Table 4 .... Equalizer Line Size—Through-Type Receiver to Evaporative Condenser[1]

Maximum Plant Capacity Tons	Equalizer Line Size Schedule 40 Pipe In.
350	¾
500	1

[1] Application Data—York Corp.

each unit be maintained; otherwise, liquid may back up in the condensing coil of the unit handling the largest tonnage.

EVAPORATOR PIPING

Proper evaporator piping and control are necessary to keep the conditioned space at the desired temperature and also to adequately protect the compressor from surges of liquid ammonia out of the evaporator. The evaporators illustrated in this section will show a few methods that have been used to accomplish these objectives. Sometimes combinations of details shown on several illustrations have been used.

Pipe Coils

Fig. 20 illustrates a gravity air circulation coil fed by a thermal expansion valve. The relative height of the coil and suction mains should be such that the coil suction can drop vertically into the suction main. This will prevent liquid that may be in the main from affecting the bulb of the expansion valve. The amount of opening of the expansion valve is governed by the refrigerant pressure on the outlet of the expansion valve and the suction temperature on the coil outlet. To operate properly, the suction gas from the coil has to be superheated. Therefore, in the design of the pipe coil, extra coil surface (about 15 percent) should be provided to superheat the suction gas. If the pressure drop of the refrigerant through the coil is more than a few pounds, the suction gas will have to be further superheated to counteract this pressure drop effect. An external equalizer will correct this situation by bringing the coil outlet suction gas pressure into the valve actuating device rather than into the expansion valve outlet pressure.

The solenoid valve shown in the line ahead of the thermal expansion valve would be controlled from a room thermostat. On installations not equipped with a suction trap, this solenoid valve should also be so wired that it can only be energized when the compressor is in operation. This will prevent the coil from filling with liquid at low loads, with resulting

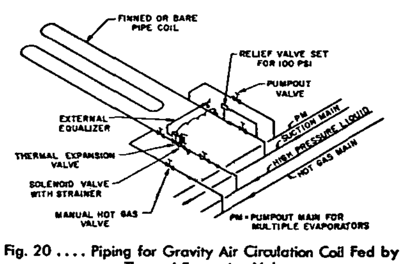

Fig. 20 .... Piping for Gravity Air Circulation Coil Fed by a Thermal Expansion Valve

surging of liquid to the compressor when the load is suddenly increased.

When a solenoid valve is used only in the liquid line, the evaporator coil is necessarily pumped out whenever the room thermostat is satisfied. This makes adequate storage capacity in the high-pressure receiver necessary. If desired, the refrigerant can be bottled up in the evaporator by use of a suction line solenoid valve wired in parallel with the liquid line solenoid valve.

For evaporator temperatures above 32 F, there will be condensate dripping from the coils. Drain troughs are therefore used to collect the condensate for discharge to a sewer.

For temperatures below 32 F, frost will accumulate on the coil. Some type of defrosting is therefore required. Pipe coils are generally defrosted by use of hot gas. This can be a manual operation because pipe coils are used only where frost accumulation is such that defrosting is required at infrequent intervals. Defrosting can be accomplished by using one valve off the discharge line in the engine room and another valve at the coil to be defrosted. This prevents hot gas from condensing in the hot gas pipe during times when no defrosting is taking place. At the end of defrosting, the coil will contain a considerable amount of liquid ammonia which will start to surge out of the evaporator as soon as the suction valve is opened. Therefore, a suction trap is required. Oil that accumulates during normal operation of the coil will be heated during the defrost cycle and will surge out of the coil when the suction valve is opened. A pumpout connection is useful in case it is necessary to open up the coil for modifications.

Hand expansion valves which have been used to feed coils will feed a constant amount of liquid into the coil at all times for any set position. Therefore, as the load changes, the setting of the valve has to be changed or the coil will operate with highly superheated leaving gas (room temperature rises) at increasing loads, or the liquid will surge through the coil into the suction line at decreasing loads. It becomes imperative for this type of coil control that a suction trap be used to protect the compressor from liquid surges and also that the suction line be liberally sized to offset the effect of ammonia liquid in the suction main.

Air Blowers

Fig. 21 illustrates a thermal expansion valve application on an air blower unit using hot gas for automatic defrosting.

When using hot gas or electric heat for defrosting, it is usually necessary to provide some means of heating the drain pan and drain line to prevent the condensate from refreezing. One method, shown in Fig. 21, is to run the hot gas and the condensate lines together (but with an air space between them) within an insulated cover. An electric heater blanket can be the heat source for the drain pan.

Since this is an automatic defrosting arrangement, hot gas always has to be available at the hot gas solenoid valve near the unit. This usually means that there must be multiple evaporators in the system so that the compressor will be running when the evaporator to be defrosted is shut down. It is also necessary to keep the hot gas header in a space where ammonia will not condense in the pipe. Otherwise, the coil will receive liquid ammonia at the start of defrosting and will not be able to take full advantage of the latent heat of condensation of hot gas coming into the coil. Also, there will be an extra amount of liquid ammonia to be handled by the suction trap at the end of each defrosting cycle.

The liquid line and suction line solenoid valves are open during normal operation and during the defrost cycle both of these valves are closed. When the defrost cycle starts, the

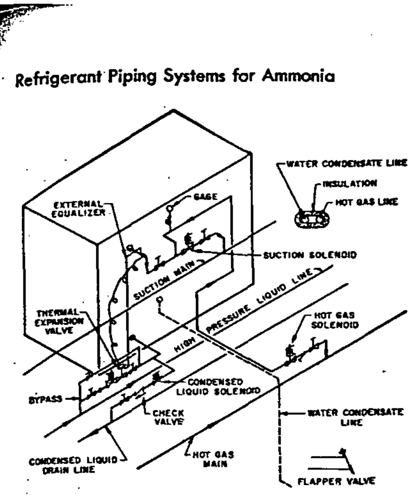

Fig. 21 .... Piping for Thermostatic Expansion Valve Application for Automatic Defrost on Air Blower

hot gas and condensed liquid solenoid valves are open. A pressure regulator may be used in the condensed liquid main to maintain a pressure of about 70 psig in the coil. A hand valve may also be used to maintain pressure in the main.

Solenoid valves are designed to hold against a higher pressure on the upstream side than on the downstream side. Therefore, a check valve is used on the outlet of the condensed liquid solenoid valve to prevent liquid from going backwards through this valve at the end of the defrost cycle.

Air Blower—Flooded Operation

Fig. 22 illustrates a flooded evaporator with a close coupled low-pressure receiver for feeding ammonia into the coil and with automatic water defrost.

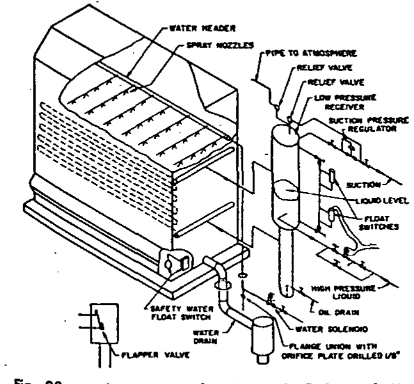

Fig. 22 .... Arrangement for Automatic Defrost of Air Blower with Flooded Coil

The lower float switch on the equalizer header at the receiver controls the opening and closing of the liquid line solenoid valve regulating ammonia into the unit to maintain a liquid level. The hand expansion valve downstream of the solenoid valve should be adjusted so that it will not feed ammonia into the receiver at a rate higher than the receiver can take without raising the suction pressure of gas from the receiver more than 1 or 2 psi.

The static height of liquid in the receiver should be sufficient to flood the coil with liquid under normal loads.

The higher float switch should be wired into an alarm circuit in the engine room to indicate when the liquid level in the receiver is too high.

The feed to the evaporator coil is connected below the liquid level in the receiver and the return from the coil is connected to the space above the liquid level. With flooded coils and horizontal headers, distribution between the various pipes is accomplished without distributing orifices.

A combination suction pressure regulator and stop valve is used in the suction line from the low-pressure receiver. During operation the regulator will maintain a nearly constant back pressure in the receiver. A solenoid coil is incorporated into the regulator mechanism to close it during the defrost cycle. The liquid solenoid valve should also be closed at this time. A room thermostat could be used to control room temperature by closing both the liquid line solenoid valve and the suction pressure regulator when the room is at the desired temperature.

A spring loaded relief valve is used around the suction pressure regulator and is set for a differential such that the receiver is kept below 125 psig.

A solenoid valve is used in the water line to the defrost header. The defrost header has to be constructed so that it is drained at the end of the defrost cycle and an arrangement is shown whereby the downstream side of the solenoid valve is drained through a fixed orifice.

The drain line from the unit should be wrapped with a heater cable or provided with some other suitable means of heat and then insulated so that the water that is used for defrost does not refreeze in the line.

The length of water line within the space leading up to the header and the length of drain line in the conditioned space should be kept to a minimum. The end of the drain line should be provided with a flapper so that after it is drained out, the flapper will close off the drain line to prevent warm air from flowing up the drain pipe and into the unit.

An air outlet damper should be closed during defrosting to prevent thermal circulation of air through the unit during the defrost cycle which otherwise would affect the temperature of the conditioned space.

A necessary safety control with this type of defrosting is a drain pan float switch arranged so that if the drain pan fills up with water, it will over-ride the time clock and stop the flow into the unit by closing the water solenoid valve.

At the end of the water spray part of the defrosting cycle, a delay of approximately five minutes should be incorporated so that the water can drain from the coil and also completely drain out of the pan. This will limit the ice buildup in the drain pan, and on the coils, after the cycle is completed.

At the completion of the defrost cycle, the pressure in the low pressure receiver may be about 75 psig and when the unit is opened to the suction main at a much lower pressure, some of the liquid will surge out into the main. The general practice is to have a suction trap in the engine room to remove this liquid from the gas stream before entering the compressors.

Fig. 22 illustrates what is referred to as a dry coil unit which