of the evaporator should be made in the suction line to prevent liquid refrigerant from draining into the compressor during shutdown.

Diagram *B* Fig. 5 represents a single evaporator below the compressor. An inverted loop is unnecessary since the evaporator will trap all liquid refrigerant.

Diagram *C* of Fig. 5 shows multiple evaporators on different floor levels with the compressor below. Each individual suction line should be looped to the top of the evaporator before being connected into the suction main, to prevent liquid from draining into the compressor during shutdown.

Diagram *D* of Fig. 5 has multiple evaporators stacked on the same floor level, and operated from one liquid solenoid valve, with the compressor below. Here it is possible to use one loop to serve the purpose. Where coil banks on the same floor level have separate liquid solenoid valves feeding each coil, then a separate suction riser is required from each coil, similar to the arrangement in *C* and *E* of Fig. 5 for best oil return performance. Where separate suction risers are not possible, pipe according to Diagram *F* of Fig. 5.

Diagram *G* shows multiple evaporators located on the same level and the compressor located below. The individual suction lines out of each evaporator drop down into a common suction header which then rises in a single loop to the top of the coils before going down to a compressor below.

When automatic compressor pump-down control is used, then evaporators located above the compressor can be free draining to the compressor without the benefit of protective loops as described above, since the evaporators will automatically be kept free of liquid by the compressor pump-down operation.

The small traps shown in the suction lines, immediately after the coil suction outlet, are recommended to prevent erratic operation of the thermal expansion valve. The expansion valve bulb is located in the suction line between the coil and this trap. The trap serves as as drain area and prevents liquid accumulating under the expansion valve bulb during compressor off cycles. Liquid lying in the line under the bulb would cause erratic operation of the expansion valve when the compressor starts up again. These traps, after the thermal expansion valve bulbs, are required only where straight runs or risers are encountered in the suction line leaving the coil outlet. They are not required when the suction line from the coil outlet drops to the compressor or suction header immmediately after the expansion valve bulb location.

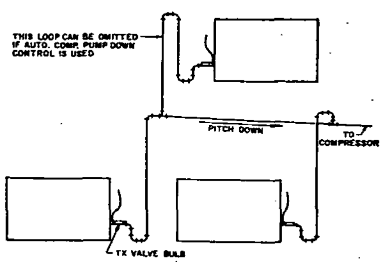

Fig. 6 .... Typical Piping from Evaporators Located Above and Below Common Suction Line

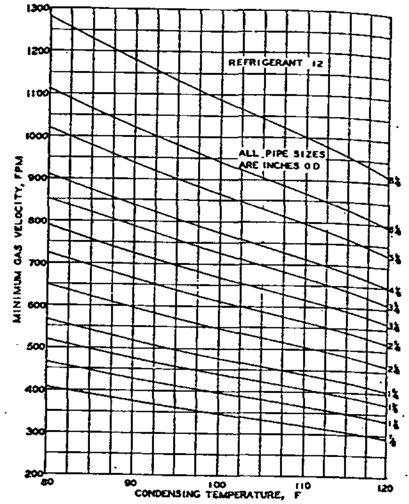

Fig. 7 .... Minimum Gas Velocity for Oil Entrainment Up Vertical Hot Gas Risers (Refrigerant 12)[2]

Suction Piping to Prevent Oil Trapping in Idle Evaporators

Suction lines should be designed so that oil from an active evaporator does not drain into an idle one.

Diagram *E* of Fig. 5 shows multiple evaporators on different floor levels and the compressor above. Each suction line is brought upward and looped into the top of the common suction line. This prevents oil from draining down into either coil that may be inactive. Also, note the small loop in the suction line leaving each evaporator. The purpose of this loop is to provide free drainage away from the thermostatic expansion valve bulb.

Diagram *F* shows multiple evaporators stacked with the compressor above. Oil is prevented from draining into the lowest evaporator because the common suction line drops below the outlet of the lowest evaporator before entering the suction riser.

In Diagram *G*, multiple evaporators are shown on the same level and the compressor is located below. The suction line from each evaporator drops down into the common suction line, so that oil cannot drain into an idle evaporator. An alternate arrangement is shown in Diagram *H* for cases where the compressor is above.

Fig. 6 illustrates typical piping for evaporators above and below a common suction line. All horizontal runs should be definitely pitched toward the compressor to insure oil return.

DISCHARGE (HOT GAS) LINES

The design of hot gas lines with self-contained condensing units is not a problem, inasmuch as they are equipped with

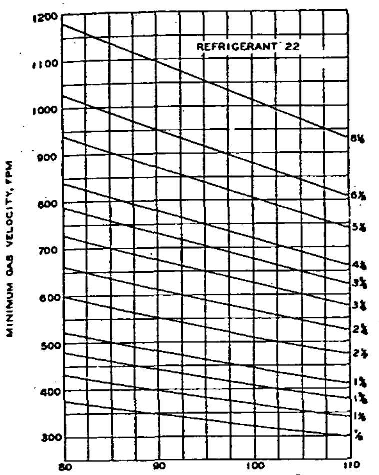

Fig. 8 .... Minimum Velocity for Oil Entrainment Up Vertical Hot Gas Risers (Refrigerant 22)[2]

this line all assembled at the factory. In the case of remotely located condensers, however, the hot gas line must be properly designed as part of the system.

Hot gas lines should be designed:

1. For correct size to provide practicable pressure drop (Chapter 69).
2. To avoid trapping oil at partial load operation.
3. To prevent refrigerant from condensing and draining back to the head of the compressor.
4. With connections to multiple compressors (from a common line) carefully selected.
5. To avoid developing excessive noise or vibration as a result of hot gas pulsations, compressor vibration or both.

Oil Entrainment Up Risers at Practical Loads

Even though a low pressure drop is desired in hot gas lines, they should not be oversized to the extent that gas velocities are reduced to a point where the refrigerant will not be able to carry along any entrained oil. In the usual application this will not be a problem in hot gas lines. In the case of multiple compressors with capacity control, it is wise to make sure any hot gas risers will carry oil along at all possible loadings.

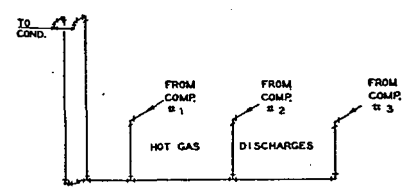

Fig. 9 .... Double Hot Gas Riser

Minimum Gas Velocities for Oil Entrainment in Risers

Minimum gas velocities for oil entrainment in hot gas line risers are shown in Figs. 7 and 8. On multiple compressor installations, the actual hot gas volume in cfm, being transmitted through the hot gas line at the lowest possible system loading, should be calculated and a riser size selected to give at least the minimum velocity indicated in the curves for successful oil entrainment, and preferably about 25 percent greater.

Sometimes in installations of multiple compressors having capacity control, a vertical hot gas line sized to entrain oil at minimum load has an excessive pressure drop at maximum load. When this problem exists, either a double riser, or a single riser and an oil separator can be used.

Double Hot Gas Risers

A double gas riser can be used in the same manner as it is used in a suction line.

Fig. 9 shows the double riser principle applied to a hot gas line. The principle of operation and sizing technique is described in the section Double Suction Risers.

Single Riser and Oil Separator

As an alternate arrangement, an oil separator can be located in the discharge line just ahead of the riser (Fig. 10). This permits sizing the riser for a low pressure drop without regard for oil entrainment velocities.

Location of the oil separator at this point results in catching practically all of the oil and returning it to the compressors. Any oil draining back down the riser, under light load or on shutdown, would accumulate in the oil separator. Precautions required with this type of arrangement are discussed later in the section Oil Separators.

In all cases, horizontal lines should be pitched downward in the direction of gas flow to facilitate travel of oil through the system and back to the compressor.

Piping to Prevent Liquid and Oil Draining Back to Compressor Head

Whenever the condenser is located above the compressor the hot gas line should loop to the floor near the compressor

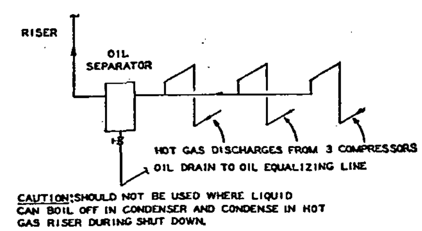

Fig. 10 .... Hot Gas Riser with Oil Separator