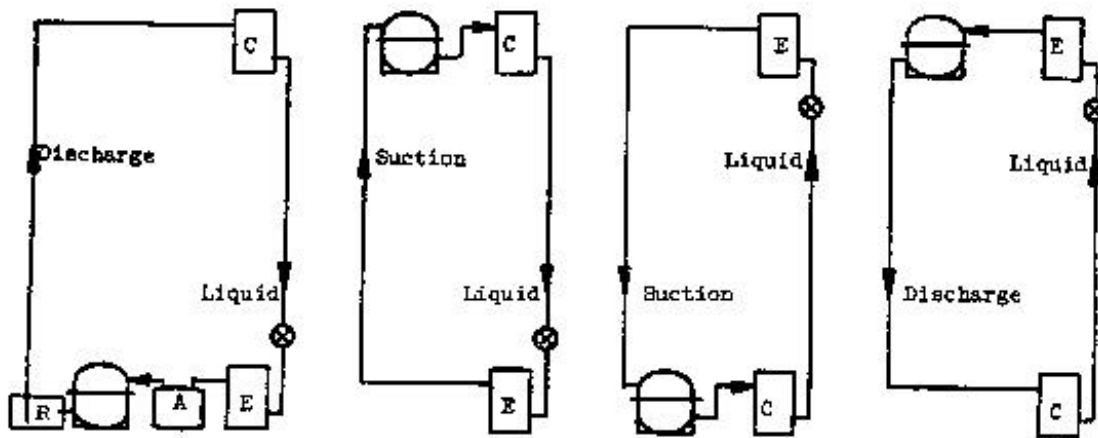


Remote mounted air conditioning and refrigeration systems with extended vertical and horizontal connecting lines must take into consideration line pressure drops and gas velocities to assure proper oil return to the compressor, proper system performance and a minimal system refrigerant charge.

This Engineering Recommendation will cover the four types of installation now in use as schematically illustrated below:



A = Accumulator C = Condenser E = Evaporator R = Discharge Receiver

In general, all of the above systems should:

- (A) Prevent liquid refrigerant from entering the compressor under both running and off cycle conditions. Refer to Tecumseh Policy Bulletin No. 107.
- (B) Have system piping designed to eliminate the possibility of oil trapping during the operating cycle.
- (C) Have interconnecting suction or discharge lines sized to maintain gas velocities sufficiently high to carry entrained oil back to the compressor quickly. Refer to Tecumseh Engineering Recommendation No. ER-1 or ER-8.

Liquid Lines should be sized to become a part of the normal pressure drop between the high and low sides of the system in order to reduce refrigerant charges to a minimum. Liquid refrigerant in a vertical column will exert a downward pressure of 0.5 to 0.6 pounds per lineal foot of tube, and depending upon the direction of refrigerant flow, will either add to or subtract from the liquid line pressure drop.

(C) (Continued)

Hypothetical Example (R22):	Up Flow	Down Flow	Horizontal Flow
Line Pressure Drop psig:	+0.6	+0.6	+0.6
Weight of Refrigerant psig:	+0.5	- 0.5	. 0
Combined Pressure Drop psig:	+1.1	+0.1	+0.6
Pressure Drop per 100 Ft.:	110 psi	10 psi	60 psi

Where possible, all line sets should be factory sized and refrigerant charge determined and all joints should be easily accessible for installation and leak detection.

- (D) Have adequately sized electrical components to assure proper voltage at the compressor and fan motor terminals.
- (E) Insulate interconnecting suction or discharge lines. Liquid lines do not require insulation.
- (F) An accumulator may be required as indicated in Tecumseh Policy Bulletin No. 107.
- (G) Place the condensing units in a manner to avoid air recirculation due to either the wind or the blower of an adjacent unit. Consideration should be given to protection against solar loading or wide ambient ranges.
- (H) In multiple installations, place the units with the longest riser closest to the outlet of the tube conduit to minimize the interconnecting tube length.

The following comments are specifically directed to each design previously illustrated and are in addition to the general comments.

Design Figure 1 Extended Lines: Discharge (Up) and Liquid (Down)

1. The discharge leaving the compressor must enter into a discharge receiver capable of containing 95% of the total system charge. This receiver will collect refrigerant condensate during the off cycle.
2. The condenser should be a down feed to allow drainage into the liquid line on the "off" cycle. A trap in the liquid line at this point is undesirable as it encourages liquid to boil off and recondense in the discharge line during prolonged "off" cycles
3. The liquid line can be sized smaller than ER-1 or ER-8 to reduce system charge and to take advantage of the liquid head (due to height), that will partially overcome the normal pressure drop. (Refer to Item C.)

4. A self-equalizing expansion valve is recommended to avoid the need to adjust capillary tube sizes to compensate for varying liquid head pressures. Capillary can be used on units where liquid line pressure drops are reasonably close and an optimum capillary size can be selected.
5. No additional oil is required since both extended lines are small and hot.
6. An accumulator should be used. The combined volume of the accumulator and evaporator should equal or exceed 100% of the total system charge. The combined volume can be considered with the compressor not running. This is to prevent the dumping of liquid refrigerant into the compressor on each "off" cycle.
7. The compressor oil heater should be energized at least twelve hours prior to the initial start up.

Design Figure 2 Extended Lines: Suction (Up) and Liquid (Down)

8. Comments 3, 4 and 7 apply.
9. The suction line size should follow this ER-1 or ER-8 recommendations for at least the vertical upflow portion of the interconnecting line.
10. Please note that additional compressor oil may be required to wet the suction line. (Refer to ER-1 or ER-8.)

Design Figure 3 Extended Lines: Suction (Down) Liquid (Up)

11. Comments 4, 7 and 10 apply.
12. Suction line sizes may be the same as or larger than ER-1 or ER-8; however, the horizontal portion should slope towards the compressor at a rate of 1/2 inch in 10 feet.
13. The liquid line size should follow ER-1 or ER-8 as it must overcome both line pressure drop and the liquid head. (Refer to Item C.) Upflow lengths are limited by pressure drop due to refrigerant weight.

Design Figure 4 Extended Lines: Discharge (Down) Liquid (Up)

14. Comments No. 4, 5, 7 and 13 apply.

In the past, some authorities have recommended suction line traps spaced every 12 feet in long upflow suction. The tube selections in ER-1 or ER-8 preclude the need for suction line traps making the building contractor's installation much more efficient and compact.