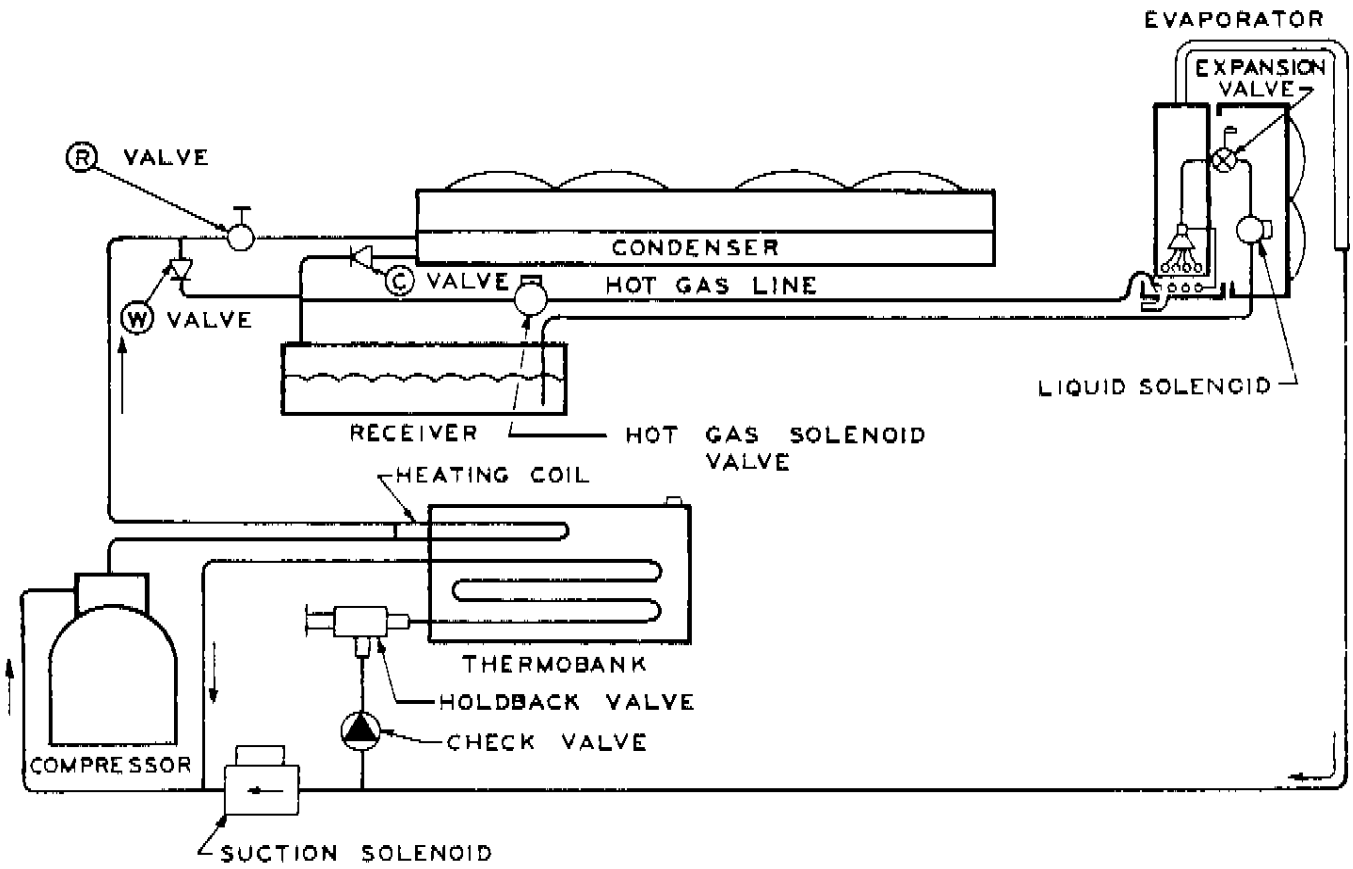
   (1) A regulating valve in the discharge line labeled "R".
   (2) A spring-loaded check valve in the condenser bypass line labeled "W".
   (3) A check valve at the outlet of the condenser labeled "C".

In addition to performing the usual function of maintaining constant head pressure at any Winter temperature, Winterstat also insures that all discharge gas from the compressor is routed directly to the evaporator during defrost. This is accomplished by the automatic closing of the "R" valve during defrost. Without this "R" valve in the system, during cold weather, some of the hot gas from the compressor would flow to the condenser and some to the evaporator, resulting in an incomplete defrost.

The extreme speed with which Thermobank defrosts is dependant on an adequate supply of liquid refrigerant at the holdback valve inlet. To insure this supply of liquid, the hot gas line which is connected to the discharge line in a non-Winterstat system, is now re-connected to the liquid line located between the condenser outlet and the receiver inlet.

During defrost the hot gas leaving the compressor traverses the "bank" heating coil and then by way of the "W" check valve enters the hot gas line enroute to the evaporator. In the evaporator the gas condenses to a liquid and returns via the suction line through the holdback valve-check valve into the holdback valve and then is re-evaporated in the Thermobank. The remainder of the defrost, post-defrost and refrigeration cycle is exactly the same as described in connection with Figure 1.

This is the only change that occurs when a Sure-Start Winterstat is added to a Thermobank-Compressor System.



THERMOBANK WITH SURE START WINTERSTAT

FIGURE 2.