Guidelines Concerning Refrigeration Pipe Run Lengths.

Excessive distances between condensing units and evaporators can result in performance loss and, in some cases, damage to compressors. Length of pipe run and selection of tube sizes are important considerations when designing a remote system.

Tecumseh states that suction runs above 30 metres are not recommended. While that company's advice may sometimes be considered conservative, this recommendation is considered appropriate for larger hermetic systems. (It would, of course, be sensible to restrict smaller hermetic systems to pipe runs less than that shown.) Other types of compressors can tolerate longer pipe runs and, based on experience, the following are considered to be realistic limits.

Compressor Type	Typical Limits	Max. Effective Length (m)
Sealed Hermetic	Tube lengths of 25m, plus elbows.	30
Scroll Compressors	Tube lengths of 30m, plus elbows	35
Accessible Hermetic	Tube lengths of 55m, plus elbows	60
Open Drive	Tube lengths of 90m, plus elbows	100

If absolutely necessary, it is possible to exceed these limits by using liquid injection quenching of the suction line so as to keep the suction superheat at the compressor below the recommended maximum. Today, with the new selection of refrigerants, the maximum recommended superheat is usually around 20K. If return gas superheat exceeds this limit, factors such as heat transfer from the electric motor and mechanical friction will contribute to high discharge temperatures. This can cause the compressor to seize, and/or oil to break down and leave deposits on the valve plate and discharge reeds. Excessive discharge temperatures can also result in copper plating forming on bearing surfaces, and this is one of the possible causes of seizure. At the same time, suction superheat at the compressor should not be allowed to fall below 10K, or mechanical damage to the compressor may occur. Ensure correct adjustment of the expansion valve and, where necessary, install a suction accumulator and/or a heat exchanger to prevent liquid floodback.

Maximum pipe runs are influenced by compressor type because of the degree to which each compressor configuration allows the above factors to increase the temperature of the gas stream. A semihermetic compressor, in which the motor is solidly mounted inside the crankcase casting, offers superior cooling to a typical hermetic compressor where the pump assembly, being spring mounted, is effectively isolated from the compressor shell.

Most scroll compressor motors are actually pressed into the compressor shell. This has the advantage of allowing much of the motor heat to be dissipated through the shell. Further, as most scrolls are not suction cooled compressors, the returning suction vapour is not superheated by the motor to the same degree as in semihermetic compressors. Refrigeration scrolls fitted with liquid injection remain cool even in the highest pressure ratio systems. Refrigeration scroll compressors can also be covered by a sound blanket if required, without any performance loss, in systems with high pressure ratios.

The motor heat of an open drive/belt drive compressor is entirely outside the vapour stream, so it is the least critical of the compressor types.

High return vapour temperatures can be very destructive in the cooler months due to lower loads on the evaporator and condenser. It is suggested that some form of condensing pressure regulation (e.g. condenser fan cycling) be employed to maintain refrigerant flow through the TX valve as, if the coil is full, then management of the return gas temperature is easier.

The other problem with reduced refrigerant feed to the evaporator is oil logging in the evaporator and the resultant non-return of oil to the compressor. Sight glasses, when fitted to compressors, will assist in balancing the oil charge. Beware of overcharging the system with oil as the surplus oil is probably accumulating in the evaporator. The result will be a wide evaporator coil TD.

Another factor to consider is that scroll compressors rely on an oil mist in the return gas to lubricate the scroll set. An excessive pipe run, coupled with a pumpdown cycle, could result in a situation where that lubrication process is impaired and wear of the scrolls is initiated. We strongly recommend that you do not exceed the recommended pipe run length, and that excessive pumpdowns be avoided.

For scroll compressors, and in fact, for any other compressor type, a pumpdown should be terminated at a pressure equivalent to a temperature 3K below the saturated suction temperature at the thermostat cut-out point. In general terms, we believe that pumpdown is often unnecessary and may be counterproductive. Particularly where electric defrost is used, the presence of liquid in the evaporator assists in completely removing frost from the coil. Other factors also influence our opinion that pumpdown should be avoided in most circumstances.

Oil generally travels through the system by mixing with the refrigerant or by being carried along the pipe walls by the refrigerant velocity. The refrigerant charge in a large system can hold 6% to 10% of the compressor oil charge, dissolved in the liquid refrigerant. Compressor manufacturers take this into account, and the initial oil charge in a compressor allows for the fact that some oil will be lost from the compressor and will 'wet' the surfaces of a normal system. New systems with long pipe runs may benefit from the addition of oil to wet the internal surfaces.

To ensure correct oil return to a compressor, the installer should also follow correct piping practices. For example, "P" traps on evaporators, "P" traps on high lifts, correct suction pipe sizing, double suction risers may be needed on systems with capacity control. Where possible, the suction line should fall to the compressor so there is a 'drain' effect back to the compressor.

If there is no sight glass fitted to the compressor, then the following can be used as a guide for the addition of oil.

A. For direct expansion systems with tube runs in excess of 10 metres, add additional oil for each 3 metre excess.

Suction Line OD	Oil Qty per 3m Excess (ml)
12.7mm (1/2")	30
15.9mm (5/8")	60
19.1mm (3/4")	90
22.2mm (7/8")	120
25.4mm (1")	140
28.6mm (1 1/8")	160

B. For larger systems, flooded evaporators, etc., additional oil @ 100ml per kg of refrigerant charged. (0.5 litre per 5kg refrigerant)

Don't forget that, when an oil separator is fitted from new, it must be filled with the amount and type of oil recommended by the manufacturer.

On multiple fixture refrigeration systems, extra care must be taken in the design of the complete system to avoid excessive return gas temperatures resulting from oversized compressors.
(Refer Heatcraft bulletin: ***Problems Associated With Multiple Fixture Refrigeration Systems***)

More compressors are destroyed by high return vapour temperatures, low oil levels and liquid floodback than by all other causes.

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